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## New Type of Washer for Low-grade Gold Ores

A Machine Which Has Been Found to Be Superior to Other Types for Treating the Saprolitic Ores of the South Atlantic States

BY JOSEPH HYDE PRATT\*

One of the more important changes to be noted in gold-mining practice in North Carolina is the introduction of a pulverizing and concentrating machine of the log-washer type, known as the Modern pulverizer and concentrator, for treating certain of the saprolitic ores that are found quite abundantly throughout many

which came in at the upper end. The logs were 20 to 30 ft. long and were more generally used to wash ores containing considerable clay.

The old principle of the log washer is unpatentable, but this new machine possesses many mechanical improvements that adapt it to the work that it is called

washers running at high enough speed to readily disintegrate the soft material and so mix the clay into a fine pulp with water that the gold can readily settle to the bottom. Each machine is essentially a long trough of boiler plate (two thicknesses  $\frac{1}{4}$  and  $\frac{1}{8}$  in. each) containing a revolving cylinder fitted with heavy cast-

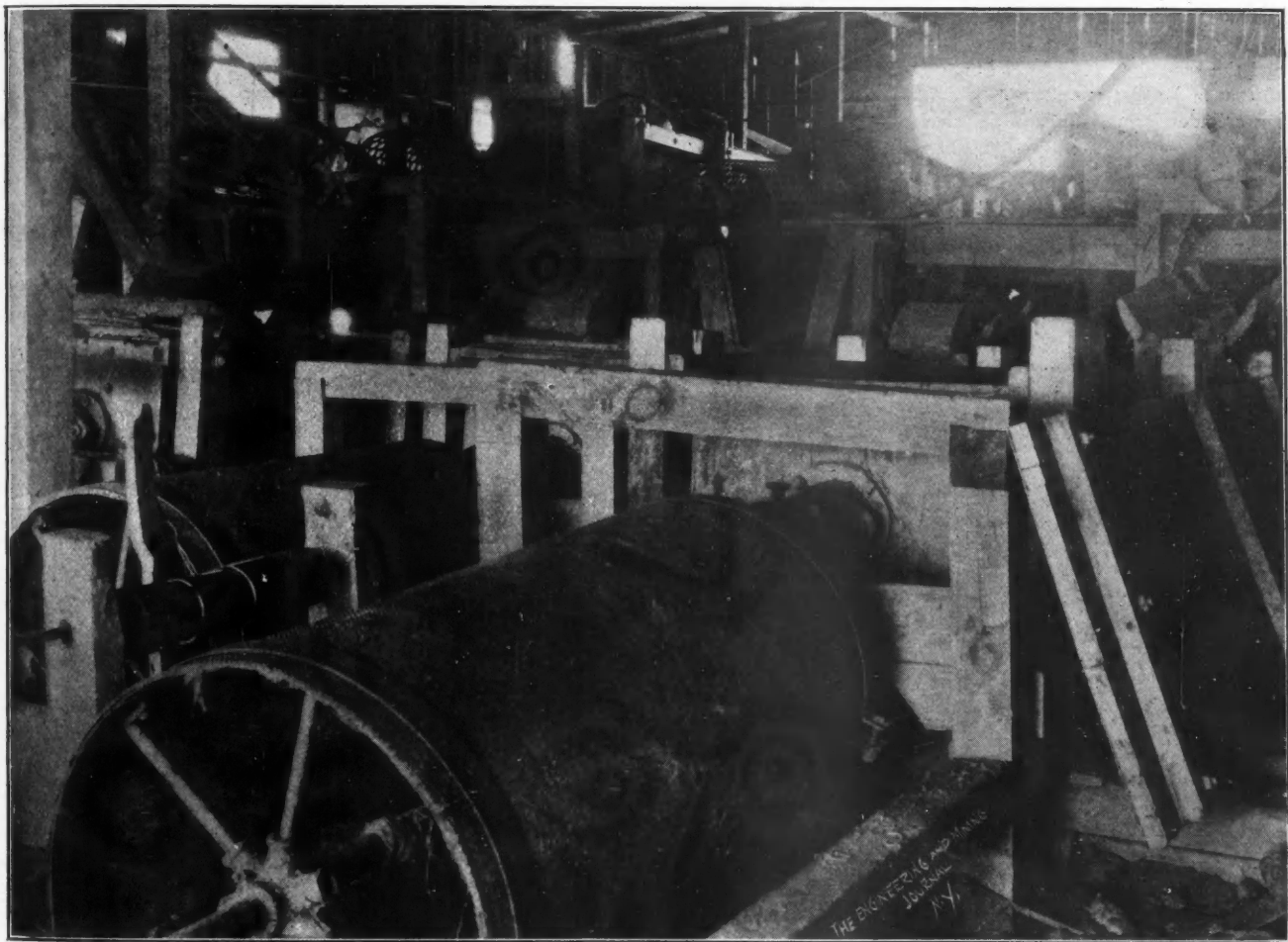


FIG. 1. GENERAL VIEW OF THREE SETS OF UNITS IN POSITION

portions of this State. The old log washer consisted of a trough that was slightly inclined when in use and fitted with a couple of revolving steel or wood logs, to which were fixed spiral arms. These advanced the material to be washed from the lower end against the water

upon to do. The saprolitic ores of these South Atlantic States contain a great deal of clay and it has been found impossible to save the gold by ordinary sluicing and amalgamation.

### THE NEW MACHINE

Each separate unit of this new machine, Fig. 2, consists of two improved log

iron arms set spirally so that the ore, while being hammered fine, is gradually worked to the discharge end, which is raised 6 in. higher than the feed end, Fig. 4. At the end of the washer, the larger, hard and nearly barren quartz stones are removed by a revolving screen and belt conveyer, this being done to save wear and power in the second washer, where the

\*State Geologist of North Carolina, Chapel Hill, N. C.

gravel is still farther reduced in size and more gold settles out.

From the trommel of the first machine, the coarse material is carried by either a traveling belt or an open-slucice box to the riffled-slucice box outside the building. The boxes are about 12 in. wide and nearly 200 ft. in length. The material, after passing through the second washer, is again screened, and the screenings run into the same line of slucice boxes as the first screenings, Figs. 3 and 5. The riffles of these slucices are made by boring inclined holes in a board that just fits the slucice box. Mercury is then placed in these holes. The pulp from this second screen, free from stones, passes through special riffled slucices about 4 ft. wide and 8 to 16 ft. in length, which contain mercury to amalgamate and save any free gold that does not settle in the machine. From these broad riffle slucices it passes to the narrow ones, 200 ft. long, through which the coarser material has passed.

The steel troughs are about 2 ft. wide by 2½ ft. deep, the first being 18 ft. long and the second 12 ft., with a semi-circular bottom and a flat wood top. The revolving cylinder is made of an 8-in. steel pipe

paddles against the surface of the water will also weight and sink some of the fine and flake gold that has a strong tendency to float off. As the discharge end of the machine is 6 in. higher than the feed end, the gold after it is once down among the pebbles of the bed, is not apt to be pushed out of the machine. Fig. 1 is a general view of three sets of units in position.

Riffles of the slucices are made by boring inclined auger holes in the planks laid lengthwise in the slucice boxes. Since all the coarse gravel has been screened out, there is little wear upon the riffles and the fall and quantity of water used are less than in the slucices of regular hydraulic mining. In cleaning up, the planks are lifted up and turned over and the gravel and mercury washed to the end of the slucice where quicksilver and amalgam are washed out in hand pans. When through cleaning up, the planks are simply replaced and the riffles filled with mercury and the machine started again.

In cleaning the washers, which is usually done twice a week, the machines are stopped and all the gravel within washed out with a hose through an opening in the

danger of the gold being washed out. While a large capacity is of advantage and desirable, still it will mean danger of insufficient grinding, too thick pulping, or too strong a flow of water. A great deal of skill and patience is, therefore, required in adjusting these machines, but when once adjusted, they will work satisfactorily. It is to be recommended that a first unit be installed and run for several months at various speeds, capacities and amounts of water, giving the machine sufficient time after each change of conditions to adjust itself. Also careful tests of the ore and tailings should be made between times. The capacity and speed should first be adjusted until the best result is given in reducing the amount of gold left in the tailings so combined that it will not pan. The pulp should, of course, be kept at a reasonable consistency throughout the changes and the amounts of water finally adjusted so that the tailings will show a minimum of free gold in the pan.

#### INSTALLATION AT THE SHUFORD MINE

These machines are made in Knoxville, Tenn. One of the first plants, one of

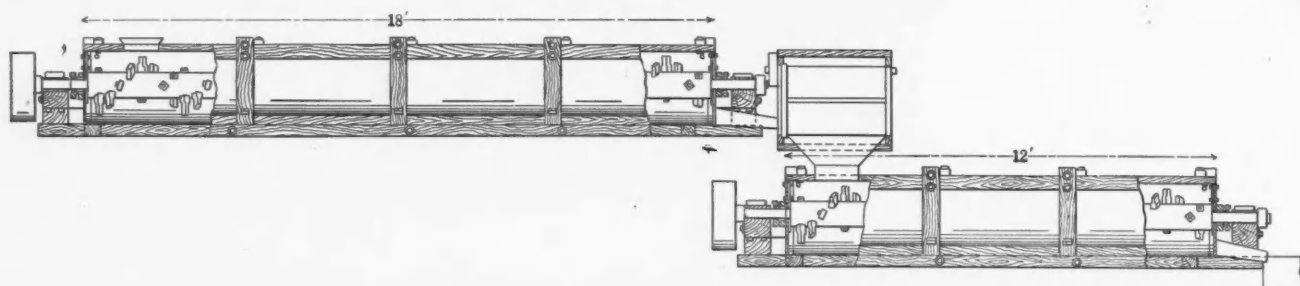


FIG. 2. MODERN PULVERIZER AND CONCENTRATOR

over a wood core carried upon a heavy steel shaft, passing through stuffing boxes at the ends of the trough.

Wrought-iron bars reach through this cylinder crosswise and project on one side about 1 to 1½ in. to receive a nut that fits the thread turned on this end of the bar. The other end of the bar projects 3 in. beyond the cylinder as a rectangular-shaped plate and to this 5½x2½x2-in. cast-iron arms or paddles are bolted. The greatest wear and tear of these machines is on the paddles, the life of which is four to six weeks. There are 48 of these paddles to the longer trough. There is about 4 in. clearance between these arms or paddles and the bottom of the troughs, which allows the formation of a bed of stones or pebbles; this reduces the wear on the bottom of the trough and also assists in saving the gold. This bed of stones is, of course, more or less shaken up by blows from the large fragments of quartz and by the revolving paddles, thus permitting the gold to settle through these to the bottom of the trough similarly as in panning. The constant striking of the

bottom. This gravel is then panned by hand and the gold amalgamated. Any nuggets that occur in the rock are pounded free from quartz and are then also amalgamated. The amalgam from all sources is strained out of the quicksilver and then retorted and the bullion sold.

#### ADJUSTMENT OF THE WASHER

It is recommended by the makers that the first washer be driven at 150 to 250 r.p.m., and the second one at 250 to 350, and that for a capacity of 10 tons per hour, each machine be given 72 gal. of water per minute. This will then at times require 25 h.p. for a complete unit of two washers and trommels. These factors will vary greatly with the character of the ore. Since the power, and therefore, the wear, will increase even more rapidly than the square of the speed, this should be kept low. In the absence of any coarse stones, there is also danger that the pulp may be too greatly agitated to allow the settling of the gold. On the other hand, the speed and work must be sufficient to grind up the ore. If there is too much, there is a

four double units, was installed at the Shuford mine, Catawba county, North Carolina. The fines obtained by washing the ore over a grizzly are carried by means of jets of water down a trough about 35 ft. long, thus becoming pretty uniformly mixed before being divided among the four washers. The trough is divided at a point about 35 ft. from the grizzly and then each of these is subdivided into two troughs, each about 25 ft. from the first division. At each division point the mixture of ore and water strikes against sharp edges that divide the material nearly equally, sending one-half of the material into each trough. Each of these four troughs feed to a unit machine through the wooden top of the trough. At this mine the machines are run at only 150 r.p.m. They were tried at a lower speed, but there was trouble with the gold sticking to clay balls. The machines use about 150 gal. of water per minute and the whole plant is run by a 35-h.p. engine which, when the three units are running, is probably overloaded. The tailings, when tested, usually pan nothing

at all, but assay a few cents, due to gold included in the sand. While this loss could be reduced by speeding up the second washer to grind the sand finer and trusting to the riffles to save what little additional free gold would not then settle in the machine, it is doubtful whether with the present small plant and so vast a quantity of ore controlled by the company such refinements are advisable, since they would probably reduce the capacity of the plant. It is estimated that the present cost of treatment is 22c. per cu.yd. loose measure with a recovery of between 50

contain the workable mineral deposits. This latter area is covered with auriferous quartz and the soil is also auriferous. The underlying schists and gneisses were found to be penetrated by seams of auriferous quartz which ran in every direction. There were, however, no veins, strictly speaking, although some of the quartz seams were several inches in thickness, and were persistent for a considerable distance in length and depth. The entire surface for a width of 300 ft. or more, and for a distance of 1000 to 2000 ft. is ore, assaying 50c. to \$1 per cu.yd. When

and their area; and also because it was desired to test with them the practicability of the new type of log washer. The process proved successful and the mine is now being profitably operated. Instead of attempting to mine the ore by stoping and trying to eliminate the low-grade material, a method of open-pit work, Fig. 7, was introduced, and all the material taken out was treated in the separators. The pit is now 90 ft. deep and 200 to 300 ft. across the top.

When mining was first started, the ore was drawn out of the pit by means of a

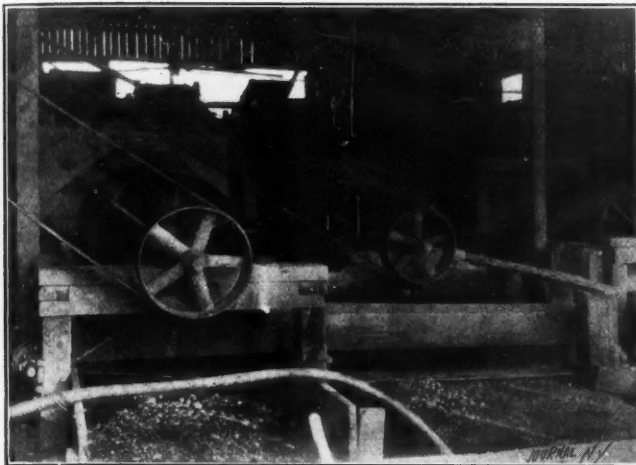


FIG. 3. SCREENS USED AFTER MATERIAL HAS PASSED THROUGH SECOND WASHER



FIG. 4. TROUGH OF BOILER PLATE CONTAINING REVOLVING CYLINDER

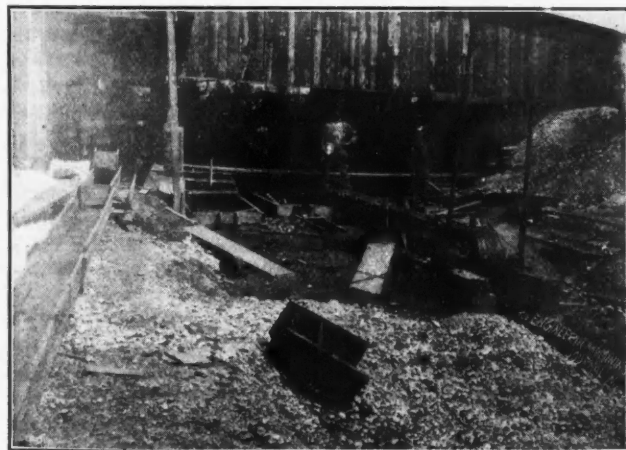


FIG. 5. SLUCE BOX AND TRAVELING BELT



FIG. 6. SELF-LOADING SCRAPE

and 75c. per cu.yd. A great deal of the success of the Catawba Gold Mining Company is due to its conservative policy, and the skill with which the whole mining and milling operation has been conducted.

PROPERTY OF THE CATAWBA COMPANY

The property owned and operated by the Catawba Gold company will bear a short description. The mine is situated in Catawba county, N. C., 4½ miles slightly south of east of Catawba, a station on the Southern railway. The mining tract comprises about 425 acres, of which 20 acres

the property was first opened, an attempt was made to mine by sinking shafts, running drifts and then stoping, but was practically a failure from the start. A shaft was sunk to a depth of 115 ft., and several levels started from this and some stoping carried on. Although many of the narrow quartz seams contain gold in some quantity, it was too expensive to mine it on account of the amount of waste material that had to be removed. About 1904, after the property had been closed for many years, it was bought on account of the depth to which the saprolites extended

self-dumping skip running on a wooden track, and discharged on a grizzly at the top of a pit. While this method handled the ore very cheaply, more economy was desired, and finally an ingenious method was devised consisting of self-loading scrapes, Fig. 6, holding from three-fourths to nearly two tons of ore. There are two of these scrapes on an endless wire rope, the loaded scrape pulling the empty one back down into the pit, Fig. 7. The ore is broken down from the sides of the pit by blasting with powder, the holes being 20 ft. deep, and al-

lowed to fall in piles at the bottom. The scrapes, as they are pulled back into the pit, are hauled over this and then, when started toward the surface, their own weight causes the edge of the scrape to be pulled down into the ore and they are readily filled by the pull of the cable. A loaded scrape can be dumped in the hopper about every 75 seconds. The scrapes are 5 ft. wide, 5½ to 6 ft. long, and 18 in. high at rear, tapering somewhat toward the front end. The bottom of the scrape

drops out. A special blade and handle permits of emptying in a few seconds. The hopper is in the shape of a circular trough made of boiler plate, into which flows two streams of water of sufficient volume and strength to wash the ore through a grizzly and then to the concentrating machines.

According to the *Journal Soc. Chem. Ind.*, March 31, 1909, it has been shown that small quantities of bismuth exert lit-



FIG. 7. OPEN-PIT WORK

extends only for a distance of about 18 in., the ore between the remainder of the side pieces of the scrape resting on the ground. The scrapes run in a trough or trench in the dirt, the steeper portions of which are protected by scantling. As the scrape comes to the top it runs over a hopper and most of the ore immediately

tle or no influence on the chemical relation of copper and nitric acid.

According to *Engineering* a contract has been made with Messrs. Sir John Jackson, Ltd., for building 300 miles of railroad across the Andes from Arica, Chile, to La Paz, Bolivia.

## German Diatomaceous Earth

Infusorial or diatomaceous earth finds many practical applications, notably in the manufacture of dynamite, polishing soaps, soluble glass, gutta-percha articles, and many other things. Germany has long been the principal producer of this earth and affords the best qualities. The principal deposits are in Hanover, where the *Kieselguhr* occurs in beds among other alluvial deposits or in proximity with lignite seams. It generally forms a granular mass of gray, brownish or pale green color; it has a dry feeling, absorbs water with avidity, is friable, and at ordinary temperatures resists chemical decomposition. It occurs in great quantities near Hützel, in the Lümberger Helde, and at Unterlness, in the same part of Hanover. It is also found at Vogelsberg, in Hesse, at Jastrobe, in Hungary, at Franzenbad, in Bohemia, and in Tuscany.

The valuable characteristics of the earth are its light weight, its absorptive power, and its non-conductivity of heat, which makes it one of the best insulating materials. It is mined in much the same way as brick clay, in open pits. It is then spread on planks or on the bare ground, in the sunshine, to dry. Artificial methods of drying do not seem to prevail. The earth should never be allowed to come in contact with flame, as it will calcine rapidly. There is no special necessity for drying *Kieselguhr* beyond that point accomplished by the sun, and, although numerous artificial means have been tried, they have not come into general use. Dry-air ovens may be advantageous in wet seasons, but are not economical except with the very finest grades of earth, such as are used for dynamite.

As the earth comes from the ground, it contains 70 to 90 per cent. of water; after drying in the sun, it still retains 15 to 25 per cent. of moisture. During shipment, it must be carefully protected from moisture.

According to *Engineering-Contracting*, April 7, 1909, the record for daily excavation in the central division of the Isthmian Canal was broken on Feb. 27, 1909. On that day 59 shovels excavated 77,064 cu.yd., an average of 1306 cu.yd. per shovel for the eight-hour day. The material excavated was loaded in 2177 Lidgerwood flats, 352 large western dump cars, and 2754 small western and Oliver dump cars, a total of 5283 carloads.

According to the *South African Min. Journ.*, March 13, 1909, the Consolidated Goldfields group yielded the following profits during February: Simmer and Jack, £57,568; Robinson Deep, £42,746; Knights Deep, £24,101; Simmer East, £7470; Simmer Deep, £10,546; Jupiter, £5413; Luipaardsvlei, £5182 and the Nigel Deep, £738, making a total of £153,764.

# Concentrating Difficult Lead Ores at Broken Hill

Auxiliary Concentrating Department Used at Block 10 Mill When Price of Lead Is High. Gangue Rocks Contain Unusual Amount of Rhodonite

BY GERARD W. WILLIAMS\*

The ore at the Broken Hill Block 10 Mine, Ltd., New South Wales, is similar in nature to that treated at the adjoining mine of the Broken Hill Proprietary Company. In the matter of rhodonite the gangue is intermediate between the quartz-calcite of the South and North mines, and the markedly rhodonite-bearing ores of the Junction North and British mines. The mill, which is of recent construction, embodies certain departures from the normal type. In particular the final concentration of the sands and slimes is so arranged that any set of tables may be cut out and the sands run direct to the dump as soon as it is shown that the price of lead will not permit of profitable closer concentration. As every unit and subunit is driven from separate motors, and as strict and careful assays are kept of the work done on any set of tables it may be easily determined when it no longer pays to further concentrate any particular class of tailings.

## THE MILL

The mill comprises four units each independent of the other and driven by separate motors, as well as an auxiliary series of slimes retreatment vanners and a vanner extension series of concentrators. The two latter can be cut out of circuit when the concentrates obtained no longer show a profit on working costs. It follows, then, that with lead at a high price the percentage recovery of lead will be higher than when the metal stands low on the market and it no longer pays to reconcentrate the slimes and tailings.

The ore from the mine, after passing the weigh bridge, is tipped from the trucks over a 1½-in. grizzly. The oversize is distributed between two Austin gyratory crushers which break down to 1½-in. cubes. The crushed ore is conveyed by aerial tram to the mill bins. The mill is situated about half a mile away from the shaft. The serious creep on this and the adjoining mines a few years ago destroyed the old mill and rendered the ground in the vicinity of the shafts unsafe for further building purposes. As before stated, the mill consists of four sections together with two auxiliary sections common to the four units. For the present only one unit will be described.

The ore from the bins is fed on a shaking screen by means of roll feeders. This screen has 3-mm. punched holes. The oversize is fed to a pair of Cornish rolls. The rolls are 30x15 in., and run at 14

r.p.m. These rolls have a maximum capacity of 1000 tons per week. The crushed ore from the rolls is divided over two trommels, each 6 ft. long and lined with punched steel (⅛-in. diameter holes). The trommels are fitted with longitudinal strips of 1½-in. angle iron, riveted at 2-ft. intervals in the trommels. These strips of iron have added considerably to the efficiency of the trommels. It seems that the strips prevent the ore from sliding round inside and by frequently lifting up the ore and allowing it to fall back on the screen a high screening efficiency is obtained.

## TANDEM ROLLS ABANDONED

The oversize from the trommels is returned by a raff wheel to the rolls. The experiment of running two pair of rolls in tandem was tried, the second pair taking the oversize from the first pair. The management states that the power costs were increased by 60 per cent. as against the present method, while slimes were only reduced by 5 per cent. As each unit at this mill is driven from separate motors, power costs are readily and accurately determined.

The undersize from the trommels (i.e., product passing an ⅛-in. diameter hole) passes over a small conical spitzlutte. The underflow runs to a double-compartment coarse jig. From the first two compartments concentrates are obtained, from the third and fourth compartments the middlings are elevated to a No. 4 Krupp ball mill. These mills grind from 4 to 5 tons per hour to pass a 3/64-in. hole. The pulp from the ball mill goes to a spitzlutte, and the underflow is fed to a double-compartment fine jig. The slime overflow from the spitzlutte at the head of the coarse jig passes through a small spitzkasten and the underflow is run over a Wilfley table. The tailings and slimes from this table, together with the overflow from the spitzkasten and the overflow from the fine jig spitzlutte gravitates to the slimes thickener. This thickener takes slimes from all the units and for the time being may be left out of consideration.

The tails from the coarse jigs are sent to draining bins and then to the dump. To return to the fine jigs: Concentrates are obtained from the first two compartments, the middlings from the third and fourth compartments are returned by elevator to the Krupp mill already referred to, and the tails go to the boot of another elevator which delivers them to two 5-ft. Forwood-Down grinding pans. The product from the pans is concentrated on two

Card tables. The concentrates go to the shipping bins, the tails to drainage bins and then to the dump, and the middlings run to a spitzkasten. This spitz, which for purposes of reference will be called spitz "A," delivers the underflow to two single-belt slimes vanners. The tails from these vanners go to the dump, the middlings to the "vanner extension" house and the concentrates to the shipment bins.

## SLIME TREATMENT

It is now necessary to return to the slimes which went to the thickeners. From now on the plant will be considered as a whole, as the four units lose their individuality at this point. The slimes and fine sands in the thickener, which takes the overflow product from all spitzkasten and spitzlutten in the four units, is pumped to a distributing box. From this box the thickened slimes are fed to four spitzkasten. The slime water which overflows runs to a sump which also receives the overflow from the main settling box. This sump receives all drainage water and after passing over "V" settlers the water is returned to the rolls.

The underflow from the four spitzkasten is distributed over 10 Card tables. The concentrates go to the bins, the tails to the drainage bins and the middlings from six tables are fed to the spitzkasten referred to previously as spitz "A." The middlings from the other four tables pass over a Card table and then pass on to the "vanner-extension" plant. The slimes from the "V" settlers, wherein the bulk of the slimes contained in the main sump return water are collected together with all drainage from the bins, trucking floors and all other places, are collected in a central sump and pumped to the "retreatment tables." The latter comprise four Wilfleys and five vanners.

The middlings from the "retreatment tables" pass to the "vanner-extension" plant. The latter comprises a series of "V" settlers, four spitzkasten, nine single-belt vanners and one Card table. As previously indicated, a strict check is kept on the assay value of all concentrates obtained from these two auxiliary plants, and they can be cut out as soon as the price of lead falls to the point when it no longer pays to retreat the middlings from the primary Card tables and slimes vanners.

## SAMPLING AND AUXILIARY CONCENTRATION

The Block 10 is the only mine where the system of auxiliary concentrators is in vogue and in view of the extreme market

\*Consulting engineer, Melbourne, Australia.

fluctuations of lead and silver, the system has many advantages. The manager of this mine posts the assays for each set of concentrators in the mill. The assays are made for every shift and in consequence the mill officers and men know at once which shift is doing the best work. The result is that a certain spirit of rivalry is created, which naturally tends to better work all around.

Too often, but little attention is paid to accurate sampling and, as a result, the actual work done on any particular set of tables is unknown. But where a careful record of the work of each shift in every department is kept the mill officers can at once place their hands on the weak spot. Detailed assaying of this character naturally involves extra expense, but if one may judge from this mill, the results more than justify the expenditure.

The labor-distribution sheet for the mill, per shift of eight hours, is as follows: Shift bosses, 1 man; tipping floor to bins, 1; rolls, 2 (boys); raff wheels, 2; jigmen, 4; grinding pans and ball mills, 1; 18 Card tables, 2; central slimes race, 1; 20 tables and vanners, 2; spitzkasten attendant, 1; elevator floor, 1; trucker boss, 1; trucking concentrates, 1; trucking tailings, 10; slimes pump, 1; slimes retreatment, 3; horse driver (to dump), 1; vanner extension, 1 (and 2 boys); sampler, 1; total, 35 men and four boys per shift, or 105 men and 12 boys per day.

The boys receive about \$1 per shift, the bulk of the men, \$1.83 per shift; and those engaged on the pans, jigs and groups of concentrators from \$2 to \$2.50. Shift bosses are paid \$2.95.

MILLING AND GENERAL COSTS

The cost of dressing the ore, during the half-year ending March 31, 1908, was \$1.495 per ton of 2240 lb. The recovery of lead was 72.1 per cent. and of silver 40.6 per cent., the crude ore averaging 15.1 per cent. lead, 13.7 oz. silver and 18.7 per

cent. zinc. Other data concerning the mill products will be found in the accompanying table. During the period mentioned, 67,054 long tons of ore were

mined and milled, the general costs being as follows:

GENERAL COSTS AT BLOCK 10 MINE.	
	Per Long Ton.
Ore raising .....	\$2.720
Transport of ore .....	0.067
Ore dressing:	
Breakers .....	\$0.103
Milling .....	1.252
Slimes retreatment .....	0.140
	<u>1.495</u>
Total .....	\$4.282

DIFFICULT ORE AT THE JUNCTION NORTH

Ore dressing at the mill of the Broken Hill Junction North Silver Mining Company is of more than usual interest, as the crude ore averages 40 per cent. rhodonite, which increases the difficulty of fine grinding and concentration. The specific gravity of the concentrates, which contain 10 per cent. of blende and 18 per cent. of rhodonite and garnet, varies from 5.9 to 6.2, while the specific gravity of the tailings ranges between 4.5 and 4.8. The working ratio in water, therefore, varies from 5.2 to 3.5 under the best conditions, and under the worst conditions from 4.9 to 3.8.

In order to obtain anything like satisfactory results from the concentrating tables they have to be run at high speed and with a long throw. The Wilfleys run 260 strokes per minute with a 1 1/8-in. throw. Needless to say the tables suffer. T. H. Palmer, manager of the Junction North company, has designed a rubber vanner belt table for sand concentration. The rubber is claimed to exercise a sort of selective action on the metallic concentrates and in consequence it is possible to run the belts at a lower speed than the ordinary concentrating tables. These vanners, which have proved extremely economical in practice, will ultimately replace all the Wilfleys tables in the mill.

SEQUENCE OF MILL OPERATIONS

The ore milled averages 14.8 per cent. lead, 10.5 oz. silver and 8.7 per cent. zinc. Following is a brief account of the sequence of metallurgical operations. The ore is raised in trucks and after passing the weigh bridge, is dumped over 3-in. grizzlies. The oversize from the grizzlies passes through a No. 5 D Gates breaker. The undersize from the grizzlies and the product from the breaker pass over a shaking screen having 2-in. holes. The oversize is sent to another breaker, which reduces it to 1 1/2 in. The final product is elevated on an 18-in. Robins belt conveyor to the mill bins. The belt is 400 ft. long, rises at an angle of 17.5 deg. and travels at 160 ft. per min. The conveyor has a capacity of 5000 tons per week. The mine output, however, averages only 1400 tons per week.

From the mill bins the ore is fed by means of roll feeders to four 3-deck shaking screens. The top grating is punched steel with 1/2-in. holes, the intermediate screen has 3 mm. holes and the third or

bottom screen has 0.75-mm. holes. The screens are actuated by "out of balance" flywheels and double buffers. They are said to do excellent work at low cost, but the vibration is very heavy. On concrete foundations this type of screen might be successful, but otherwise the vibration imposes a severe strain on the woodwork of the mill.

The oversize from the upper and intermediate screens is fed to two pairs of Cornish rolls, a choke feed being maintained. The rolls are 33 in. in diameter by 18 in. on the face. The tires of the flanged rolls are Krupp armour plate, but Cammel-Laird toughened steel is used for the plain rolls. The tires have a life of 15,500 tons and each pair of rolls has a maximum capacity of 1500 tons per week. Running at 23 r.p.m., the rolls require about 40 h.p. each. The product from the rolls is again elevated to the shaking screen and the product which passes the 3-mm. screen and is retained on the 0.75-mm. screen is sent to two May jigs.

MINERALS FINELY DISSEMINATED

The concentrates, which are obtained from the first two hutches of the jigs represent only 25 per cent. of the total lead recovered. The galena is in fine grains and in consequence the ore must be finely crushed before the bulk of the contained mineral is liberated. The middlings from the two jigs go to four 4 1/2-ft. grinding pans and two No. 4 Krupp mills. The jig tails are sent to the mine for stope filling.

The product from the grinding pans and ball mills shows on sizing that 13 per cent. remains on 0.5-mm. mesh, 56 per cent. on 0.25-mm. mesh and 11 per cent. on 0.15-mm. mesh. This product is elevated and distributed, without classification, to nine Wilfleys and five sand vanners. The product that passes the 0.75-mm. mesh in the three-deck shakers is distributed to four Krupp vanners. The tailings go to the dump, together with the tailings from the other sand tables, the middlings to the grinding pans and the slimes to the settlers that receive the slimes from all the other tables. After thickening the slimes are passed over six slime vanners.

The mill is still in a transitional stage and costs and recoveries have recently been slightly improved upon. In particular the recovery of lead has been increased to 65.5 per cent., the lead recovery during the last half of 1907 having been 63.7 per cent. The silver recovery for that period was 45.1 per cent. The concentrates averaged 58 per cent. lead, 29.1 oz. silver and 6.2 per cent. zinc. On a weekly average of 1350 tons treated, the cost of dressing the ore was \$1.88 per long ton, but as the mill was working under exceptional disadvantages this cost is abnormal. During the same period mining cost averaged \$2.84 per ton, about 75 per cent. of this expense being for labor.

PRODUCTS FROM BLOCK 10 MILL.

Product.	Percentage by Weight.	Silver, Oz. Per Ton.	Lead, Per Cent.	Zinc, Per Cent.
Concentrates*.....	17.5	32.4	61.2	9.4
Jig tails .....	28.9	6.7	3.7	15.4
Vanner tails .....	10.7	11.0	6.2	24.2
Jig middlings .....	2.0	10.5	6.6	23.6
Wilfley tails .....	1.6	9.1	5.4	18.8
Wilfley extension tails .....	2.5	9.4	5.0	22.6
Reground tails .....	22.3	8.1	3.6	23.3
Slimes .....	14.5	14.6	10.2	24.2
Crude ore† .....		13.7	15.1	18.7

\*Recovery of lead, 72.1 per cent.; silver, 40.6 per cent.  
 †Tonnage treated, 67,054 tons (2240 lb.).

cent. zinc. Other data concerning the mill products will be found in the accompanying table. During the period mentioned, 67,054 long tons of ore were

## Mica Mining

A. S. ATKINSON\*

Until quite recently, mica was one of the unimportant mineral products which mining engineers passed by without much more than a cursory investigation. It was only 10 years ago that I could have secured the option on Canadian mica deposits for an insignificant sum while now these same deposits yield an annual output valued at \$50,000. The change came when the electrical industry began to use mica in connection with electrical apparatus and, so rapidly has the demand increased that today mica mining is an industry of fair repute. In spite of the fact that we, as a nation, are the largest electrical manufacturing country on the globe, and the largest consumers of mica in the industries, less attention has been paid to the exploitation of the mineral here than in Canada, India and other countries.

It would seem as if this might be due to the fact that we have no great possessions of good mica to draw from but this is not borne out by the geological reports. We have valuable mica deposits in half a dozen States, notably in New Hampshire, North Carolina, South Dakota and Alabama. Recently very excellent deposits of phlogopite were found to exist in North Dakota and another rather extensive deposit of muscovite was unearthed in Tennessee. Biotite is found in considerable quantities in western Pennsylvania and Virginia.

### MICA OF COMMERCE.

In general there are three species of mica recognized in commercial uses. Muscovite, or potash mica, has a wide demand and when found in a pure state the crystals are nearly white with a slight yellowish tinge. It is in special demand for windows of lanterns and for stove doors. Biotite is known as black mica and is of magnesia-iron composition. It is found in deposits in this country and in Canada and while not suitable for all purposes, has a commercial value. Sometimes black mica belongs to the phlogopite or magnesia-aluminum variety, as this mica ranges in color all the way from amber and light brown to black. Both of these micas are of great value when found in large deposits, with good cleavage, and especially when obtained in large and nearly transparent sheets.

### CANADIAN AND UNITED STATES MINING METHODS

The total output of mica in the United States averages scarcely \$100,000 per year, while that of Canada reaches nearly \$250,000 and India is accredited with a yearly output of nearly a million dollars worth of this mineral. The reason for the lat-

\*Mining engineer, P. O. Box 1189, New York.

ter's supremacy in mica mining is found in the cheap labor costs of the country. The better facilities and modern methods of America should, however, more than overbalance this advantage.

In Canada and the United States, the methods of mining pursued show how far this infant industry has advanced over that of India. Mica is found in a great variety of veins or sheets, masses, dikes and lenses; the pegmatite occurs chiefly in the Laurentian formations. In open quarries the mica is taken from the surface rock in a simple way, but the work as a rule is interrupted by bad weather, so in New Hampshire where open quarries are worked, a portable tent or shed has been found useful to protect the workings. The power drill is used and also knives driven by compressed air which cut out the sheets in big masses so they can be easily split as needed. Underground mining is the more satisfactory method and is adopted where the deposits are sufficiently large to warrant extended work. A number of underground mines are worked successfully under improved conditions and the returns justify the investment. Where underground mining is to be adopted, the deposit should always be sampled with drills before extensive equipment for hoisting, etc., is put in.

The general method of opening up underground deposits is to sink a shaft and then open up the deposit at intervals of from 30 to 50 ft. Sometimes the mica is found only in small deposits and when one has been exhausted, drifts are run in several directions to find other pockets. These pockets as a rule, in a good mica, are close together, and a few tests with drills beforehand enable the miner to work with intelligence.

Hand drilling is often resorted to in order to prevent damage to the mica crystals. The holes are loaded with very small charges so that no great destructive work will be done by the explosive. The chief object is to loosen the rock and not blow up the mica. When the mica deposit is uncovered hand picks must be used. All sorts of power drills and blasting charges have been tried for mica mining, but in each case the work must be performed with care and in consideration of the conditions which prevail. In the past, in some cases, the rock was simply blasted out and then carried to sheds where the mica was picked. This, however, proved a very wasteful process as many fine sheets of mica were injured. Formerly the mica was split and trimmed by hand, but the modern method is to use machines and by them the output per man has been more than quadrupled.

### COMMERCIAL CONSIDERATIONS

Mica sheets of unusual size and perfection always command special prices. In the Saguenay district of the lower St. Lawrence, and also at the Mattawa, north

of Ottawa, very fine large sheets of mica are found in the deposits. The mica appears in thick layers of dark rose color, which when split furnish some of the best sheets found. This district has not been thoroughly explored and new discoveries of good deposits are constantly being made.

Near the surface, mica is apt to be injured by water seeping through the rocks, which either discolors the mineral or renders it very friable and brittle. For this reason after a deposit has once been proved, it pays to work it by underground methods as the better quality of output insured will overbalance the greater expenditure necessitated. The surface discoloration and weathering do not usually extend to any depth.

Surface mining is, of course, cheaper on account of the smaller plant required and the simplicity in getting at the material. In underground mining at least 1250 lb. of mica must be extracted from every 100 tons of rock mined to make the work profitable, but in surface work if 800 lb. of trimmed mica can be obtained from each 100 tons of rock, the profits are satisfactory. In the Saguenay district as much as 3000 lb. of trimmed mica are obtained from each 100 tons of rock from underground mining and at some of the surface mines 2500 lb. are secured.

Many other considerations affect the cost of mica mining. In one mine in Canada a ton of fine mica ranging from 3 to 7 in. in size is mined at a daily expense of \$47 but in another mine the cost is \$170 for only 600 lb. These two mines probably represent the two extremes of cost. The variance is caused by differences of the deposits and supply, but it is not likely that the latter mine could be worked long if it were not that large, exceedingly fine specimens are obtained, which usually command high prices in the markets.

The average yield of many mines will probably show only 5 per cent. of mica sheets cutting 4x6 in. and 50 per cent. cutting 1x3 in. However, in such cases the supply must be large enough so that at least 600 lb. of trimmed mica can be obtained from 60 tons of rock at a total daily cost of about \$50.

The public has been slow to invest in mica mining, and in fact nearly all of the mines are operated by close companies which realize that a steady and uniform profit is more valuable than spasmodic abnormal yields. A mica mine is in no sense a wildcat, but a safe and sure investment if the conditions are thoroughly investigated before mining is undertaken. In many cases old abandoned mine dumps are now being worked over, for at present, scraps of fine mica can be marketed at a fair profit.

### CONSIDERATION OF THE PHYSICAL PROPERTIES

The physical properties of mica greatly

affect its commercial value. Perfect transparency is one of the most valuable qualities and where this transparency is without any flaw, the returns from a mine are 20 per cent. higher. In some cases impurities have been deposited between the cleavage planes of the mica and in others the crystallization has been disturbed. In either case the transparency is seriously affected, and in most cases this defect cannot be eradicated. In some localities feldspar or quartz has been deposited between the cleavage planes. Where these impurities are in a loose condition they can be removed by a process of washing which does not injure the product.

Flexibility is another very essential characteristic and as mentioned above, mica mined from surface workings is apt to be soft and lacking in this respect. Where the mica is partially decomposed, it has little commercial value other than for use in paint.

Considerations of the quality of the mineral should always precede a decision to invest money in the exploitation of mica deposits. Failure to do this has resulted in many disappointments. This is just as necessary as investigating the nature of the deposit, for both are essential to success. While less expensive machinery is required for mica mining than for any branch of metal mining, the proper equipment of a plant demands quite a little investment of funds. Unless the supply and quality are going to prove satisfactory for a considerable time, it is unwise to undertake the work of opening an underground mine. Surface mining on the other hand may be undertaken without much risk.

### Assaying Silver Bullion

F. T. C. Hughes (*Bull.* 41, I. M. M.) describes an interesting method of assaying silver bullion in use at the Indian mint. The method consists of dissolving the assay piece in nitric acid, precipitating the silver with hydrochloric acid and weighing the silver chloride formed. The work at the mint embraces the determination of the silver contents of fine silver, Mexican dollars, Chinese "lycee" silver, and various coins. In most cases granulated samples are taken of the melts as well as punchings from the coins. The assay-piece weight chosen is 18.821 grains, which weight of pure silver gives 25 grains of silver chloride. The 25-grain weight is the unit weight, and the other weights are decimal parts of it.

The assay pieces (*musters*) are carefully adjusted to weight, check weighed, and placed in bottles. To each bottle 5 c.c. of nitric acid (sp. gr. 1.25) is added by means of a pipette, and the solution assisted by placing the bottles on a hot plate. The nitrous fumes are removed from the bottles after solution is complete by blowing into the bottles through a piece of glass tubing. The bottles are then removed from the hot plate and 150 c.c. of

cold distilled water introduced into each bottle, followed by the addition of 5 c.c. of hydrochloric acid (sp. gr. 1.075). The bottles are then stoppered, allowed to stand a few minutes and then shaken by hand, a final twist of the hand serving to wash down the sides and the stoppers. The bottles are nearly filled with a rapid inflow of water, settled for an hour when the supernatant liquor is removed by siphoning until about 1 in. is left in the bottom of each bottle. The bottles are again nearly filled with water, shaken and settled overnight, with the stoppers in place.

The stoppers are removed in the morning, the bottles inclined and tipped so that the chloride may collect on one side and inverted in a trough of water over small Wedgewood cups standing in white porcelain saucers. The finger is kept over the mouth of the bottle while inverting, but is removed before any of the chloride has touched it. The bottles are held by clips in their inverted position and are tapped and turned until all of the chloride has settled out. The finger is again placed over the mouth of the bottle and the bottle removed for traces of chloride.

The cups are removed from the trough and any particles of chloride in the saucers carefully transferred to their respective cups. The water is carefully decanted from the cups, tapping them meanwhile to collect their contents. The cups are next dried in hot-air ovens at 212 deg. F. until the cake of silver chloride shrinks away from the cup and can be readily loosened by means of a gentle tap. The temperature of the ovens is next raised to 350 deg. F., and maintained at that temperature for three-quarters of an hour. The cups are then cooled, the hardened cake removed with a pair of platinum-tipped forceps to the balance pan and rapidly weighed to prevent the absorption of moisture, which is liable to take place in damp weather.

The results are accurate, but the time and labor consumed are large. Gold, platinum, tin, antimony, bismuth, mercury and lead interfere in this method, and slight modifications are necessary when they are present. The silver is recovered from the silver chloride by melting the chloride with 70 per cent. chalk and 4 per cent. powdered charcoal.

### Departure in Sheet-ore Mining in the Joplin District

BY TEMPLE CHAPMAN\*

The "sheet-ore" mines of the Joplin district are now developed continuously over a stretch of country about 10 miles in length, and a greater ore area is indicated. The workings about each mill usually cover an area of from 10 to 40 acres and the ore mined has usually been of a thick-

ness varying only between 8 and 12 ft. in height. This stratum has rarely been worked profitably when the average saving of zinc and lead concentrates amounted to less than 3 per cent. of the crude ore mined, and yet the general yield from all the sheet-ore mines runs but slightly over 3 per cent. The cost of this mining plus the 10 per cent. royalty paid by most sheet-ore mines is as great or greater than the receipts at present ore prices. Therefore the following departure in mining methods is important.

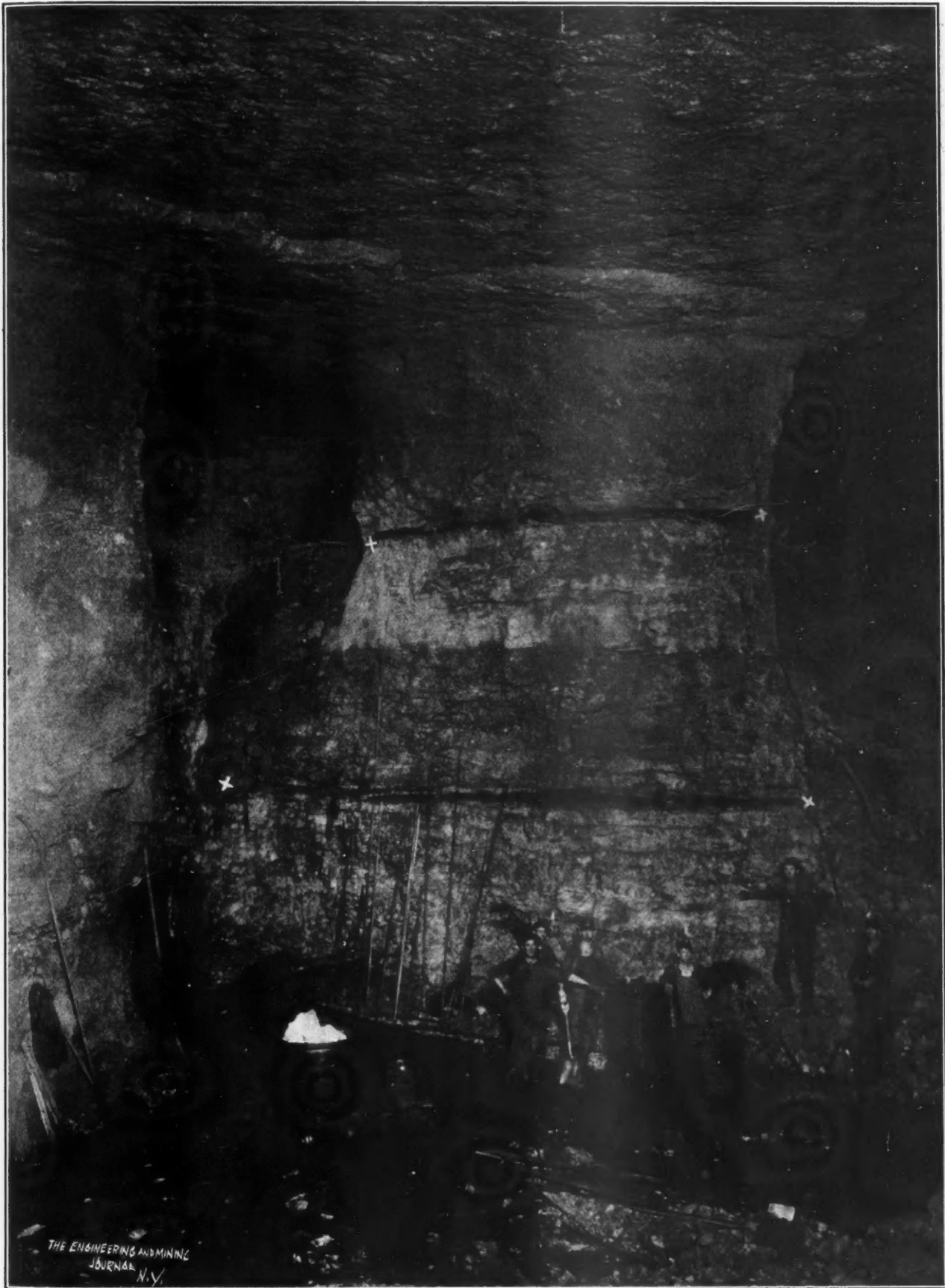
Recently several of the "sheet-ore" mines have sunk deeper into the "sheet" and have taken up a "12-ft. stope" (the floor of the mine). From this operation the yield of concentrates has hardly averaged 2½ per cent. of the tonnage of crude ore mined, but the cost of mining has been greatly reduced and the grade of the concentrates has been high (63 per cent. zinc). Where in the heading 10 air drills and \$100 worth of dynamite daily were required to "break" 500 tons of rock, in the stope one machine drill and \$20 worth of dynamite are doing the same work and keeping a big mill busy day and night.

In the Red Dog mine at Webb City, Mo., we are taking up a "second stope" or third level, showing the sheet orebody to be approximately 30 ft. in thickness in all. In the accompanying illustration above the white crosses will be seen the stratum of disseminated lead and zinc ore originally worked by all the sheet-ore mines, this original level usually having a height of 10 ft. Below this will be noted the two strata indicated by the four white crosses which mark the second level or "first stope" now operated by a few of the Webb City mines. Still lower is the "second stope" or third level opened in the Red Dog mine where the entire thickness of the "sheet-ore" body was first worked. The photograph shows the wonderful regularity of the stratification. There are four main strata each about 8 ft. thick, which consist of (1) the richer, disseminated zinc and lead ore; (2) a more or less barren stratum of white flint; (3) a good grade of zinc ore contained in two regular seams; (4) a disseminated and pockety lead ore. Each main stratum is of a distinct color and different formation from each of the other three.

Above the ore, extending to the surface, is a body of limestone 200 ft. in thickness, while under the ore and going down to the sandstone is the second limestone 600 ft. thick, so our new development shows that the entire flint stratum between the two limestones is mineral-bearing and probably "pay ore." It also indicates the possibility that 30 ft. is the workable thickness of the sheet-ore body throughout its area in this district. The amount of ore that might be mined from a 40-acre tract, leaving enough pillars for holding the roof, would be 3,000,000 tons, and the yield in zinc and lead concentrates, at 2½ per cent. saving, would be 75,000 tons.

\*Webb City, Mo.





MINING THE ENTIRE SHEET-ORE BODY AT RED DOG MINE, WEBB CITY, MO.

# Ore Handling Bridge at Duquesne Steel Works

The Duquesne Bridge Has a Span of 230 Ft. with a Cantilever Extension of 65 Ft. at Either End; Capacity Exceeds 600 Tons per Hour

At the Duquesne plant of the Carnegie Steel Company a large ore-handling bridge has recently been installed which possesses a number of interesting features. The bridge spans an ore yard of about 1800 ft. in length, serving six large blast

The bridge is of approximately 230 ft. span between trucks, and has a cantilever extension at either end of about 65 ft. The iron ore is brought within reach of the bridge by transfer cars, which operate between the car dumper and the ore yard

moves it from the storage pile and delivers to transfer cars for distribution into various compartments of the bins, from which the supply for the blast furnaces is drawn as needed.

At the farther end of the bridge a V-



GENERAL VIEW OF ORE-HANDLING BRIDGE AT CARNEGIE STEEL COMPANY'S PLANT, DUQUESNE, PENN.



HANDLING ORE AT YOUNGSTOWN, OHIO, WITH A HEYL & PATTERSON BRIDGE

furnaces. Adjacent to the furnaces are storage bins under which the larry cars operate to conduct the ore from the bins to the furnace skips. One supporting leg of the bridge rests on this bin structure, and the other is carried by a concrete wall 26 ft. high.

and run on tracks carried by the bin structure. These transfer cars discharge their load through an open track on baffle plates, which form a temporary pile along the bin side of the storage yard. By means of the grab bucket the bridge gathers up the ore and places it in storage or re-

shaped leg furnishes the support but at the furnace end, a single shear leg supports the bridge as is shown in the accompanying illustration. Throughout the design of this structure flexibility was sought; this provides for the inequalities in travel of the two ends of the bridge,

and absorbs endwise shocks and thrusts due to the quick acceleration of the trolley, without straining the bridge.

The bridge is propelled along its track by two 52-h.p., Westinghouse, type K, crane motors; a motor is placed on each truck and is controlled from the cab. The two controllers for these motors are set adjacent, and are so arranged that a single handle moves either controller separately or both simultaneously. This arrangement allows one end of the bridge to be moved without affecting the other, and on a long travel should one end of the bridge structure get in advance of the other end, the higher-speed motor will be retarded until the slow one overtakes it.

On this bridge is used a 10-ton Hulett patent excavating bucket, which is operated by two 225-h.p., Westinghouse, crane motors of mill-type construction. The bucket with its load of ore weighs approximately 50,000 lb. The trolley traversing mechanism is driven by a 225-h.p. motor of the same type as the hoisting motors. The two bucket-operating motors are geared together and operate by a single magnetic-type controller, providing also for dynamic braking. This relieves the trolley of a considerable item of wear in the matter of brake blocks. The bridge is of large capacity, having been constructed to handle 600 tons per hour. It has, however, within the last four months far outstripped this amount. The bridge was constructed by Heyl & Patterson, Inc., of Pittsburg.

At Youngstown, Ohio, an ore-handling bridge of much the same type, but of approximately 100 ft. greater length has been installed at the plant of the Youngstown Sheet and Tube Company. This bridge is shown in operation in one of the accompanying engravings. The propelling gear differs from that of the Duquesne bridge in having four motors instead of two, the trucks at the four corners being in this instance duplicates.

### Rapid Estimation of Arsenic

Harley E. Hooper (*Bull.*, 41, *I. M. M.*) describes a rapid method for the estimation of arsenic in ore. The method is based on the reaction between arsenic, when present in its higher form of oxidation, and potassium iodide in an acid solution. The iodine set free by the reduction of the arsenic is titrated with standard thiosulphate solution. The method is suitable for sulphide or oxidized ores containing 1 per cent. or more of arsenic and is free from interference by the other ordinary constituents of ores, such as lead, copper, zinc, iron, manganese or nickel, since

these are either removed during the analysis or do not react with the thiosulphate.

In the standard thiosulphate solution, 1 c.c. = 0.005 gram of arsenic and is standardized either against copper or arsenious oxide. In standardizing with copper, 0.3 gram is dissolved in 10 c.c. dilute nitric acid, the fumes boiled off, ammonium hydrate added till just alkaline, any excess boiled off and 1 c.c. of glacial acetic acid added. The solution is cooled, potassium iodide added and the free iodine titrated with the thiosulphate. The arsenic value is  $75/127.2$  of the amount of copper taken.

The standardization with arsenious

to take 0.5 gram of the ore in a 12-oz. tumbler beaker and treat with 10 to 15 c.c. of a moderately strong solution of potassium chlorate in concentrated nitric acid. The solution is evaporated to gentle dryness and then heated for a few minutes to get rid of oxidizing matter. After cooling and adding 10 c.c. of dilute ammonium hydrate, the solution is brought to a boil, 25 c.c. of sodium hydrate (25-per cent. solution) added, boiled again, filtered hot and washed with hot water. If the volume exceeds 50 c.c. it should be evaporated to that bulk and then neutralized with concentrated hydrochloric acid and treated as in the standardization.



DETAILS OF V-SUPPORT OF ORE BRIDGE AT DUQUESNE, PENN.

oxide is made by taking 0.264 gram of the pure salt, adding 5 c.c. of concentrated nitric acid, evaporating to dryness and heating strongly for a few minutes, then taking up the residue with 25 c.c. of a 25-per cent. sodium-hydrate solution, warming and diluting to a bulk of 50 c.c. The solution is neutralized with concentrated hydrochloric acid, 25 c.c. more acid added in excess, then cooled, the potassium iodide added and the titration performed with the thiosulphate. Starch is not used as an indicator during the titration, but after the solution is colorless, starch is added as a test of the completeness of the titration.

The method for a 20-per cent. ore is

The proportion of hydrochloric acid present should be from one-half to three-fifths of the total volume. The titration should be done slowly, especially toward the end and if the yellow color returns a few drops of thiosulphate will discharge it, and the higher reading should be taken. The method is altered when antimony is present by fusing the ore with sodium peroxide in a nickel crucible and extracting the fused mass with water. Starch as noted before should not be used as an indicator during titration but only to confirm the end point and if any color is shown the analysis must be repeated. For careful work, blanks should be run to test the reagents.

### Restoring Dredged Ground \*

In the State of Victoria, Australia, much gold is obtained by hydraulicking and dredging. In 1907 there were 133 dredging plants in operation, 45 of these being bucket dredges, 84 pump-hydraulic sluices, and four jet elevators. In 1907 these plants treated 20,199,892 cu.yd. of material which yielded 97,821 oz. gold, or an average of 2.32 grains per cu.yd. of gravel treated. In this industry 2468 men are employed. Three of the bucket dredges treated more than 9000 cu.yd. a week; four, more than 8000 cu.yd.; and 17 dredges between 6000 and 7000 cu.yd. a week. In many respects dredging is in a more advanced state than in most other districts, for in Victoria an attempt to restore the dredged area to usefulness for agricultural purposes is being made and meeting with some success.

#### THE SAND LAUNDER ORDINARILY USED

One of the features of the year has been

in it, held down by battens and cleats. The area of the extra gold-saving surface of the gold is saved in the sand launders, this being the finest gold in the gravel.

In bucket dredging when the gravel contains much clay, difficulty is experienced in saving the gold, for the balls of clay which are not broken up carry considerable gold into the tailings. This difficulty has been overcome to a large extent by the use of a revolving screen, inside of which are heavy iron chains hanging in loops and bunches. This screen works longitudinally around a fixed iron bar attached to which are spikes or teeth spaced about 6 in. apart. These teeth act as a paddling rake, and the loose-fitted, dangling chains agitate and break up the coarse lumps of material as the screen revolves.

#### RESTORING THE DREDGED AREA TO USEFULNESS

As has been said before, considerable attention is being given to the reclaiming of dredged ground. The sand boxes de-

ft. An opening, 5 ft. long, extends from the lower end of the main box to the upper end of the extension loam launder; during ordinary dredging operations while the special loam chute is not in use, the gravel discharges through this opening.

#### THE LOAM LAUNDER FOR RESOILING GROUND

The upper end of the extension loam launder, Fig. 2, is as wide as the main launder, but within a short distance the width is reduced to 26 in., the depth being 9 in. The movable portions of the launder *E* and *F* are made of  $\frac{1}{8}$ -in. plate, bent into a semi-circular trough; a light angle iron is riveted along each of the upper edges to form flanges. When the chute is in position for use, these flanges rest on top of the upright sides of the main sluice box. Sections *E* and *F* of the loam launder, when in operation, extend along the inside of the main sluice box from near the bottom of the drop-chute bars to just across the 5-ft. opening, bridging the latter and conveying the resoiling material

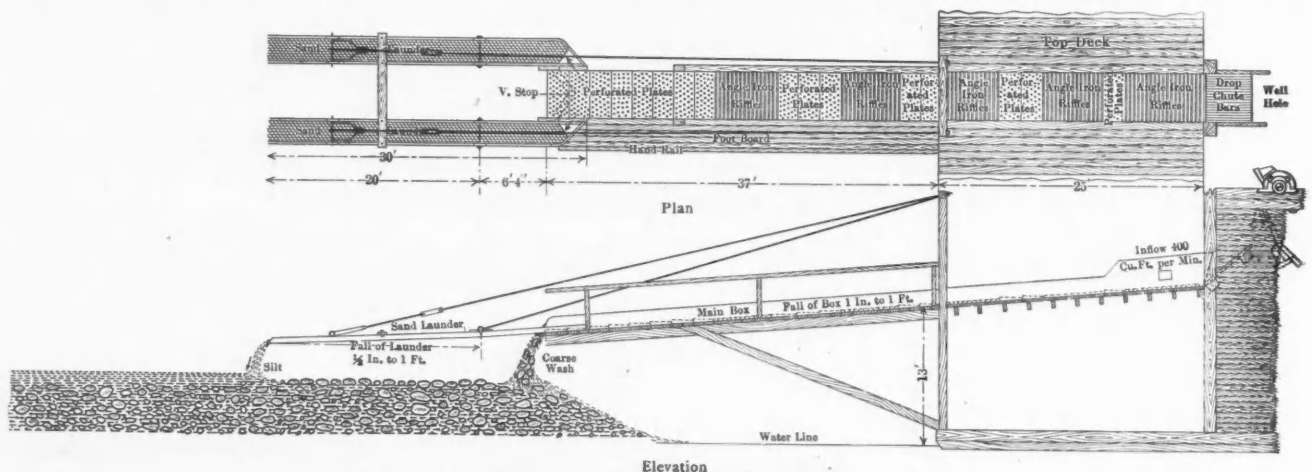


FIG. 1. TYPE OF TAILINGS LAUNDERS USED IN VICTORIA, AUSTRALIA

the tendency for bucket dredges when working in suitable ground where the material is of a loose, friable, sandy nature to discard screens and elevators and to use instead riffle-bottomed sluice boxes such as are shown in Fig. 1. This latter method is more economical both in regard to initial cost and to maintenance, and by the adoption of a simple contrivance (the silt distributor) the dredged material is classified so that the fine sand is deposited on top, partially restoring the dredged area to usefulness. But the main advantage of these launders is the additional saving of gold obtained rather than the restoration of the area, for as none of the water is removed from the dredged material the silt is carried deep into the gravel, and so the best part of the soil is lost. These sand launders are laid with cocoa matting placed under protecting sheet iron having  $\frac{3}{4}$ - or 1-in. openings

\*Abstracted from the report of D. B. Sellers, State hydraulic engineer, in the Report for 1907 of the Secretary of Mines for Victoria, Australia.

scribed above are not especially suitable for this work, but at two plants, the Constance dredge at Eurobin, on Owens river, and the Tullock's dredge on Livingston creek, Omeo, satisfactory restoring devices are being used, while the Crooked River company has recently started to use similar contrivances. In any restoring process advance stripping is necessary in order to keep separate the surface soil and in order to enable the dredging to be done with as little water as possible, so that the fine silt will not be carried down into the underlying coarse gravel.

The method used with the Confidence dredge consists in working the gravel and surface soil separate. The gravel is deposited near the dredge, while the soil, which is stripped before the gravel is touched, is conveyed farther and is deposited on a part already covered with gravel. On the Confidence dredge the main sluice box is 4 ft. wide by 18 in. deep, and its length from the drop-chute bars to the end of the delivery is  $56\frac{1}{2}$

into the extension loam launder which deposits approximately the same thickness of soil on top of the gravel as was originally there. The upper end of section *F* is made rectangular, and of such size that it fits into the main sluice box near the drop-chute bars. The portable sections *E* and *F* are raised and lowered by a continuous wire rope extending from a winch on the dredge framework. This rope goes from the chain strap around the end of section *E* through a small pulley *H*, fastened to a rope passing from the head of the derrick to the aft gantry; then it passes through a double pulley suspended on the before-mentioned line, and is next taken through another small pulley *L* on the framework of the dredge to the drum of the winch used to raise or lower the loam launder. The operation of raising or lowering occupies only three minutes; the whole time from the stopping of gravel dredging to the delivery of loam from the buckets into the launder is about 10 minutes. When being raised the

shorter and lighter section *F* rises from the main box first, and continues to ascend until blocked by the stops at *G G*. Then the upper end of *E* begins to rise and is hoisted to *H*, where it is held in position until again required. While dealing with surface soil or loam, sections *E* and *F* are lowered each morning into their place inside of the main box, and advance stripping is done for two or three hours.

#### ADVANTAGES OF THE SYSTEM

During that time, with a face from two to three chains long sufficient ground is stripped to admit of gravel dredging for the remaining portion of the 24 hours. The soil is stripped at the rate of about 85 cu.yd. per hour; the gravel is dredged at the rate of 60 cu.yd. per hour. Allowing for delays, in a week's run of 130 hours about 100 cu.yd. more of ground can be dredged, and in the case mentioned more gold can be saved by separately stripping and conveying the overburden through the loam launder than by sending both gravel and overburden together

#### Assaying Stamp Mill By-Products

Much has been written concerning the assaying of ores and usual metallurgical products, but there has been published comparatively little regarding such by-products as battery chips and screens, plumbago crucibles, drosses, etc. The methods described by Leslie J. Wilmoth (*Journ. Chem., Met. and Min. Soc. of South Africa*, VIII, pp. 230-232) for the assaying of by-products were indirectly the result of some experiments on the assaying of copper ores for gold. An almost pure carbonate of copper ore was mixed with a gold ore in such proportions as to contain 8 per cent. copper and 35 dwt. gold per short ton.

#### OBJECT OF THE EXPERIMENT

The object of the experiment was to collect the gold in a lead button and pass the copper into a gold free matte by adding sufficient sulphur to the charge to unite with the copper. The charge used was: Ore, 1.0 a.t.; granulated soda, 2.0;

The silica was used to protect the crucible and it seems as though an excess of flux was used. The nail served the same purpose as in the ore assay. The charge is given a hot quick fusion and then washed down with a small amount of litharge and charcoal. The heat used is a little higher than with the usual assay, and after the fusion has become quiet the crucible must stand in the furnace for a full twenty minutes. The method is excellent for gold, but when silver is to be determined, the matte should be re-run by scorification.

The sample of battery screens consisting of small clippings of the screens is carefully oxidized in roasting dishes in the muffle until all the iron is in the oxide condition. The roasting dishes are then removed from the muffle, cooled and their contents pulverized using care to avoid losses during the operation. The sample may then be assayed by the usual methods or by the matte method. The basic character of the slag tends to a loss of gold in the slag with the usual methods, and

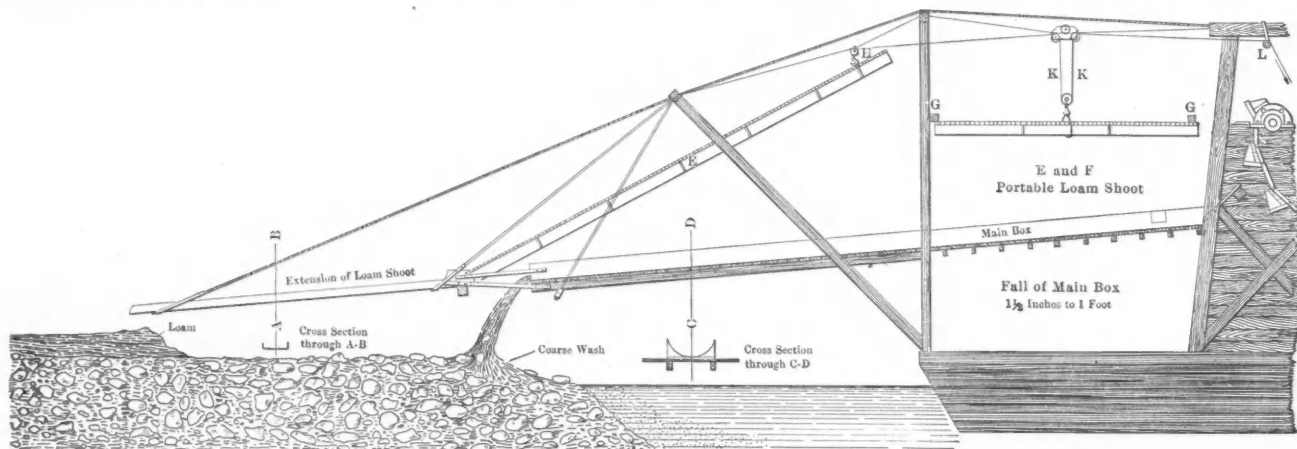


FIG. 2. CROSS-SECTION OF CONFIDENCE DREDGE, SHOWING LOAM LAUNDERS RAISED

through the sluice box. The cost of stripping the soil and dredging the gravel is about 2d. per cu.yd., the area resoiled being six acres.

Water is required to wash the soil along the launder, but in practice it is found that only about 10 per cent. of the quantity necessary to keep the sluice box clear of ordinary gravel is sufficient to convey the loam through the resoiling launder. By the exercise of a little care and by building small brush and stone dams, the quantity of loam that is carried back to the pit by the return water can be reduced to moderate limits. Some soil drops into the pit when scooped up by the buckets, and some soil goes away in suspension at the save-all box, so that all the soil cannot be deposited again on top of the gravel. Nevertheless, the Confidence dredge is at present replacing from 80 to 85 per cent. of the surface loam on top of the dredged gravel so that the resoiled gravel is almost as useful for grazing and agriculture as originally.

fused borax, 2.0; litharge, 1.0; sulphur, 1.2 grams; charcoal, 1.5 grams; one 6-in. iron nail. The iron nail took up any excess sulphur and kept the lead button malleable. It was found that the lead collected all of the gold and the matte was practically gold free.

The method was so successful that it seemed applicable to the assaying of battery chips. The sampling of battery chips is at the best very unsatisfactory and when to this is added equally unsatisfactory methods of assaying, the perplexity of arriving at the true value of a lot can be imagined. It was desired, therefore, to remove one of these perplexities by devising a suitable method for this material, which consists of lumps of iron ranging from the size of a pin head to lumps 0.5 inch in diameter. The matting method was successfully applied to the battery chips using: Chips, 1.0 a.t.; granulated soda, 1.5; fused borax, 1.5; sulphur, 0.5; silica, 0.5; charcoal, 1.0 gram; iron nail.

Mr. Wilmoth, therefore, prefers the matte method. The charge for the direct fusion was: Oxide, 1.0 a.t.; granulated soda, 1.5; fused borax, 1.0; litharge, 2.0; silica, 0.5; charcoal, 1.5 grams. The charge used for the matte method was: Oxide, 1.0 a.t.; granulated soda, 1.0; fused borax, 0.5; litharge, 1.0; silica, 0.5; sulphur, 0.5; charcoal, 1.0 grams; one nail.

According to Consul John E. Kehl, a local railway company has acquired a large tract of land at East bay, about 15 miles from Sydney, Nova Scotia, which is said to contain large deposits of gypsum. The deposits will be thoroughly exploited by the present owner, with the assistance of government experts. Tests already made point to an exceptionally large quantity of material of unusual purity.

According to the *Journal Soc. Chem. Ind.*, March 31, 1909, a small percentage of copper in lead has little or no influence upon the reaction of lead with nitric acid.

# An Investigation of the Cost of Mining Coal

Actual Operation Costs Are Analyzed, and it Is Shown That the Rate of Wages Is an Effect, Not a Cause, in the Economy of Mining

B Y J. R. F I N L A Y\*

Modern civilization is propelled by the annual combustion of upward of 1,200,000,000 tons of coal. This vast use of power other than human or animal muscle is the basic fact in the mightiest revolution in industry, in art and in habits that the human race ever experienced. Every time we press a button to turn on an electric light, every time we enter an elevator or a street car we participate not only in a human revolution, but in a great geologic fact; for the mining and destruction of coal removes some of the important strata of the earth's crust.

Coal mining is the basis and dependence of other kinds of mining just as it is of other industries. And farther, since coal mining is one of the simplest and commonest of mining operations, it serves as a standard by which the complexity and cost of other kinds of mining may be appraised.

If coal were not so abundant and widespread its use could not, of course, be so extensive and fundamental. The fact of its wide distribution is the most powerful element in the conduct of the business. If coal were not cheap it could not be so extensively used; it would not, therefore, be so valuable. But because it is cheap it is often wasted; it is cheap because it can be offered in the market by innumerable competitors, whose aim is not the wise use of coal, but ready money profit from it. Hence this most valuable of mineral resources has been in considerable measure crudely and greedily exploited.

The cost of coal to the consumer depends on two elements that vary widely: 1. Mining, and 2. Transportation; but since the effect of the latter is self-evident, I do not propose to discuss it.

## FACTORS THAT INFLUENCE COST OF MINING

I. The cost of mining coal depends, in my judgment, upon the following factors:

- (a) The thickness of the seam.
- (b) The purity of the coal in the seam.
- (c) The regularity of the seam.
- (d) The geological attitude as regards angle of dip occurrence of faults, etc.
- (e) The climate, cost of living, etc.
- (f) The depth.
- (g) The amount of water to be pumped.
- (h) The solidity of the roof.
- (i) The presence of gas, dust, or other elements of danger.
- (j) Topography of the surface.

Some other factors may influence the

\*Mining engineer, 2 Rector street, New York City.

cost in a minor degree. Such as the hardness of rock encountered in development work, hardness of coal, cost of supplies, etc.

It will be noted that I have mentioned only natural conditions leaving out the factor that many would be inclined to place first on the list—the rate of wages. I do not believe that this is a factor at all. The price of labor is determined by the natural factors. It is an effect, not a cause, in the economy of mining. If we have two neighboring districts with the same natural advantages, but in which the rates of wages are different, that difference is apparent, not real. The difference will be equalized by the supply and demand for labor as automatically as water runs down hill. If a mine pays lower wages than its neighbor it will have poorer men; if other conditions are the same, the cost will be the same. You cannot change this natural law; it is like the force of gravity.

## LABOR COSTS AND WAGES

I hope that no one will understand this dictum to mean that where natural conditions are the same, the wages will be the same, or that the cost of labor will be the same; on the contrary, these things vary a good deal. Management, scale of operations, appliances of all kinds vary, or may vary, almost without limit among various enterprises. These factors help to establish wages and labor costs: they are quite independent both of natural conditions and of labor conditions, and have to do with the success or failure of enterprises. They introduce variations in cost that are, or may be, equal to the margin of profit that there is in the business.

## HOW LABOR COSTS MAY DIFFER WITH SAME RATE OF WAGES

To elaborate a little, let us suppose that Smith and Jones are two rival operators in neighboring coal mines in which the natural conditions are exactly the same and in which coal is salable at \$1 per ton. There are only two mines in the district and each can produce twice its actual tonnage. Smith is a good operator, with sufficient capital, equipment, development and ventilation. He can mine coal for 60c. per ton. Jones is a poor operator, and his mine is poorly opened. It costs him \$1 per ton to produce coal. It is obvious that the successful and opulent Smith has the decision as to how great a difference there shall be in labor costs in that district. He can prevent Jones from making a

profit, and can close him down by selling coal under \$1 per ton, which is Jones' cost. It is obvious that the difference between labor costs here will be approximately as 6 is to 10. This is not due to the rate of wages; it is just the difference between Smith and Jones.

## HOW WAGES MAY DIFFER AND COSTS BE THE SAME

Now let us suppose that Smith and Jones are 2000 miles apart and each sells his coal at a point midway between them with equal transportation costs. Smith can supply the market and so can Jones, and each wants to sell all he can, and can produce all he can sell. Smith can sell without loss as low as 60c. per ton. Jones, if he pays as much wages as Smith, cannot sell for less than \$1. Neither Jones nor his employees know anything of Smith's superior methods and appliances, and they have no means of living except by selling coal. Obviously under these conditions there is only one thing to do—work for less money. So Jones fixes his wages at 60 per cent. of Smith's wages and continues business. This rate is fixed by the efficiency of Jones as against Smith. His men get just what they earn. In other words, the final result is exactly the same as if each laborer were in business for himself.

## ACTUAL COSTS

Returning now to the natural factors that govern the cost of coal mining, the find that their number and importance is very considerable, and if all coal were to be mined we should have enormous differences of cost. As a matter of fact, these great differences do not at present exist because the commercial conditions of the country cause the elimination of all mines except those favorable for cheap working. This results from the fact that there is in this country, according to the U. S. Geological Survey, 2,000,000,000,000 tons of coal of all kinds easily accessible. This coal is spread over an area of 500,000 sq.m., and may be attacked at many thousand favorable points. The unfavorable seams will have to wait to be worked after the better ones are exhausted.

## PRICE OF COAL AT MINES

According to the excellent review of the "Production of Coal" for 1907, published by the U. S. Geological Survey, the extreme variation in the price of coal at the mines in the various States is only from 99c. in West Virginia to \$4.10 in Idaho.

The last figure is for only 7500 tons, and doubtless represents a case where an isolated but unfavorable seam may be worked because high transportation charges prevent the introduction of coal from other places. Leaving out such abnormal cases and considering only States where the output reaches 1 per cent. of the production of the country we find that the price of bituminous coal at the mines varies only between 99c. for West Virginia to \$1.68 for Arkansas. Pennsylvania anthracite is valued at \$1.91, but I shall explain later that the cost of anthracite is radically different from that of bituminous coal and no comparison should be made except with very careful explanation.

It is probable that the figures of average price of coal at the mines give the best general idea to be had of the cost of mining throughout the country. The price, of course, exceeds the cost, but it can be confidently asserted that the difference is not over 10 to 15c. per ton, if we consider the whole output of States. Within given fields there must be considerable variation; some mines working cheaply and with large profits, while others have no profits at all and some, if all capital charges were correctly made against them, would be found running at a loss. But it is quite obvious that the entire industry cannot run at a loss and that the average complete cost must fall inside the average selling price. It is difficult to get specific figures that will illuminate the general subject as accurately as the broad figures published by the Survey and I doubt if we can form a better idea of average costs than by assuming them to be 90 per cent. of the selling price. This assumption gives us the following for bituminous coal:

SELLING AND COST PRICES OF BITUMINOUS COAL.

	1903.	1904.	1905.	1906.	1907.
U. S. price.....	\$1.24	\$1.10	\$1.06	\$1.11	\$1.14
Cost.....	1.11	0.99	0.95	1.00	1.00

United States average price for 5 years, \$1.13; estimated cost, \$1.00.

	1907 Price.	Estimated Cost.
Pennsylvania.....	\$1.03	\$0.93
West Virginia.....	0.99	0.90
Maryland.....	1.20	1.08
Virginia.....	1.02	0.91
Kentucky.....	1.06	0.95
Illinois.....	1.07	0.96
Alabama.....	1.29	1.17
Arkansas.....	1.68	1.50
Colorado.....	1.40	1.26
Wyoming.....	1.56	1.40
Utah.....	1.52	1.37
New Mexico.....	1.46	1.31
Washington.....	2.09	1.88
Michigan.....	1.80	1.62

These costs are intended to be complete, that is, to cover both operating and capital charges. I shall endeavor to give some reasons for believing them to be fairly accurate, but first let me disavow any intention of applying them to any particular property or district. It would be more enlightening, possibly, to take some detailed statements of costs and

compare and digest them. But such statements are hard to get and I must confess that those I have been able to secure are open to grave question as to their accuracy. For instance, I have the statements of a coal company operating three different mines. Detailed statements of operating costs for each month for each mine are given for a period of years. The aggregate tonnage and total operating cost may be figured out only with great labor. To get five years' operation averaged, I should have to combine 180 different cost statements. If this were necessary to secure the facts, one might be heroic enough to do it, but, after all, it would only give the results of an insignificant fragment of a single field and a single management. But far worse than this, after making this compilation, I should still doubt its accuracy because a single glance at the balance sheet reveals the fact that in mining 1,000,000 tons of coal, \$350,000 has been added to capital charges. The writing off of such charges is a matter of judgment, based on familiarity with the property itself. I cannot possibly supply either the time or the experience required to form a judgment of my own as to this rate of depreciation, and yet, in a business of narrow margin like that of bituminous coal, it is a matter of great importance whether 1c., or 5c., or 15c. per ton must be added for depreciation.

It is interesting to note that E. V. d'Inwilliers, in his article on "Estimated Costs of Mining and Coking" (*Trans. A. I. M. E.*, Vol. XXXV, 1905) shares the same difficulty in arriving at true costs for coal-mining operations. He expresses himself as follows: "The cost of coal delivered to an oven, and the cost of the manufactured product, depends largely upon individual judgment or practice, and on general management. Therefore, without having access to the accounts of a number of individual mines, it is not possible to do more than approximate the average regional cost of mining coal or manufacturing coke. . . . For, though each plant in a district may be mining upon the same scale of wages, the computation of net mining costs may differ to a considerable extent in two adjoining plants, due to different methods of book-keeping, to a difference of opinion as to what items are properly chargeable to mining account and to capital account, or to physical difference at the two mines."

Mr. d'Inwilliers goes on to estimate the real cost of mining and coking at Connellsville and at Reynoldsville, Penn., the first a slope mine, largely self-draining, on a seam capable of producing 9000 gross tons (10,000 short tons) to the acre; the second a shaft mine where considerable pumping will be required and capable of producing 7200 gross tons (8000 short tons) per acre. His estimate per gross ton is as follows:

	Mining Cost.	Coal.	Royalty.	Total.
Reynoldsville.....	\$0.66	\$0.86	\$0.04	\$0.90
Connellsville.....	0.34	0.52	0.08	0.60

Reducing this to a short-ton basis we find that Mr. d'Inwilliers' estimate of total cost is:

Reynoldsville.....	80c.
Connellsville.....	53c.

These figures are for January, 1904. I find that for that year the average price of bituminous coal in Pennsylvania is reported at 96c. My arbitrary estimate for cost of 90 per cent. of the price gives us 86c. for that year. Now, since it would seem that the Reynoldsville mine represents conditions not far from average in the Pennsylvania bituminous-coal regions, it appears that the difference between my estimate and Mr. d'Inwilliers' estimate is not so great, but that it might all be covered by a difference of judgment between two men in "what is chargeable to operating account."

PITTSBURGH COAL COMPANY

The reports of the Pittsburgh Coal Company, which operates 60 mines in the neighborhood of Pittsburg, so situated that they must represent nearly average conditions for the Pennsylvania bituminous field, show the following: The average number of short tons mined per acre is 7000. Net profits for 8 years average 13.8c. per ton. The total cost for all capital charges is 16.2c. per ton. If we assume that the U. S. Geological Survey figures for the value of coal at the mines will hold good for the Pittsburgh Coal Company, we get the following, per short ton:

Average price of coal for 5 years.....	\$1.03
Cost—Capital charges 16.2c.....	
Operating " 73.0.....	0.892
Profit.....	0.138
	\$1.030

Similarly the Monongahela River Consolidated Coal and Coke Company, also operating near Pittsburg, with an extraction of 8000 tons per acre, shows the following for 9 years:

Assume price of coal as before.....	\$1.03
Cost—Capital charges 0.17c.....	
Operating " 0.74c.....	0.91
Profit.....	0.12
	\$1.03

CAPITAL CHARGES

Without going into further tables of figures I find that in Pennsylvania the capital charges may be calculated as follows: A charge of 5c. per ton is made arbitrarily to cover the depletion of coal lands. If the property is bonded, this 5c. per ton is put into a sinking fund to retire the bonds.

In addition, current interest must be paid on capital or bonds. This charge will be in some proportion to the amount of unmined coal lands held for the future. Thus, if a company has a coal reserve for

100 years on its capital account, its interest charges must be greater than if its reserves are only enough for 20 years.

It appears that it requires approximately \$1 per ton of annual product to equip a coal mine for operation. Thus, for an output of 1,000,000 tons per year \$1,000,000 will be needed for plant and equipment. The renewal or depreciation of this plant will cost 6 per cent. per year.

In summary, then, we have:

For coal in the ground .....	5c.
For interest on \$1. capital .....	5c.
For depreciation of same capital .....	6c.
<b>Total .....</b>	<b>16c.</b>

It is self-evident that the operating costs will vary more than capital costs; probably about in proportion to the total. Thus, if we find at one mine total costs of 96c., of which 16c. is for capital and 80c. for operating, we would probably find that at another mine where the total cost is only 72c., the cost would be 60c. for operating and 12c. for capital. My reason for believing this is that a mine that is cheap to work must also be cheap to open.

While I am inclined to think that under present or recent conditions, the average cost of bituminous coal in Pennsylvania is 90c. or more, there is reason to believe that some of the most favorable mines work much cheaper.

Mr. Gary, in his recent testimony before the Ways and Means Committee on tariff revision, states that the cost of coke at the ovens, presumably at Connellsville chiefly, was in 1906, \$1.75 per ton, on which there was 54c. profit. This reduces the cost of coke to \$1.21. If the burning of the coke costs 31c., we have left 90c. for the coal, of which 1½ tons are required per ton of coke. This figures the cost of coal at the mines of the U. S. Steel Corporation down to 60c. per ton. Presumably this includes a sufficient allowance for depreciation. If so, the cost seems remarkably low and probably represents the cost of bituminous coal under the most favorable conditions. At any rate it agrees pretty well with Mr. d'Inville's figures for a representative Connellsville mine.

Certain other figures given by Mr. Gary about costs are of interest. He says that wages of all classes at coal and coke plants belonging to the U. S. Steel Corporation in 1908 averaged \$2.39 per day. Now at coal mines labor is usually about 75 per cent. of the total expense; we may, therefore, calculate that the whole cost per man per day is about \$3.20. If coal is mined for 60c. per ton there must be an output of about 5½ tons for every man. In the State of Pennsylvania at large, the output is only 3.6 tons per man. If this output is obtained at a total cost of \$3.20, then the cost per ton is 89c. This agrees with my other figures for Pennsylvania.

Let us apply this reasoning to other coalfields and see how close it brings us to

my estimate of cost at 90 per cent. of the selling price.

In Michigan the wages are undoubtedly about the same as in Pennsylvania. I have estimated the cost of Michigan coal at \$1.62 per ton. The output per man per day is \$2.11. If we divide \$3.20 by this amount we get \$1.52.

Again, in Wyoming I am informed that wages of coal miners average about \$3.60 per day. If this is 75 per cent. of the whole cost per man, that cost is \$4.80 per day. The output per man averaged in 1907, 3.42 tons; the cost per ton, therefore, should be \$1.40. This is exactly my estimate by the 90-per cent. rule.

I have no information as to the average wages of coal miners in Colorado, but some light can be had on costs there from another source. The average value of coal at the mines in that State in 1907 is given at \$1.40. My 90-per cent. rule gives a cost of \$1.26. The Colorado Fuel and Iron Company mined that year about 4,500,000 tons of coal at a profit of \$900,000, or 20c. per ton. This profit was not altogether on mining since some of the coal was sold at a distance from the mines. Besides this the profits were diminished by certain fixed charges, of which the exact proportion belonging to the fuel department is not clear. At any rate it seems that the net profits on coal from mining were not over 10c. If, then, the U. S. Geological Survey is right in its average price of coal, the actual cost must have been about \$1.30.

Following are some more detailed figures on the cost of operating a slope mine, self-draining, in Virginia. The figures are complete in all respects except that of depreciation. I am in doubt whether that item is fully taken care of, but having no means of forming an individual opinion, I cannot express one. The seam averages 7 ft. thick:

COST SHEET AT A VIRGINIA COLLIERY.

	1905-1906.	1906-1907.
	Per Ton.	Per Ton.
Mining .....	\$0.246	\$0.251
Timbering .....	0.010	0.018
Ventilation .....	0.008	0.010
Removing refuse and deposit.	0.005	0.017
Tracks .....	0.030	0.031
Haulage .....	0.067	0.102
Dumpage .....	0.009	0.012
Blacksmith shop .....	0.006	0.007
Repairs .....	0.009	0.008
Supplies .....	0.007	0.003
Salaries—Plant .....	0.017	0.019
Switching .....	0.005	0.006
Engineering .....	0.003	0.005
Extraordinary expenses .....	0.007	0.011
Adjustment stables account .....	0.005	
Sinking fund .....	0.100	0.100
Attorneys fees and legal expenses .....	0.025	0.016
General expense .....	0.014	0.012
Salaries—General office .....	0.040	0.058
Interest and discount .....	0.073	0.068
Taxes .....	0.011	0.011
Insurance .....	0.005	0.005
	<b>\$0.702</b>	<b>\$0.770</b>
Summary:		
Labor .....	\$0.382	\$0.423
Supplies .....	0.052	0.077
Sinking fund .....	0.100	0.100
	<b>\$0.534</b>	<b>\$0.600</b>
General expense .....	0.056	0.070
Interest, insurance, taxes, attorneys fees .....	0.112	0.100
	<b>\$0.702</b>	<b>\$0.770</b>
Tons mined .....	240,371	221,552

It is interesting to note the increased cost in 1907 over 1906, due to the unhealthy pre-panic business conditions.

COKE MANUFACTURE AND ANTHRACITE MINING

The production of commercial anthracite is so different a problem from that of mining bituminous coal that its cost is nearly parallel to that of coke. Run-of-mine anthracite is worthless for fuel. It will not burn unless it is carefully sized. It will not burn if there is even a moderate mixture of slate or bone in it. The sizing and rejection of impurities necessitates careful crushing, sizing and washing. It is distinctly a process of concentration as well as of sizing, for the loss in the "breakers" will average fully one-third of the run-of-mine tonnage. The cost of concentrating, or operating the breakers, is from 30 to 50c. per ton shipped—not cheap milling by any means, and no doubt mining men not acquainted with the fact will be surprised at it. The comparison may be tabulated as follows:

	Coke.	Anthracite.
Tons run-of-mine per ton .....	1½	1½
Cost of manufacture per ton .....	30c. to 60c.	30c. to 50c.

Several instances of actual figures for coke have come to my attention. Mr. d'Inville's calculated average results at two Pennsylvania points for five years ending 1903 as follows:

CONNELLSVILLE REGION PLANT OF 500 OVENS.

Coal, 1½ tons, at 56c. net ton .....	\$0.840
Charging, leveling, drawing and labor .....	0.326
Salaries, supplies and depreciation .....	0.050
<b>Total .....</b>	<b>\$1.216</b>

It will be noted that I deduce from Mr. Gary's evidence that the actual cost of coke in Connellsville to the steel company in 1906 was \$1.21.

REYNOLDSVILLE PLANT OF 500 OVENS.

Coal, 1.7 tons, at 70c. .....	\$1.19
Charging, leveling, drawing and labor .....	0.10
Salaries, supplies and depreciation .....	0.05
	<b>\$1.64</b>

In neither of these cases have I used any table exactly as given by Mr. d'Inville's. He does not give the details of his estimates for a five-year average, and I have endeavored to supply them. There seems to be same mistake in his average of Reynoldsville costs, for they do not work out in proportion as he gives them.

Another example of coke costs more in detail is from a 200-oven hand-operated plant in Virginia—in 1906:

Cost of coal, 70.2c. per ton.	
Coal used in making coke .....	1.027
Crushing .....	0.023
Charging .....	0.033
Leveling and sealing .....	0.028
Drawing .....	0.210
Loading .....	0.134
Switching .....	0.023
Salaries at plant .....	0.033
Tracks .....	0.008
Repairs .....	0.021
Supplies .....	0.012
Extraordinary expense .....	0.006
Insurance .....	0.001
<b>Total .....</b>	<b>1.561</b>



In summary:

Raw material.....	1.027
Labor.....	0.459
Supplies.....	0.075
	<u>1.561</u>

The following year, 1907, the costs at the same plant were as follows:

Raw material.....	\$1.227
Labor.....	0.524
Supplies.....	0.114
Total.....	<u>\$1.865</u>

ANTHRACITE MINING

The extraction of run-of-mine anthracite is rather more expensive than that of bituminous coal chiefly because the anthracite seams are very much more folded. It is necessary to do vastly more development work in rock, and necessary also to use more timber in supporting gangways than is the case in flat seams. However, the constantly changing dip prevents the use of uniform methods throughout the mines. On the other hand, the coal often occurs in magnificent thick seams. The actual difference in cost for run-of-mine I do not estimate at more than 10c. per ton, 92c. for bituminous and \$1.02 for anthracite (per short ton, the long ton is used at the mines).

Below will be found consecutive statements of the costs of the Philadelphia & Reading Coal and Iron Company for a

improvements, which is regularly charged in as an operating cost. This is entirely as it should be, and the charge is doubtless based on the theory that the annual improvements to plant are simply sufficient to cover the renewal of equipment. The company has charged to improvements and equipments at collieries \$13,092,635. This is equivalent to about \$1.30 per ton on its annual output. Some companies would have charged a much larger amount to this item. The amount has not been increased in recent years in spite of the fact that since 1902 the output has increased 50 per cent. It is usual to charge off for depreciation at coal mines 6 per cent. of the capital employed in the plant and equipment. In the case of the Reading company, such a sum would have been sufficient in 1902, but would fall far short of the charges made in 1908. As costs are usually calculated, therefore, it would seem that this company is writing off somewhat more for depreciation than is strictly necessary. It would be obviously logical for the company to hold on its balance sheet a greater capital for an output of 10,000,000 tons per year than for an output of only 7,000,000 tons.

In other words, I wish to express my conviction that the costs given by the Philadelphia & Reading company for an-

and mine owners are taking in this humane movement, and it is bound to result in a decrease in the number of deaths in the mines. The sole purpose of the Government in taking up this work was to demonstrate its usefulness. It is not the intention to make the rescue-station work permanent."

"Perhaps the most complete of these private stations is that of the Frick Coke Company, which employs 30,000 men. The station has been erected at the Leisingring mine, near Connellsville, Penn., in easy reach of all the Frick company's mines. There is a corps of six men being trained in the use of the oxygen helmet, a device that admits artificial breathing for two hours in the most deadly gases known. In order that the men be given practical experience in the use of these helmets, a part of the station has been devoted to an air-tight room which is filled with gases that will not support life. The men are being given a daily drill in this gas-filled room and are gaining confidence in the use of the helmets. Within a short time, the corps will visit the Government experiment station at Pittsburg, where the members will be given further instructions by the Federal experts.

Whenever a disaster occurs in any of the Frick company's mines, the rescue

PHILADELPHIA & READING COAL AND IRON COMPANY—STATEMENT OF COSTS.

	1902.	1903.	1904.	1905.	1906.	1907.	Per Ton.	1908.	Per Ton.
Anthracite mined, tons.....	6,968,566	6,299,449	8,707,508	9,438,665	9,132,353	10,034,713		10,218,392	
Mining and repairs, 1.733.....	\$12,076,964	\$11,635,094	\$16,683,568	\$17,378,181	\$16,904,915	\$18,741,729	1.867	\$19,026,334	1.865
Royalty.....	392,646	370,226	561,603	621,530	620,217	677,143		667,722	0.066
Taxes.....	253,212	255,714	239,927	305,900	296,953	296,953		339,087	0.033
Repairs of houses.....	17,644	15,274	22,087	57,693	37,215	53,040		49,849	0.008
Damages account dirt, 0.34.....	35,990	6,366	47,104	25,352	7,260	15,768	0.300	2,054	
Improvements.....	863,428	867,330	1,273,035	1,730,974	1,131,038	1,345,229		1,286,010	0.128
Depletion of lands.....	374,101	340,445	454,241	478,326	458,541	499,059		514,350	0.051
Fixed charges.....	419,858	377,747	317,224	104,035	118,466	115,074		117,248	0.012
Total cost per ton, 2240 pounds.....	\$14,433,843	\$13,858,196	\$19,598,789	\$20,691,691	\$19,583,552	\$21,744,995		\$22,002,654	
Cost per short ton.....	\$2.07	\$2.20	\$2.25	\$2.19	\$2.36	\$2.167		\$2.153	
	1.85	1.96	2.00	1.95	2.10	1.93		1.93	

period of years. These tables in the main explain themselves, but it is worth while to make the following comments: The actual cost of mining and repairs will be seen to average about \$1.80 per long ton, equivalent to about \$1.60 per short ton. This is for current operating only, but it includes the cost of putting the coal through the breakers, and it is a cost based on the finished product which may be calculated to be only two-thirds the run-of-mine product. Details for the cost of breaking are not given, but from inquiries made in the region, it seems that 40c. per ton is an average. Deducting this sum we get \$1.20 for mining alone, and this is for mining 1½ tons of run-of-mine coal. The actual cost, then, per ton of run-of-mine to this company seems to be some 80c. per short ton.

The capital and general charges that follow in the statements largely explain themselves. The only item to which I wish to draw special attention is that of

thracite mining are adequate in all respects, and that, therefore, the accompanying statement gives an excellent idea of the real cost of anthracite mining.

Coal Companies Establish Rescue Stations

Four stations for the training of miners in rescue work have been established recently by the big coal companies of the country and several more are in contemplation. This is a direct outcome of the demonstrations in rescue work being made by the United States Geological Survey, Technologic Branch, at its experiment station in Pittsburg, Penn., and at the sub-rescue station in Urbana, Ill.

"The fact that these stations have been established is gratifying to the Geological Survey," said Director George Otis Smith today. "It shows the interest operators

corps will respond at once and will immediately enter the mine for the purpose of bringing to the surface miners who have been injured or are unconscious from the effects of gases. With these helmets, the rescuers can enter any gas-filled mine where it would be sure death for the miner to go. In many disasters, the men fortunate enough to be outside of the mine when the explosion occurred, have had to remain at the surface for hours, waiting for the ventilation to drive the gases out, knowing all the time that their comrades were dying.

A second rescue station has been established by the Fairmont Coal Company, Fairmont, West Va. A trained corps of helmeted men is ready for any emergency in this field.

A third station has been erected by the Pittsburg-Buffalo Coal company at the ill-fated Marianna mine, in Pennsylvania, which last November suffered an explosion with a loss of 140 lives. Already this

station has a complete corps of six highly trained men who know how to use the oxygen helmets.

A fourth station is at the Zeigler mines in Zeigler, Ill. This company also has a trained corps of six men, all picked for their coolness, courage and daring, for these elements are necessary in rescue work.

Mr. Paul, who has charge of the rescue work for the Government, recently left Washington for Europe where he will study rescue work at the European stations. "In the short time we have been operating, we have saved the lives of six men," said Mr. Paul "and if we did nothing more, the results would warrant everything that has been done so far by the United States in trying to reduce the accident death rate in the mines." However, I am satisfied more good will come from our efforts. The four stations just established will be the means of saving the lives of many miners, for we all know, many a poor fellow, imprisoned in a mine filled with the dread firedamp has lived in agony for hours before he died. I understand that the operators are to establish many more stations.

### Automatic Switch Arrangement on Mine Inclines

BY ROBERT GRIMSHAW\*

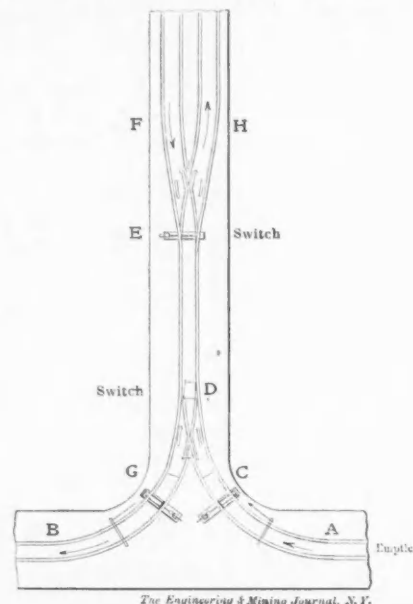
As a rule, in the German mines, and as far as I know, up to the present time in America, the inclines have at the head and foot, turn-tables on which the "empties" are directed to the various headings. These turn-tables cost money for installation and repair, and this repair item upsets the traffic; furthermore, special employees are usually necessary to turn them.

The simple and practical arrangement shown in the accompanying cut, and which I understand is being introduced into some German mines, is intended to do away with the turn-tables, and what is more important, with the men necessary to work them.

Referring to the sketch: *A* is the track for the empties, *B* that for the loaded cars on the wire-rope incline. The empties are run as far as the point *C*, and there hitched to the cables. Passing the throw switch *D* they run in the direction of the arrow past the tongue switch *E*. The full cars run in the direction of the arrow *F*, open the tongue switch *E* and pass the throw switch *D*, going as far as *G*, where they are attached to the rope, which runs them along the track *B*, in the direction of the arrow. The switch *D* is so arranged that after the empties have run over it, the loaded cars, whether they come from *F* or from *H*, are always run onto the track *B*; while the tongue switch is so arranged that it shunts the empties automatically and alternately to *F* and to *H*.

The hand-switching arrangement at *E*

is mechanically unnecessary under normal conditions, but it is there so as to provide for the chance that the switch might not work automatically. The German mining regulations call for certain arrangements of switches and barriers which must be there, whether or not any other contrivances are put in that might replace them.



GENERAL PLAN SHOWING ARRANGEMENT OF AUTOMATIC SWITCH

In order to facilitate pushing the empties, the tracks *A* and *B* are given about a 1-deg. fall in the direction of the arrow.

This arrangement renders unnecessary any coupling of the cars and turning of either empties or loaded ones. Of course, an increased output is possible; the men need not go on the incline at all, and the danger of accident is reduced.

### Colliery Notes

Recent experiments where gunpowder of given composition was exploded in the presence of one volume of firedamp to 14 of air,  $5\frac{1}{2}$  grains of water vapor, and 7.3 per cent. by weight of coal dust, showed: (1) That the explosion of such blasting powder left behind it gases which would burn; (2) that these gases did sometimes burn and cause a secondary flame; (3) that after these gases had burned, there was a vacuum caused as soon as they were cooled down to the natural heat of the mine strata.

In the Saar collieries, in Germany, the evolution of firedamp appears to follow a regular course and is more marked in the bituminous-coal groups than in the longflame; it also increases with the depth from the surface. The mines in this district now follow their development work by using extensive packing, which practice has greatly aided in the diminution of accidents by falls of stone or coal. Engineers at the Saar collieries claim that

the use of water in settling dust is not effective, because it induces danger through causing rock to crumble. As a substitute for water, a solution of chloride of calcium is used, or, better still, its dry powder, which, in consequence of its great hygroscopic properties, is soon converted into a concentrated solution, and is capable of preventing the formation of dust for three months. The only objection advanced against the use of this salt is the expense, so that recourse is often had to a cheaper substitute, in the form of rock salt. The results obtained from the use of chloride of calcium in various German mines have been excellent.

Notwithstanding the increasing popularity of electric haulage, the endless-rope system remains in favor at many collieries where special conditions exist. The best features of this latter system of haulage are: (1) It is capable of dealing with large outputs in an easy form; (2) there is less wear and tear of rolling stock than with other systems; (3) it travels at a much lower speed than other system for a given output; and (4) it is, as a result of the foregoing advantages, less liable to breakage and accidents to persons and animals. In determining the size and weight of the rope in an endless-rope system of haulage, an ample margin should be allowed for safety, considering at the same time unusual strains which may come upon the rope by overloading. The net strain on the rope at the driving-pulley rim may be taken as the net load or resistance to be overcome by the engine. In practice, it is usual to allow from 25 to 50 per cent. for friction in engine gear and margin for undue requirements.

Some engineers believe that dust containing the highest percentage of volatile matter is the most dangerous; others assert that steam-coal dust with a high percentage of carbon is the most dangerous. Mr. Ashworth, the well known English authority states that it does not matter which kind of dust occurs providing it is equally fine and from a gaseous mine. He also says that no dust is really dangerous unless it is exposed to a certain degree of heat and for a certain length of time. In this connection, a German professor, named Bichel, has shown that  $\frac{1}{6}$  oz. of black powder would ignite, while 2 lb. of carbonite (a variety of permitted explosive used in Europe) would not do so, because the duration of the powder flame was 500 times as long as that of carbonite. This same authority states that with a temperature of 1200 deg. F., a flame must last for 10 sec. to ignite firedamp, but if the heat was 1800 deg., only 1 sec. was required. Continuing the discussion, Professor Bichel says that the speed of detonation varies greatly; thus, the speed of dynamite is five miles per second, while that of carbonite is only  $1\frac{1}{2}$  miles per second.

\*Engineer, Dresden A, Germany.

# Precipitation of Copper from Butte Mine Water

Waters Carry from 0.01 Per Cent. Copper to 0.03 Per Cent. and Higher; Weakly Acid Waters Require Slower Flow. Leaching Old Tailings

BY CHARLES J. STONE\*

The industry of precipitating copper from the mine waters of the Butte district within the past 10 years has grown to such an extent that it is at present of material and increasing commercial importance. No less than 30 precipitating and leaching plants are in operation along the Silver Bow creek in east Butte, and the total output of precipitate, or cement copper is about 750 tons per month. The product will average 60 per cent. pure copper and approximately 900,000 lb. of copper per month are recovered.

The operators of these plants are the large mining companies themselves, down to the leasers and to the individual who takes the tail waters from the large operators and wins from it a little of the remaining copper that will precipitate. The Boston & Montana, an Amalgamated com-

**WATER PUMPED IN WOOD-LINED PIPES**  
Flanged-steel pipes with lead gaskets and lead lining were found to withstand the action of the water with a degree of satisfaction, but wood-lined pipe, which is less expensive, is now in practically universal use throughout the Butte district. For high-pressure water columns in shafts and other lower pressure pipes, a flanged-steel pipe is used and the wooden lining forms a male and female connection at the joints.

The lining is composed of pine slats put in place with hot asphaltum and the key piece is fitted and driven in firmly, so that the lining is held tightly in place. The whole pipe lining is then carefully painted with asphaltum, and when the pipe is put in place, great caution is taken in packing the joint to prevent seepage. In shafts

been exposed to the oxidizing influence of air and where waters leach through them, are productive of the highest grade of cupriferous water. When a deep level is opened, the flow is found to contain free acid, but only a small amount of copper sulphate is present. As the levels become opened and decomposition of the sulphides takes place, the water is enriched.

A flow coming from a section where the sulphide ore is burning or from a level where the fire has been extinguished, is enriched remarkably. The mine water of the Boston & Montana has been built up within a short period of time from this source alone from 0.02 per cent. copper content to above 0.2 per cent., and at this strength it threatened to destroy the phosphor-bronze castings of the pumps. For this reason an effort is made, where pos-



LEACHING TAILINGS WITH BUTTE MINE WATER



BOSTON & MONTANA SETTLING TANK AND CLEAN-UP HOUSE

pany, alone recovers 100,000 lb. of copper per month, and its operation shows a profit over and above its entire pumping expense.

While there is nothing new to engineers or metallurgists in the precipitation of copper in an acid solution by passing it over scrap iron and tin cans, yet some of the Butte operations present features of interest. Great difficulty was at first experienced by the mining companies to find something that would withstand the action of the mine waters on pumps and pipes and that would be within a reasonable cost. Phosphor-bronze castings were found to be necessary for the entire water end of all pumps where the water was found to be even slightly acid. The phosphor bronze is composed of 93 per cent. copper, 0.5 per cent. phosphorus, 4.5 per cent. tin and 2 per cent. lead. This metal, however, was too expensive for pipes.

\*Consulting mining engineer, Butte, Mont.

where water from the upper levels drips on the pipes, it has been found necessary to thoroughly paint and cover the pipes with canvas, and the canvas then receives a thick coat of asphaltum. Wooden, wire-bound pipes are also used underground for light service, and on the surface wooden launders or flumes are used.

The copper content as well as all other mineral salts and the amount of free acid tained in the mine waters, varies widely in different mines and different sections in the district. Cupriferous waters were not encountered to any great extent in the upper levels, nor at shallow depths, but when the shafts penetrated the great copper horizon at from 500 to 2200 ft. in depth, the waters were found to be highly charged with mineral salts and free acid.

**ENRICHED WATER FROM FIRE LEVELS**

Old workings, abandoned upper levels and gob or stope fillings that have long

sible, to regulate the grade of water to a strength that will not attack the bronze pump parts.

The cupriferous water from the various mines carries from 0.01 per cent. to 0.031 per cent. copper as copper sulphate. The process to recover this as native copper by passing the solution over scrap iron is simple. The iron supplants the copper in its union with the sulphate radical, the copper being precipitated as a crystalline powder, while the sulphate of iron is carried off in solution. It would appear that the mine waters are extremely poor in copper as compared with the solutions in a leaching operation, but when a mining company is pumping 500 gal. per min., the precipitation amounts to approximately 1600 lb. of copper per day and the saving is effected with but little expense.

**PRECIPITATION EQUIPMENT**

The copper precipitation is effected in

open launders and in towers. The launders are set at sufficient grade so that the water flows rapidly, and scrap iron of all classes is thrown into it, but care is taken to allow the water to flow freely. The launders are from 3 to 4 ft. wide and from 1 to 2 ft. in depth, and are built single or double. The water is kept at from 6 to 12 in. in depth in the launders. If the water as it comes from the mine is strong in acid, better results are obtained where the water flows at a greater velocity, but if weak in acid, a slower flow is desirable. It is well at all times to keep the iron and launders free from accumulations of iron oxide.

The towers are built from 8 to 12 ft. wide, 10 to 14 ft. high, and from 50 to 150 ft. long, the size depending entirely upon the flow to be handled. They are built open on sides and ends and large scrap sheets of iron are placed to hold the dripping water within the water-tight bottom; or they are inclosed entirely on all sides by baffle boards to keep all water within the tower sump. The water comes into the top of the tower in an open laun-

der shipped to Great Falls where it is smelted in reverberatory furnaces. The average quality of the precipitate is between 60 and 70 per cent. copper.

A well-arranged plant is so located that the solutions can flow by gravity from the mine through the launders and down through towers, with the clean-up vats and dryer under the same roof. The extent or magnitude of the plant depends upon the limit of extraction it is found profitable to make from the solution. All launders and towers should be built in parallel duplicates so as to facilitate rapid and thorough cleaning. Wrought and steel scrap are better than cast iron and thin sheets are more satisfactory than heavy pieces. About 75 lb. of cement copper are recovered in practice from 100 lb. of scrap material.

#### LEACHING OLD TAILINGS DUMPS

A number of the large tailings dumps from the early concentrating mills, which were neglected for years, are being worked successfully in connection with the

were driven through the dump on the slime-covered soil of the valley and a cribbed trench surrounds the dump, all of which lead to a common sump to be elevated into the precipitating towers or flows by gravity into precipitating boxes.

The water which is fed to the ponds contains but a trace of copper and is very weak in free acid. After leaching, its copper content has been built up to 0.02 per cent. and precipitation is satisfactory. The product from this particular plant averages 80 per cent. copper. They are pumping 750 gal. of mine water per minute upon the sands and, approximately, 80 per cent. of this is recovered and fed to the precipitating plant. A daily analysis of the leached solution will give a close estimate of the daily recovery of copper.

This method of leaching, while attended with serious losses in solutions, is possibly the only method by which the sands can be treated commercially. However, it does not prove that it would not be advisable to convey the sands to leaching tanks and add a small amount of sulphuric acid to assist extraction. A 20 per



BOSTON & MONTANA PRECIPITATING TOWERS AND LAUNDERS AT BUTTE, MONT.

der and the flow is regulated by means of gates and side distributing troughs so that the shower is uniform throughout the tower. The tower is filled with scrap iron for perhaps one-quarter to one-half its height.

#### BETTER EXTRACTION IN TOWERS

Experience has shown that a better extraction is effected in the towers than in the launders. This is especially noticeable where the solution is both weak in acid and copper. Doubtless exposure to air has a beneficial effect, but the arrangement is more efficient in that the falling water keeps the scrap clean and bright, and prevents an accumulation of iron-oxide slimes.

A clean-up is effected by turning the flow into other launders of the plant, scrubbing and washing the scrap free from copper scale and sluicing the launders and tower sump into settling vats, where the clear solution is decanted off. The cement copper is then dried, barreled and

precipitation of copper from mine waters. The dumps carry approximately 1 per cent. of copper. Years of weathering have made possible the leaching of these tailings on a profitable basis.

The dumps are from 20 to 50 ft. in depth and cover many acres of ground. The James Gillie lease, operating on the old sands of the Montana Ore Purchasing Company, is worth studying from an engineering and economic standpoint. The dump, which is located in the bed of Silver Bow creek, contains upward of 200,000 tons of sands. They average from 20 to 30 ft. in depth.

The supposedly barren tail water from the precipitating towers of the Boston & Montana Company is elevated to the highest point on the dump. Ponds of from 5000 to 15,000 sq. ft. are arranged so that the overflow from the higher will run to the next lower pond until the entire flow is absorbed. To reclaim the water after it has leached through the sands and taken up the soluble copper, two level tunnels

cent. loss in solutions on the method that now obtains at this plant amounts to a loss of 324 lb. of copper per day. This, doubtless, sinks into the soil of the valley and is beyond recovery. As far as known to the writer, no regrinding and leaching test has ever been made on Butte tailings to determine if they can be worked commercially.

The Broken Hill Block 10 Company, New South Wales, has practically completed a contract (*New Zealand Mines Record*, Feb. 16, 1909) to sell to the De Bavay Company 300,000 tons of zinc bearing tailings. The price to be paid per ton will depend upon the average value of spelter over a term of three years.

In the February issue of the *New Zealand Mines Record* it is stated that the North London Railway Company carries 1,000,000 tons of coal and coke, and 2,000,000 tons of merchandise over its lines in the course of a year.

## Manganese Deposits in Southern India

In India the production of manganese increased from 3130 tons in 1893 to 581,036 tons in 1907. The extensive prospecting in India has opened up a new manganeseiferous region in the southwest embracing the native state of Mysore, the northwestern part of the Bombay Presidency, and the Portuguese territory of Goa. In Mysore alone by 1907 more than 1000 square miles of land had been taken up for manganese mining, notwithstanding the fact that this region only came into prominence in 1906. In this same year the export from Mormugao harbor increased ten-fold.

These south Indian manganese occurrences are classed by F. O. Ahlers, in a paper presented before the Institution of Mining and Metallurgy at London, November, 1908, as either being in conjunction with the South Indian laterites or, as in the hematite-quartzite bands of the Dhawar beds. The Goa deposits and others toward the western Ghats are cited as examples of the first class. Examples of the second type are found throughout the huge hematite-quartzite beds which characterize the Dhawars. Here exploitation has advanced where the manganese bodies open out into large blows of almost solid ore.

In general, although the quartzite bands carry some manganese the ore deposits worthy of note are considered to be due to secondary enrichment from meteoric waters. The replacement is easily observed on the outcrops where the iron oxides were attacked first. Angular fragments of the original iron ore are frequently observed coated with manganese.

Disintegrated quartzite fragments in the form of quartz sand are also found in much of the ore, giving to it a spotted appearance. Where the replacement has been complete the ore usually runs more than 50 per cent. metallic manganese.

The manganese deposits, information of which we gain from the work of Mr. Ahlers, are those of the native state of Sandur, Bellary district, in the north of the Madras Presidency. The Sandur state occupies an elliptical basin about 24 miles long with a width of about 13 miles. The Narihalla river cuts transversely through the two ranges of hills which form the rim of the basin.

### GEOLOGY

The Sandur hills are a portion of one of the beds of the Dhawar series of rocks. These are of Archaean age and of a schistose nature. The characteristics of this locality are those of other Dhawar areas. The predominant rocks are argillites, hard crystalline schists in the lower beds, but weathered to soft shales toward the tops of the ridges. Hematite quartz-

ite bands occur frequently running conformably with the country and massive intrusive dikes, usually of a basic nature, traverse the series. Surrounding the hills is gneiss, which is the most common rock in this part of India.

In the north end of the valley there is a true syncline, but the southern part is more complex and is connected to the east with the Copper Mountain range. Upheaval is marked as indicated by the upturned strata in the middle of the basin. The dip flattens out toward the rim, and flat hill tops forming a high plateau are characteristic. Another noticeable feature is the ferruginous deposits chiefly of laterite and lateritic conglomerates covering the plateau. Hematite is bedded with the country rocks while the laterites form a capping sometimes 25 ft. deep.

### THE OREBODIES

The manganese deposits are situated in the softer rocks of the series usually at or near the forests of the hills. These deposits may be divided, for consideration, according to location into four divisions, namely: Those occurring at the top of the outside slope of the western range; those in a similar position in the northern part of the eastern range; those at the top of the inside slope of the eastern range, and those occurring as plateau deposits.

Deposits of the first nature are of the greatest importance, and for 24 miles along the range nearly every spur on this outside western slope shows an outcrop of ore. In places there are sheer cliffs showing 70 ft. of ore, and many are to be seen from 20 to 40 ft. high, and of lengths ranging up to 400 ft. These deposits present a remarkable view, and by their appearance of continuity and from the fact that they always conform with the country in dip and strike suggest an immense bed of ore. Drifts and prospecting pits have, however, proved the maximum depth attained by these orebodies to be about 80 ft. The lateral extent is so great, however, that there is an immense amount of ore.

The other three occurrences of ore are of minor importance. On the inside slope of the western hills few large deposits are seen; on the eastern hills the deposits are of no great extent, and those on the plateau have a depth of only about 10 ft. The manganese ore ends abruptly in contact with a conformable layer of hematite which changes in a couple of feet to ferruginous shale and then to lithomarge. The lithomarge is relatively thick and underlain by the country rock.

### THE ORE

The manganese ore of the Sandur deposits is remarkably pure, although always associated with iron. Psilomelane is the chief ore. It is hard and of a bright, steely luster where exposed to the air,

but friable and schistose in the interior of the deposits. Braunite and some wad is also found in the plateau orebodies. This is more closely associated with the iron capping than with the massive deposits. Remarkable, too, for Indian manganese occurrences, nests of fine manganite crystals are found all through the ore. Crystals of pyrolusite and probably of hollandite as pseudomorphs after manganite have also been identified by A. Chose in his study of the ore of Sandur. Harmful impurities all run low, silica usually below 2 per cent., and phosphorus fairly constant at 0.01 per cent. The ore always carries some iron, seldom less than 5 per cent., and ranges through all stages from ferruginous manganese to pure hematite.

By students of these orebodies the original rock is considered to have been metasomatically replaced by the oxides of manganese and iron through the agency of meteoric waters. Mr. Ahlers found that the country rock 10 ft. below the lithomarge contained 3.75 per cent. metallic manganese. He considers that as erosion advanced the manganese was concentrated, then acted upon by solutions, charged with carbon dioxide derived from decaying vegetable matter, acting as solvents. These solutions rising as the surface rocks became heated in summer, deposited their metallic burden at the surface. This is corroborated by the fact that the greatest wealth of ore is found on the hillsides most exposed to the sun. The association of ore with lithomarge is characteristic of the region. Everything indicates that the site of these interesting orebodies was formerly occupied by a soft shale, while this same evidence all tends to disprove any such theory as that of original deposition which might be offered to explain these occurrences.

## Zinc Mining in Algeria

It appears from particulars given at the general meeting of the Mines d'Ouasta et de Mesloula, Algeria, that the working of both mines was successful in 1908. The Ouasta calamine is forwarded to Antwerp and the zinc contents of the shipments have been improved by the newly installed concentrating mill. The Mesloula lead ore, sold to the Compagnie de Pontgibault, was forwarded to the works at Couéron in Loire-Inférieure. The board of directors has informed the shareholders that concentrating mill No. 2, begun in 1908, is now completed and started. Thus equipped, the Mesloula mine can yield a yearly production of 10,000 tons of marketable ore and will rank as the first lead mine in Algeria. The company is interested with Mokta-el-Hadid in the Ain Al-léga concession of lead, zinc and silver ores, and is carrying out an interesting program of investigations both in Algeria and Tunisia.

## Milling in the Cripple Creek District, Colorado

By S. A. WORCESTER\*

It is my purpose in this article to afford some useful suggestions to operators interested in the Cripple Creek district, by mentioning some of the causes which have contributed to failure in its past milling operations; also by directing attention to results thus far obtained by mills in operation, to encourage conservative investment in local treatment plants of moderate size, well designed for economy in construction, operation and maintenance.

I have now in mind 24 mills, ranging from 10 to 1000 tons estimated daily capacity, which have been erected in this district and operated with varying degrees of success and failure.

### MILLS THAT WERE FAILURES

One or more of the largest of these plants have been grafting operations and have not run for more than a few days or perhaps a few weeks at any time. Two custom stamp mills, built at large expense early in the history of the district, with the aid of little or no knowledge of a practical process for these ores, had short lives, and, after periods of idleness, burned to the ground.

Two later custom mills, one a roasting and cyanide plant, the other a large chlorination plant, were operated with fair success as long as the general grade of ore was sufficiently high to justify their minimum treatment charge of \$6 or more per ton. When the grade of ore lowered, they ran intermittently for a while, then were destroyed by fire. At least eight of the mills now standing were built with capacities far too large for the available ore supply. Several of the present mills were erected by managers having no practical knowledge of milling operations, yet perfectly willing to try their own valueless ideas *ad infinitum*, at the expense of the shareholders. These mills either have been, or will have to be, remodeled completely before satisfactory results can be obtained.

Aside from flagrant financial irregularities, the principal cause of failure is probably the fact that managers did not ascertain with sufficient thoroughness the quantity, character and value of ore available for treatment, before erecting plants. It is difficult for some men to believe that mill returns from their own plants will sometimes run far below their mine samples. They are also unable to resist the temptation to overestimate the continuity of an orebody and to build accordingly.

\*Mechanical engineer, Victor, Colorado.

### FAULTS OF LOCATION AND DESIGN

A number of mills by being located at a distance from railroads, have incurred a minimum haulage of 65c. per ton, which is quite a serious item. Nearly all of the mills are so located as to require either haulage or tramping from mine to mill. There is at present but one mill in this district at which the mine skip dumps directly into the mill bin, and this skip dumps at a point so low that the ore interferes with further dumping as soon as the bin is about one-fourth full. The items of labor and power cost and maintenance are dependent primarily on the design of the plant. In many cases plants which were intended by their designers to be completely automatic have had their mechanical details so incomplete and so poorly designed and arranged as to render continuous operation impossible.

In local cyanide plants it is no uncommon practice to shovel or scrape ore into a crusher instead of using an automatic feeder, to load tanks with a hand-operated car instead of an automatic conveyor, to level the charge with the shovel instead of the automatic excavator, to discharge the tanks with the shovel and perhaps tram the tailings to the dump with a car. Automatic machinery for these operations, now thoroughly practical, is at the command of every well-informed designer and repays its cost in a few months, sometimes a few weeks, of continuous operation.

### ITEMS OF EXPENSE AND LOSS

One important item of expense in this district is the cost of water. Those plants that sluice out their tailings pay large monthly bills for this item alone. Several objections to this method may be cited, including the labor cost of sluicing tanks, the expense of maintaining dams if the tailings are to be retained on the millsite, the maintenance of metal-lined sluices if the tailings are carried any considerable distance, the frequent damage to filter canvas by the sluicing stream, the liability to damage suits when tailings are allowed to run down the gulch, and the loss of possible values in the tailings, which, although at present are negligible, may at a future time be made valuable by improved processes if the tailings are retained. These objections may be removed by use of the excavator and conveyor system, which deposits the tailings automatically near the mill, at very small cost.

Among fruitful sources of loss in past milling practice has been the revolving roasting furnace in its various forms, losing much in dust and wasting heat by its short and direct passage from the grates to the stack. The revolving furnace is now out of use in this district. The chlorination process, always expensive, has now been superseded gener-

ally by the cheap and simple cyanide process. Oxidized ores are crushed to the required fineness and treated by simple leaching or by agitation in cyanide solution. Briefly summarized, the principal causes deterrent to past and present milling in this district seem to be: (1) Graft, or large financial irregularities; (2) entire ignorance or inexperience; (3) lack of knowledge of the most economical process (4) overestimated ore supplies and excessive plant investment; (5) ill-advised location of plants; (6) poor mechanical design and construction.

Passing the first and considering the second cause named, it is highly important that the manager, if not experienced in mill work, should have sufficient business sagacity to select and employ experienced and educated men for his expert work, so as to accomplish results. The third cause reminds us that laboratory tests are seldom sufficiently comprehensive to furnish full data as a safe basis for designing a milling plant. I consider it advisable to erect and operate an experimental plant, in some cases one-tenth of the probable size of the complete installation, and to operate it until all parts of the orebody have been thoroughly tested. In some cases this experimental plant may later become a unit or part of the completed mill.

The fourth cause overestimated or supply, reminds us that the value of thorough preliminary sampling and testing is seldom fully recognized. It is far better to expend several hundred or even several thousand dollars, if necessary, in repeated sampling and adequate testing, in order to learn positively that a plant will not be justified, than to invest ten times as much time and money in a plant, only to learn that success is unattainable. The fifth cause suggests that where conditions are favorable the mill should be so located that the mine-skip may dump directly into the mill bin, thus eliminating all transportation.

### DESIGNING THE PLANT

The sixth cause mentioned brings to mind the propriety of employing the best obtainable talent, even at considerable expense, for the design and construction of the mechanical features of the plant. The engineer employed for this work should combine thorough technical training with considerable practical experience, and should be given time sufficient to complete designs and specifications in a thorough manner, before commencing construction. Very few mining operators appreciate fully the very great economies, both in construction and operation, which are made possible by carefully considering and comparing a number of different preliminary pencil layouts of a projected plant, the engineer being in collaboration with the manager and perhaps one or

more of his assistants, and due weight being given to any suggestion offered, in order that no point of importance may be overlooked. When the drawings and tracings are completed, and specifications and bills of material written, they should be carefully checked by some other person than the designer, in order that no mistakes in figures, calculations or dimensions may pass out, to cause misfits, delays, expense and possibly litigation. This thorough and painstaking course of procedure is, in itself, more expensive than merely making one or two hasty pencil drawings and beginning work on the plant at once, but the more conservative start will inevitably result in earlier completion, at less cost, better construction and far more satisfactory operation. By submitting complete blueprints and specifications to competitive bidders, using the engineer's estimates, a low tender can nearly always be secured.

#### SUCCESSFUL PLANTS

Although many past records are discouraging, there are at present in more or less regular operation in this district, five cyanide plants, three of which use comparatively coarse crushing and the simple leaching process, while a fourth separates the pulp into slimes and sands, leaching the sands and agitating the slimes. The fifth plant reduces the entire pulp to slime and treats by agitation with cyanide solution, finally washing the rejected slime with the Butters vacuum filter. The average gold content of the ores treated by these five plants, with an approximate daily capacity of 250 tons, is hardly greater than \$4 per ton, or 50c. less than the lowest rate offered by the outside custom mill for freight and treatment, yet these local mills are clearing a fair profit. One local plant has been treating for some time about 100 tons per day, of ore averaging less than \$2 per ton, yet it is paying regular dividends. The comparative success of these plants is a standing invitation to mining operators to enter the milling field, with its probable larger net results.

#### MINING AND MILLING COSTS

A few figures will suggest how small a portion of the mineral value of the ores of this district become net returns to the small shipper. Mining is seldom less than \$2 per ton. Hauling is 65c. minimum; sampling \$1; freight and treatment \$4.50 minimum; moisture and other penalties, resampling and incidentals will raise the minimum cost to more than \$8. In mining operations of moderate size, it is seldom that any net profit can be realized from ore not exceeding \$8 in gold content. An operator having 8000 tons of \$8 ore might possibly net 50c. per ton, or \$4000, by the time the ore is exhausted, under favorable circumstances.

The following figures, based on practice, indicate good results from a very small plant, located so that the mine skip dumps into the storage bin of the mill, from which the crusher is fed. This roasting and cyanide plant of 20 tons daily capacity will cost about \$12,000, ready to run. It is so designed as to be operated by one man, on each of three eight-hour shifts. Supposing this mill to operate continuously for 400 days, treating 8000 tons of \$8 ore, daily operating costs per day will be about as follows: Mining cost, \$40; interest, repairs and amortization, \$30; labor and superintendence, \$15; cyanide, \$2; power, \$2; roasting, \$6; water, \$1.80; laboratory, incidentals, etc., \$1.20; total daily cost of mining and treating 20 tons, \$98. The gross daily result of 85 per cent. extraction will be \$136 and the net daily result \$38. The total net profit from 400 days' operation will be \$15,200. The plant should, after 400 days, be worth \$6000. While the initial expense of a roasting furnace is an item of considerable importance in plants for treating the unoxidized ores of this district, it is a fact not generally known that a furnace of the McDougall multiple-hearth type, with which I have had considerable experience, can be built and operated successfully on these ores in much smaller and less expensive units than those now generally used. The principal objection to its adoption thus far raised, namely its tendency to produce dust, is easily overcome by a trifling modification in the method of transferring the ore from hearth to hearth. Its economy of fuel, space and power over all rectangular furnaces is quite obvious, and the low initial cost is also much in its favor. There are in this district a number of bodies of oxidized ore of low grade, entirely suitable for moderately coarse crushing and plain cyanide treatment by the leaching process. A 20-ton mill of this character can be erected in this district for about \$7000. Suppose the available ore to be 10,000 tons, of \$5 per ton, dumped by the mine skip directly into the mill bin. If properly designed, this mill can be operated by one man, working eight hours per day, the crushing being done in about four hours. The mining cost can be made about \$1.50 per ton under proper conditions, and treatment, including labor, power, water, cyanide, amortization, repairs and incidentals, will cost about \$1.20 per ton; with this automatic plant, giving a recovery of 80 per cent., or \$4 per ton, there should be obtained a net return of \$1.30 per ton, or \$13,000 from 10,000 tons. The plant should be worth at least \$3000 after 500 days.

If a plant is so located as to involve expensive transportation, and is built without a thoroughly considered design, so that the initial and operating costs are

excessive; if the extent, character and value of the ore supply are uncertain; then there is small probability of success. On the other hand, with a well determined ore supply, a treatment plant so located as to eliminate all transportation, and so carefully and thoroughly designed and constructed as to reduce initial cost as well as operating cost to a minimum, there is extreme probability of the small plant competing very successfully with the distant custom mill. The mills of the past have been largely wasters. Present mills, although not all automatic, are still a marked improvement on past practice, and I predict confidently that future mining operations will be largely augmented by the success of mills of moderate size, contiguous to the mines.

### Mineral Possibilities of the New Hebrides Islands

By G. M. COLVOCORESSES\*

Little has been written concerning the geology or mineral possibilities of the New Hebrides islands. There are two reasons for this: (1) The interior of all these islands is almost unexplored; (2) such exploration and prospecting as has been done has not yet resulted in finding any workable mineral deposits (with the exception of sulphur) in spite of the occasional wild stories of hidden wealth that filter out from various parts of the group. The New Hebrides islands are situated in latitude 12-20 deg. south and longitude 165-170 deg. east, or about 200 miles directly north of New Caledonia. The total area of the group is estimated at something over 6000 sq.m., and the population is composed of about 500 whites (French and British subjects) and an undetermined number of natives variously estimated at from 40,000 to 75,000. The climate of these islands is of the worst, being very hot and very moist, especially in the hurricane season (December to March).

During the years 1902, 1903 and 1904 the greater part of which I spent in New Caledonia, various tales of mineral finds in the New Hebrides kept coming to Noumea, and at the beginning of 1905 I determined to make a trip to the New Hebrides and ascertain, if possible, the truth of some of these stories. I had, moreover, two distinct objects in view: (1) to examine the volcanic deposits of sulphur which were known to exist on the islands of Vanua Lava and Tanna; (2) to determine whether or not the New Caledonian formation of peridotite and serpentine rocks with their attendant deposits of nickel, chrome and cobalt ores

\*Mining engineer, 43 Exchange place, New York.

extended northward and cropped up again in the New Hebrides.

Accordingly I spent the greater part of January and February, 1905, in the New Hebrides, traveling about on a small copra-trading steamer, visiting eight of the principal islands, examining the beaches, river beds and rock formations and any accessible point of interest, and obtaining specimens and information from the missionaries, settlers and natives. The trip itself was an unusual and interesting one, but the results in the main were unsatisfactory.

#### GEOLOGY

It would be hard to imagine a region in which it is more difficult to do prospecting or geological work. Expeditions into the mountains and interior of the islands were only possible in a few cases and almost invariably the jungle vegetation was so thick and the outcrops of rock so rare and hard to trace, that any real study of the formations was impossible.

The formation of practically all the larger islands seems to be similar; there is a core or center of volcanic origin, the volcanoes themselves being generally extinct, but some are still active on the islands of Vanua Lava, Ambrym, Aoba, Lopevi and Tanna. In some cases as Lopevi, the island itself is really nothing but the volcano which rises in a perfect cone from the sea to a height of over 4000 ft., with deep water close to the shore and practically no lowlands surrounding the slopes of the mountain. On most of the islands, however, the volcanic core is surrounded by sedimentary and coral formations, and the land has been raised by successive upheavals so that the coralline limestones are often found at a height of several hundred feet. At various times lava flows have spread out over these benches of coral and in some cases completely covered them and run over into the sea.

The coral rocks and the lavas seem to form by far the greater part of the islands. The lavas are mostly acid in character, with feldspar predominating and generally perfectly crystallized. For the most part they appear to have cooled very quickly, being full of gas bubbles. In places tufas have formed together with pumice stone and great beds of volcanic sand. There are, however, some schist formations of sedimentary origin generally of limited extent, much thrown and tilted and metamorphosed in places. These are usually covered with heavy soil and vegetation and very little can be said concerning them. Chronologically, I believe that all of the New Hebrides islands are of comparatively recent origin and they are still very incomplete since land is continually being made by the volcanic outflows from above and also by the uplift of the coral reefs from beneath. In places subsidence may be going on, but for the most part the contrary is the case.

#### ROCKS AND ORE DEPOSITS

As stated, the rocks forming these islands are mostly coralline, volcanic lavas, tufas and schists. Nowhere was I able to find any evidence of peridotite or serpentine formations, nor of any outcrops of intruded plutonic rocks with which ore deposits might well be associated. It is, however, possible that such exist in the more inaccessible portions of the group and especially in the central mountains of Santo and Mallicolo.

Decomposition of the more basic portions of the lavas have formed small beds of ferruginous clay and ochre at several points and the latter is used by the natives as a paint with which to smear their bodies and decorate their totems. Magnetic-iron sands also are found in some quantities near the seats of volcanic action and especially along the sea beaches where the lavas have been broken and ground up by the waves.

On the island of Mallicolo there are some deposits of graphite. The mode of occurrence is not clear, but it seems probable that the deposits are of the bedded variety. They are found in schists formed largely from calcareous (coral) sediment and partially metamorphosed, due to some volcanic activity in their vicinity. The quality of the graphite is rather poor, and no deposit of commercial importance has yet been found.

On the island of Pentecost and elsewhere, I found considerable iron pyrite in the river beds, but none of the specimens examined contained gold in any appreciable quantity. Rumor of placer gold in some of the river sands and of gold-bearing quartz veins in the interior have been persistently circulated, but I was unable to find any evidence of their truth. The natives of these islands possessed no gold, the missionaries and settlers who have inhabited portions of these islands for over 50 years have never obtained any, and I am strongly of the opinion that no gold is to be found in this group in sufficient quantities to pay for its extraction.

#### SULPHUR

As to the sulphur, it is here, of course, purely a volcanic product, and deposits have been formed and are still forming at Vanua Lava, Tanna, and to a less extent on some of the other islands. The gases emanating from the craters and the fumaroles and crevices along their sides and the waters of the hot springs near by are highly sulphurous, and the sulphur is deposited as a sublimate in thin layers mixed with sand and silicious sinter. No deposits of cinnabar, stibnite, or other sulphides seem to be associated.

As stated in an article in the *JOURNAL* Dec. 23, 1905, an attempt was made a few years ago to work the sulphur deposits on Vanua Lava, and considerable money was expended for equipment. But the fever and dysentery quickly bowled over the en-

gineers and white laborers who went there, proving fatal in many cases, and for this and other reasons the project was then abandoned. Recently there has been some dispute as to the ownership of this property, but this will probably be settled in the near future by the joint English and French commission which is for the first time issuing regular titles for all properties held or claimed in these islands.

At Tanna, considerable sulphur was mined about 20 years ago and shipped to Australia, but a later eruption of the volcano completely closed up the entrance to Port Resolution, the shipping port, and since that time no active work has been carried on here.

Possibly the sulphur deposits may be again worked in the future; also some mineral deposits of value may be discovered and worked after the natives have been brought under better control and systematic exploration is made possible. But in general, I have not a good opinion of the mineral possibilities of the New Hebrides. The difficulty of access, especially during the hurricane season, the long distance from the principal markets of the world, the high cost of all supplies, the unhealthy climate, the lack of skilled labor and the poor quality of the unskilled labor available are some of the things that would have to be seriously considered by any mining company wishing to operate in the New Hebrides.

### Making an Electric Hot Plate

C. A. Rose (*West. Chem. and Met.*, IV, pp. 113-114) describes a home-made resistance-wire electric hot plate. A box of 1/16-in. sheet steel, 2 1/2 to 3 in. deep and the other sizes as desired, is lined throughout except the top with 0.25 in. asbestos, using several thicknesses on the bottom. The asbestos is fastened to the vertical sides by iron strips, 1/8 x 1/2 in., bolted to the box. The top of the box is a 3/16-in. plate fitted loosely and supported by the iron strips. Resistance-wire coils, 5/8 in. diameter are strung back and forth across the box, insulating each coil from the adjoining one with a 1-in. strip of heavy asbestos paper. Adjacent turns of a coil should not be in contact. The coils are held in place at their ends by wire fastenings attached to an extra strip of 1/4-in. asbestos at either end of the box.

An absorption of 1280 watts per sq. ft. of surface will maintain the hot plate at a temperature of 327 deg. C. The length and thickness of the wire can then be easily calculated, using as heavy wire as possible on account of its mechanical advantages. With a 230-volt circuit, Mr. Rose used 600 ft. of No. 18 wire (Brown & Sharpe gage) wound in two coils, connected in multiple, for a hot plate of about 2 1/2 sq. ft. area.



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\*Illustrated.

## The Decision on the Commodities Clause

The decision of the United States Supreme Court on the appeal taken by the Government from the Circuit Court in the suits brought to enforce the Hepburn law, while it is on the face of it a reversal of the lower tribunal, proves to be much less than that in practical effect. The Circuit Court held that the so-called commodities clause was unconstitutional in that it would deprive the companies directly concerned in the suit of their property without due compensation. The Supreme Court sets aside this part of the decision, holding that the law in itself is constitutional and that its passage was within the powers of Congress to regulate interstate traffic. On the other hand, it limits materially the contentions of the Government and brings down the provisions of the law in such a way as, to make it cover a very narrow limit.

The Hepburn act prohibited railroad companies from carrying commodities which they own, or in which they were interested, and was intended to compel railroad companies to divest themselves of all ownership in coal mines or other industrial enterprises. The suit to enforce the law was brought against a number of the anthracite coal companies of Pennsylvania as the most conspicuous offenders. It proves, however, under this decision, that it cannot be enforced even against these companies. The Court holds that the ownership of stock by a railroad company in a coal-mining company does not constitute such ownership of the coal carried as would debar the railroad from transporting it; and further that it is not forbidden to carry it, provided it is sold in good faith before the transportation is begun. Under this decision those anthracite carrying roads which mine their coal through the medium of a subsidiary corporation need not make any change in their present arrangements. In two cases—those of the Delaware & Hudson and the Delaware, Lackawanna & Western—where the companies own and operate their mines directly, it will be necessary for them either to transfer those mines to another corporation in which they may own all the stock; or to alter their methods of selling by disposing of the coal at the mines, instead of selling it at tidewater or other points. Such arrangements

can be made without much difficulty, although they may require a little time to effect.

In brief the Supreme Court decides that the act is constitutional, but with such limitations as will make it practically impossible to enforce it in the sense and intention with which it was originally passed.

The most important change effected by the law will be that the anthracite-coal roads will have to discontinue the practice, which has prevailed for a number of years, of buying the coal of the independent operators at an agreed percentage of the tidewater price. Such coal, it would seem, will have to be accepted at a freight rate to be established as other freight rates are. It is probable, however, that a subsidiary company could purchase such coal under any lawful agreement, as that would be quite apart from the transportation.

## The Lake Coal Trade—A Study of Freight Rates

The coal operators of the Pittsburg district, through a representative committee, have recently made an application to the Interstate Commerce Commission, charging that the railroads discriminate unfairly in the rates charged on coal from that district and Ohio, as compared with West Virginia coal. This is especially the case with the rates on coal to Lake Erie ports for shipment by water to the Northwest; and it is these rates which have been selected as the point of attack before the Interstate Commission.

The case of the operators is fairly stated in a circular issued by H. P. Taylor & Co., of Pittsburg. A table has been compiled and is presented, showing the railroad rate on Lake coal from different districts, the average haul from each district, and the rate per ton-mile, based on those average distances. This table, in condensed form, is as follows:

	Present Rate.	Haul, Miles.	Rate per Ton-mile, c.
Pittsburg.....	\$0.88	160	0.550
Ohio No. 8.....	0.85	155	0.548
West Virginia:			
Fairmont.....	0.97	240	0.405
Kanawha.....	0.97	351	0.274
New River.....	1.12	490	0.228
Pocahontas.....	1.12	460	0.231
Cabin Creek.....	0.97	453	0.214
Thacker.....	0.97	380	0.255
Kentucky:			
Big Sandy.....	0.97	420	0.231
Marrowbone.....	0.97	490	0.198

The ton-mile rate is, therefore, more than twice as great on Pittsburg coal as on Kanawha, and nearly three times that on some Kentucky coals. It is claimed that if a uniform ton-mile rate—say 0.4c.—were imposed, the rate from the Pittsburg district to Lake ports would be 64c., while on West Virginia coals it would run from \$1.28 up to \$1.96 per ton. Such a difference would, of course, be of great importance. It is also urged that the cars from West Virginia mines go back empty, as a rule, while many of those from Pittsburg have a return load of iron ore.

So far this presents the Pittsburg operators' argument. The case as to rates is not presented with entire fairness, however. The terminal expenses are nearly uniform on all coal, whatever the haul, and this reduces considerably the apparent discrimination. Deducting these on a conservative estimate of their amount the actual haulage rate—to take extreme cases—would be about 70c. on Pittsburg coal and 94c. on New River; the ton-mile rates being 0.438 and 0.192c. This is still a sufficient discrepancy.

Every railroad manager, however, knows the extreme difficulty of imposing a uniform ton-mile rate in such cases as this, where its use would probably put certain districts out of competition for a certain class of trade. In the Seaboard bituminous trade the question was fought out years ago, when West Virginia coal first began to seek that market. In that case an equal ton-mile rate would have barred out the New River and Pocahontas coals entirely, in favor of Cumberland, Clearfield and Broad Top. It was only a rate, which for years did not exceed 0.25c. per ton-mile, that brought Pocahontas, for instance, into the Eastern markets, and gave it a chance to secure the place which its quality warranted in the trade. On a uniform ton-mile rate, indeed, the Pittsburg district itself would be practically out of the Seaboard market.

It does not appear, moreover, that this discrimination in rates has really affected the Pittsburg district as much as is claimed. There have been other causes in operation, and the district has really lost comparatively little of its share in the trade. The proportion of the Lake shipments furnished by three leading districts, has not varied greatly for six years past, as shown in the following table, which gives each district's percentage:

Season.	Pittsburg.	Ohio.	West Va.
1903.....	56.6	23.6	19.8
1904.....	59.4	21.5	19.1
1905.....	59.8	20.3	19.9
1906.....	60.0	19.8	20.2
1907.....	55.2	24.9	19.9
1908.....	51.4	25.2	23.4

Up to 1907 the Pittsburg district held its own very well, the loss in its proportion coming in 1907 and 1908. In 1907 the chief gain in proportion was made by Ohio. The West Virginia percentage was about stationary until 1908, when it increased considerably. Last year, however, was rather an exceptional one, owing to the great falling off in the trade. It is probable that the West Virginia gain was not due so much to the freight rates as to the fact that the operators, with a lower mining wage rate, were able to—and did—offer lower prices, while the large Pittsburg operators maintained their quotations on the same level as in the preceding year. The lower prices counted in a poor year, and the greater proportion of the trade going to the West Virginia mines was the result of cheaper coal quite as much, or perhaps more, than of the freight rates. Pittsburg coal is claimed to be the standard of quality in the West, but much of the West Virginia coal approaches it very closely.

### The Index Number for 1908

The well known index number, representing the prices of commodities, computed by A. Sauerbeck for 1908 has lately been published. This is 73, against 80 in 1907 and against 72 as the average for the 10 years ending with 1908. The most important feature in these statistics is the showing that the decline in prices from 1907 to 1908 was entirely confined to materials, the index number for them alone having been 74 in 1908 compared to 86 in 1907. In food stuffs there was no decline, the number having been 72 for each year, which was the highest figure since 1893. This accounts for the general complaint that the recent industrial depression has not been accompanied by any decrease in the cost of living. The explanation is, of course, that the harvest in the last two or three years has not kept pace with the demand for food. This is a condition that will doubtless correct itself in perfectly natural ways, but in the meanwhile the shortage and corres-

pondingly high prices impose burdens upon the bulk of the population that are hard to bear, that diminish their capacity for accumulating savings, and consequently delay the recovery of the full measure of commercial prosperity.

From the nadir of the depression in the early part of 1908 there has been a slow but steady improvement which during the first quarter of 1909 became more pronounced and is now undoubtedly gaining force. The ultra-optimistic are of the opinion that conditions are leading to an era of "unparalleled prosperity." This may be so, but it is difficult to see how it is going to come to pass until the agricultural development of the world increases so as more nearly to fit the demand. In the meanwhile it is well to remember that in spite of the undeniable revival in business the world has not yet pulled out of the slough of depression. The number of idle railway cars and unemployed men in the United States is still large, factories are still operating at less than full time, commerce in Europe is still under a cloud, and some of the unfavorable basic conditions, such as high cost of living and increasing taxation, continue to exist.

JUDGE HUNT, IN THE United States Circuit Court, on April 27 rendered a decision dismissing the case of Fred J. Bliss against the Anaconda Copper Mining Company and Washoe Smelter Company, and ordering each party to the action to pay its own costs. The decision is final. This celebrated case was begun in May, 1905, and cost the farmers of the Deer Lodge valley \$100,000; the cost to the companies is not known, although it must have been many times that incurred by the farmers. The case is one of the largest that this or any other Federal court has ever heard. The decision establishes another precedent.

THE GEOLOGICAL SURVEY is about to publish the results of its investigations on the smokeless combustion of coal in boiler plants. The gist of them is that the flame and distilled gases should not be allowed to come into contact with the boiler surfaces until combustion is complete. The experts of the Survey do not seem to have added anything material to the stock of knowledge in William Kent's "Steam Boiler Economy."

**The Decision on the Commodities Clause**

In a decision handed down on May 3 the Supreme Court of the United States has rendered a decision on the so-called commodities clause case. This involves the constitutionality and legality of the clause in the Hepburn railroad-rate law prohibiting railroads from owning and producing the commodities they transport over their lines.

Briefly summarized the decision of the Supreme Court in the cases holds the law to be constitutional, but it does not concede the contentions of the Government as to its scope. An especial exception is made as to the ownership of stock in a different corporation, which it is held does not constitute such ownership as would permit transportation under the terms of the law. It is also held that ownership of a commodity applies only to the time of transportation. If before transporting it the railroad company has, in good faith, parted with the commodity it may carry it.

The principal point of the decision is in relation to railroads holding the stock of subordinate companies, and on that important point the finding was favorable to the roads. Justice Harlan dissented on the stock feature, but otherwise the decision was unanimous.

The chief points of the decision are as follows:

1. The claim of the Government that the provision contained in the Hepburn act, approved June 29, 1906, commonly called the commodities clause, prohibits a railroad company from moving commodities in interstate commerce because the company has manufactured, mined, or produced them, or owned them in whole, or in part, or has had an interest direct or indirect in them, wholly irrespective of the relation or connection of the carrier with the commodities at the time of transportation, is decided to be untenable. It is also decided that the provision of the commodities clause relating to interest, direct or indirect, does not embrace an interest which a carrier may have in a producing corporation as the result of the ownership by the carrier of stock in such corporation, irrespective of the amount of stock which the carrier may own in such corporation, provided the corporation has been organized in good faith.

2. Rejecting the construction placed by the Government upon the commodities clause, it is decided that that clause, when all its provisions are harmoniously construed, has solely for its object to prevent carriers engaged in interstate commerce from being associated in interest at the time of transportation with the commodities transported, and, therefore, the commodities clause only prohibits railroad companies engaged in interstate commerce from transporting in such commerce commodities under the follow-

ing circumstances and conditions: (1) When the commodity has been manufactured, mined or produced by a railway company, or under its authority and at the time of transportation the railway company has not, in good faith before the act of transportation, parted with its interest in such commodity. (2) When the railroad company owns the commodity to be transported in whole, or in part. (3) When the railroad company, at the time of transportation, has an interest direct or indirect in a legal sense in the commodity, which last prohibition does not apply to commodities manufactured, mined, produced, owned, etc., by a corporation because a railroad company is a stockholders in such corporation. Such ownership of stock in a producing company by a railroad company does not cause it, as the owner of the stock, to have a legal interest in the commodity manufactured, etc., by the producing corporation.

3. As thus construed the commodities clause is a regulation of commerce within the power of Congress to enact. The contentions elaborately argued for the railroad companies that the clause, if applied to pre-existing rights, will operate to take property of railroad companies and, therefore, violate the due process clause of the fifth amendment, were all based upon the assumption that the clause prohibited and restricted in accordance with the construction which the Government gave that clause, and for the purpose of enforcing which prohibitions these suits were brought.

As the construction which the Government placed upon the act and seeks to enforce is now held to be unsound, and as none of the contentions relied upon are applicable to the act as now construed, because under such construction the act merely enforces a regulation of commerce by which carriers are compelled to dissociate themselves from the products which they carry and does not prohibit where the carrier is not associated with the commodity carried, it follows that the contentions on the subject of the fifth amendment are without merit.

4. The exemption as to timber, etc., contained in the clause is not repugnant to the Constitution.

5. The provisions for penalties are separable from the other provisions of the act. As no recovery of penalties was prayed, no issue concerning them is here presented. It will be time enough to consider whether the right to recover penalties exists when an attempt to collect penalties is made.

6. As the construction now given the act differs so widely from the construction which the Government gave to the act and which it was the purpose of these suits to enforce, it is held that it is not necessary, in reversing and remanding, to direct the character of decrees which

shall be entered, but simply to reverse and remand the case with directions to enforce and apply the statute as it is now construed.

7. As the Delaware & Hudson Company is engaged as a common carrier by rail in the transportation of coal in the channels of interstate commerce, it is a railroad company within the purview of the commodities clause and is subject to the provisions of that clause as they are now construed.

**April Dividends**

The accompanying table shows the total amount and amount per share, of the dividends paid during April, 1909, by a number of mining and industrial companies in the United States; and by some foreign companies:

U. S. INDUSTRIALS.	Location.	Amt. per Share.	Amt. Paid.
American Ag. Chemical . . . . .	U. S.	\$3.00	\$544,590
Central Coal and Coke, com. . . . .	Mo.	1.50	76,875
Central Coal and Coke, pfd. . . . .	Mo.	1.25	23,437
National Lead, com. . . . .	U. S.	1.25	186,317
Pittsburgh Coal pf. . . . .	Penn.	1.75	519,767
Texas and Pacific Coal . . . . .	Texas	1.50	35,910
Va. Carolina Chem., pf. . . . .	U. S.	2.00	360,000

U. S. MINING COMPANIES.	Location.	Amt. per Share.	Amt. Paid.
Alaska Mexican . . . . .	Alas.	\$0.40	\$72,000
Alaska Treadwell . . . . .	Alas.	0.50	100,000
Alaska United . . . . .	Alas.	0.25	45,050
Boston & Montana Am. Smg. & Ref., pfd. . . . .	Mont.	3.00	450,000
Am. Smg. & Ref., com. . . . .	U. S.	1.75	875,000
Bunker Hill & Sullivan . . . . .	U. S.	1.00	500,000
Camp Bird . . . . .	Ida.	0.15	45,000
Copper Range . . . . .	Colo.	0.24	196,800
Colorado . . . . .	Mich.	1.00	384,185
Daly West . . . . .	Utah	0.08	80,000
Elkton . . . . .	Utah	0.30	54,000
Gold Dollar . . . . .	Colo.	0.01	37,500
Goldfield Con. . . . .	Nev.	0.005	12,500
Homestake . . . . .	S. Dak.	0.30	1,770,428
Iron Blossom . . . . .	0.50	109,200	
Jamison, g. . . . .	Utah	0.08	80,000
MacNamara . . . . .	Cal.	0.02	7,800
Phelps Dodge & Co. . . . .	Nev.	0.01	5,000
Silver King Co't'n . . . . .	U. S.	2.50	1,123,365
Sioux Con. . . . .	Utah	0.15	187,000
Utah Con. . . . .	Utah	0.07	52,249
Tonopah of Nev. . . . .	Utah	0.50	150,000
United States, com. . . . .	Nev.	0.35	350,000
United States, pf. . . . .	Utah	0.50	175,466
Wolverine . . . . .	Utah	0.87	425,118
	Mich.	5.00	300,000

FOREIGN MINING COMPANIES.	Location.	Amt. per Share.	Amt. Paid.
Buffalo . . . . .	Ont.	\$0.05	\$45,000
El Rayo . . . . .	Mex.	0.48	124,000
Guggenheim Expl. . . . .	Mex.	2.50	518,252
La Rose . . . . .	Ont.	0.20	228,073
Mines Co. of Am. . . . .	Mex.	0.02	40,000
Nipissing . . . . .	Ont.	0.25	300,000
Right of Way . . . . .	Ont.	0.15	74,927
Nova Scotia Steel and Coal, pf. . . . .	Nova Scotia	2.00	20,600
Temiskaming . . . . .	Ont.	0.06	150,000

# Views, Suggestions and Experiences of Readers

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

## CORRESPONDENCE AND DISCUSSION

### Treatment of Magnetite in Copper Blast Furnace

Last summer in operating the smelter at Hadley in southeastern Alaska, I had some experience in the treatment of magnetite carrying copper pyrites. Before saying anything about the treatment, it will be of interest to note the composition of the ores treated. The main ores smelted came from the Mamie and Stevenstown mines, and had the composition shown in the accompanying table. Silica was required to make a smelting mixture and the silicious ore used carried: SiO<sub>2</sub>, 62 per cent.; Fe, 15; CaO, 1.3; S, 10; Al<sub>2</sub>O<sub>3</sub>, 5; and some copper, gold and silver the exact amounts of which I do not feel at liberty to divulge at this time.

	SiO <sub>2</sub> .	Fe.	CaO.	S.	Al <sub>2</sub> O <sub>3</sub> .
Stevenstown.	19.3	24.1	9.7	7.7	11.0
Mamie.....	14.0	42.0	2.5	3.0	7.5
Silicious ore.	62.0	15.0	1.3	10.0	5.0
Slag.....	30.0	37.0	5.0	....	1.20

With these ores mixed in suitable quantities to make a smelting mixture, we find the sulphur content is rather low for making a grade of matte suitable for clean slags, also the alumina being high will cause the furnace to run slowly and further assist in the oxidation of the sulphur, giving a higher grade matte than when conditions are right for fast running.

The condition of the ore going into the furnace affects the oxidation of the sulphur. I found by taking run-of-mine ore, we kept the grade of our matte lower. In other words, by feeding large pieces of ore we got less oxidation, thereby conserving the sulphur for the matte. In this connection I might say that pieces weighing as much as 500 lb. were fed directly into the furnace. Another marked advantage in feeding coarse ore, was the reduced amount of flue dust.

By figuring the alumina in the mixture as silica I did not have any trouble with the furnace. As soon as the combined silica and alumina exceeded 45 per cent., unmistakable signs presented themselves, such as bridging and indications of an incipient freeze up. Average analysis of the slags was about as follows: SiO<sub>2</sub>, 30 per cent.; Fe, 37; CaO, 5; Al<sub>2</sub>O<sub>3</sub>, 12. The matte produced usually ran about 45 per cent. copper.

For 24 hours I ran a slag having the

following analysis: SiO<sub>2</sub>, 27 per cent.; Fe, 39.6; Al<sub>2</sub>O<sub>3</sub>, 10.5; CaO, 6. The slag itself was fairly clean but carried from the furnace into the settler uncombined magnetite which manifested itself above the matte as a mush. On raising the silica in the slag this mush immediately disappeared. When running this low silica slag, a curious condition showed in the connection spout, namely, an incessant sparking similar to an iron cupola, and undoubtedly due to metallic iron oxidizing in contact with the air.

B. H. BENNETTS.

Tacoma, Wash., April 30, 1909.

### A Method for Calculating Slags

In calculating a charge for any type of furnace, either blast furnace or reverberatory, for smelting copper or lead ores, it would seem to be desirable that a definite formula be used for the slag calculation instead of the "hit and miss" method sometimes used, or going through the operations found in some textbooks. These are undoubtedly simple enough but lengthy, and not always practical. The calculation of lead blast-furnace charges in Furman's well known work is the most direct and simple, but involves the algebraic calculation of a new formula for each slag.

The use of the following formulas has saved me much time, and they are published with the hope that they will be of value to others. Of course, it must be understood that the charge calculated to make any given slag is only the basis to work from, and will nearly always be changed to meet the special conditions in running the furnace. These conditions are variable, such as quantity and pressure of air blast, size of the furnace, temperature, physical character of the ore and many others.

No attempt will be made in this article to describe the preliminary calculations for the matte, its quantity and tenor, but it will be assumed that this has been done and we know definitely all the available slag-making constituents of the ores to be smelted. In tabulating the available amounts of slag-forming constituents in the ores, it is convenient to bring them all under three heads, viz., SiO<sub>2</sub>, FeO and CaO. The SiO<sub>2</sub>, FeO and CaO in the coke ash may be included under their respective heads in the "stock" ore, designated as silicious ore in the accompanying table. The iron in the matte and

speiss, if any, is deducted from the total FeO in the "stock" ore.

Assume that we have the following ores to smelt, considering only for our purpose their available SiO<sub>2</sub>, FeO and CaO and leaving out of the table the gold and silver also copper, lead, sulphur, arsenic, etc.:

	SiO <sub>2</sub> and Al <sub>2</sub> O <sub>3</sub> Per Cent.	FeO and MnO. Per Cent.	CaO and Earths. Per Cent.
Silicious ore....	68.0	15.0	7.0
Iron ore.....	20.0	50.0	3.0
Limestone.....	12.0	4.0	45.0

What weight of the iron ore and limestone must be added to 100 lb. of the silicious ore to form a slag of any desired ratio of SiO<sub>2</sub>, FeO and CaO?

Let  $S$  = percent. SiO<sub>2</sub> wanted in the slag  
 $M$  = percent. FeO wanted in the slag  
 $N$  = percent. CaO wanted in the slag } 90 %

$A$  = lb. SiO<sub>2</sub> in the silicious ore.  
 $B$  = lb. FeO in the silicious ore.  
 $C$  = lb. CaO in the silicious ore.

$d$  = per cent. SiO<sub>2</sub> in iron ore to be added.  
 $e$  = per cent. SiO<sub>2</sub> in limestone to be added.  
 $f$  = per cent. FeO in iron ore to be added.  
 $g$  = per cent. FeO in limestone to be added.  
 $h$  = per cent. CaO in iron ore to be added.  
 $l$  = per cent. CaO in limestone to be added.

From simple algebraic equations for two unknown quantities, deduced from the slag ratio of SiO<sub>2</sub>, FeO and CaO, we have the following formulas:

Required iron ore =

$$\frac{NBe - MCE - SBl + MAI - NAg + SCg}{Sfl - Mdl - Nfe + Mhe - Shg + Ndg}$$

Required limestone =

$$\frac{NB + NXf - MC - MXh}{Ml - Ng}$$

Suppose we wish to charge the above ores so as to make a slag of, say 40 per cent. SiO<sub>2</sub>, 42 per cent. FeO, 8 per cent. CaO, totaling 90 per cent. of the slag composition. The letters in the formulas would be represented as follows:

$$S = 40 \quad A = 68 \quad d = 0.20 \quad g = 0.04$$

$$M = 42 \quad B = 15 \quad e = 0.12 \quad h = 0.03$$

$$N = 8 \quad C = 7 \quad f = 0.50 \quad l = 0.45$$

Substituting these values for the letters in the formulas, we have for the required amount of iron ore,

$$\frac{(8 \times 15 \times 0.12) - (42 \times 7 \times 0.12) - (40 \times 15 \times 0.45) + (42 \times 68 \times 0.45) - (8 \times 68 \times 0.04) + (40 \times 7 \times 0.04)}{(40 \times 0.50 \times 0.45) - (42 \times 0.20 \times 0.45) - (8 \times 0.50 \times 0.12) + (42 \times 0.03 \times 0.12) - (40 \times 0.03 \times 0.04) + (8 \times 0.20 \times 0.04)}$$

or

$$\frac{14.4 - 35.28 - 270 + 1285.2 - 21.76 + 11.2}{9 - 3.78 - 0.48 + 0.1512 - 0.048 + 0.064} = \frac{983.76}{4.9072} = 200.5 \text{ lb.}$$

For the required limestone we have

$$\frac{(8 \times 15) + (8 \times 200.5 \times 0.50) - (42 \times 7) - (42 \times 200.5 \times 0.03)}{(42 \times 0.45) - (8 \times 0.04)}$$

or

$$\frac{120 + 802 - 294 - 252.63}{18.9 - 0.32} = \frac{375.37}{18.58} = 20.2 \text{ lb.}$$

For the assumed ores we have the following charge weights:

	Weight. Pounds.	SiO <sub>2</sub> Pounds.	FeO Pounds.	CaO Pounds.
Silicious ore..	100.0	68.0	15.0	7.0
Iron ore.....	200.5	40.1	100.2	6.0
Limestone.....	20.2	2.4	0.8	9.1
Total.....	320.7	110.5	116.0	22.1

From these figures we get 248.6 lb. of these slag-forming constituents, which give a slag of 39.96 per cent. SiO<sub>2</sub>, 41.94 per cent. FeO, 7.99 per cent. CaO. A charge of 1000 lb. would be: Silicious ore, 312; iron ore, 625; limestone, 63 pounds.

Should there be no Fe in the limestone nor CaO in the iron ore, the expressions in the formulas containing the factors *g* and *h* are omitted. In regard to Al<sub>2</sub>O<sub>3</sub> if the slag which it is desired to make is high in silica (a bisilicate or over), then in making up a charge include the Al<sub>2</sub>O<sub>3</sub> with the SiO<sub>2</sub>. If the slag is to be of lower silicate degree than a bisilicate, it is safer to include a part of the Al<sub>2</sub>O<sub>3</sub> with the bases.

HENRY EARLE.

Denver, Colo., April 26, 1909.

### Electric Smelting in Norway

In the Journal of April 24, 1909, page 844, appeared the following announcement: "The Electric Smelting Company will install at Ludvika, Sweden, two furnaces for smelting iron by electricity and two for making steel, of the type designed by Dr. Eugene Haanel, of the Mines Department of Canada."

This plant will not be erected in Sweden, but in Norway, and will consist of two electric high furnaces, of 2500 h.p. each, for the reduction of iron ores, and two steel furnaces, of 600 h.p. each, together with a rolling mill for billets and flat iron. The plant will later be extended with four more electric high furnaces and four more steel furnaces of larger size.

The above plant is being designed and will be equipped by the Electro-metall Company of Ludvika, Sweden, which designed and patented the furnaces above mentioned, and which I investigated in Sweden.

EUGENE HAANEL.

Ottawa, Can., April 26, 1909.

### The Revelation of a Metallurgical Secret

On my return from Italy I have read over the accumulated numbers of the JOURNAL and have noted the editorial in the issue of Feb. 27 on the "Revelation of a Metallurgical Secret." If reference be made to page 18 of the revised edition of my "Notes on Lead and Copper Smelting," a description will be found of the Argo process as I supposed it to be, which was published in the first edition of that book in 1897. The chain of evidence leading to the conclusion is given in detail and the deduction agrees with the "revelation" in every respect, even to the electrolytic process being better and cheaper.

Philadelphia, Penn. H. W. HIXON.

April 30, 1909.

[The fact that Mr. Hixon, so cleverly deduced the Argo process does not detract from the interest of the paper by Mr. Pearce or make that paper otherwise than a revelation. However, Mr. Hixon deserves all praise for his high metallurgical knowledge and keenness in deduction which led him to the solution of a problem that for many years had baffled many inquirers. He must, of course, be gratified to have an official pronouncement that his solution was correct.—Ed.]

### Diamond Mine in Pike County, Arkansas

In connection with the discussion of the diamond region of Arkansas in the JOURNAL of March 20 and Feb. 13, 1909, by John T. Fuller and Prof. John C. Branner, formerly State geologist of Arkansas and now professor of geology at Stanford University, Cal., I can readily realize how Professor Branner feels in regard to the occurrence of diamonds in Arkansas, and I distinctly remember his stating to me that he had said nothing at the time of his survey, because of the unwarranted excitement which was then spreading through Arkansas.

In the company of Dr. J. S. Diller, of the Geological Survey, I visited Elliott county, Ky., and after spending a number of days in a region in which everything was present in the way of rock associations excepting the diamonds themselves, we failed to find them. Work has been indefatigably carried on there for a number of years, and much money has been spent without finding a single diamond. It was in view of this fact that Doctor Branner was restrained from prophesying more than he did.

On my visit to the Pike county peridotite locality in January, 1907, I remained there about a week with the owners of the property and devoted more than half of that time to a diligent, painstaking search without finding a single diamond. Dr. Henry S. Washington, who visited the locality before my arrival, had the same ill

success. He was there during the period of my visit and remained after my departure. There was nothing strange, however, in the failure to discover diamonds; because if they should exist in the proportion of 1/5 to 1/2 a carat to a load, which is the proportion of the South African yield, there would not be more than one part of diamond in from 1,000,000 to 10,000,000 or 20,000,000 parts of material. Then again, the diamond may be more or less coated with earth or mud, which would render it hard to detect.

Doctor Washington and myself found Doctor Branner's maps most carefully made and of the greatest value in our work, as were also his geological deductions, which were admirable. Knowing both Mr. Fuller and Doctor Branner as I do, I feel confident that both have meant well, and that neither would wish to discredit the other. I hope there will be no controversy where there should be nothing but harmony and good fellowship; and that the ultimate result of the property may warrant the work being carried on there.

GEORGE F. KUNZ.

New York, April 26, 1909.

### Mining in the Alamos and Arteaga Districts

As a constant reader of the JOURNAL I take the liberty of making a few comments on the article which appeared in the issue of April 3, 1909, entitled "Mining in the Alamos and Arteaga Districts," by George M. Bloomer. Touching what is called Contact No. 1, Alamos district, the article in question is misleading. The principal misstatements in the article are:

Of the various mines mentioned, the Quintera and Zambona are designated as the only ones under actual operation. As a matter of fact, the Zambona, Santo Domingo and Promontorio are the mines which are being worked, the Quintera having closed down several months ago.

The Promontorio neither was nor is being equipped by the American company which bought the Mexican concern in 1905. A second American company has lately taken hold of this property and is only just commencing operations. The first company did nothing.

The Zambona workings are only 730 ft. in depth, not 1050 ft. The Teresa has no indications nor work on it to deserve at all to be termed a promising prospect. The Alamos mountain is far from being thoroughly mineralized, the mineralization being practically limited to the contact on its extreme west. Wood and water are not abundant, and "water-power opportunities" are entirely absent. The view purporting to show the Zambona mine and reduction works is not a view of the Zambona at all.

AMOS J. YAEGER.

Minas Nuevas, Son., Mex., April 19, 1909.

## Chronology of Mining, April, 1909

*April 1*—Explosion in the Echo mine of Buery Brothers Coal and Coke Company, Fayette county, W. Va.; four men killed—John Mitchell day was celebrated by 300,000 miners in Pennsylvania—Utah Fuel Company fined by the United States Government for conspiracy to defraud the Government of coal lands.

*April 2*—Coal strike inaugurated at Alberta, Canada.

*April 4*—Fire broke out on the eighth level of the North Mahanoy colliery, Pennsylvania.

*April 8*—Second meeting of anthracite miners and operators in Philadelphia.

*April 9*—Explosion at du Pont Powder Works, Wayne, N. J. Damage to property, 20,000—Oil still at Point Richmond, Cal., exploded; two men killed; loss, \$50,000—Dynamite explosion in Berwind-White Coal Company's mine at Windber, Penn.; seven men killed, four entombed.

*April 10*—Riot at Velardeña, Durango, Mexico. Six policemen killed.

*April 13*—John Fritz medal awarded to Charles T. Porter at a joint meeting in New York of the Mining, Civil, Electrical and Mechanical engineers—Gas explosion at Superior coal mine at Linton, Ind.; 20 killed.

*April 14*—Sale of Alaska Copper and Coal Company's Bonanza mine to J. P. Morgan and the Guggenheims.—Eight hundred union coal miners of the Bend Coal Corporation, Johnstown, Penn., go on strike—John Mitchell addressed the Pennsylvania legislature on the "Ideals of the Trade Union Movement."

*April 15*—Gas explosion at George's Creek Coal and Iron Company's mine, Farmington, Va. Three men killed—Over 600 officers of the United States Steel Corporation met at Scottdale, Penn., to receive reports from the commission which visited coal industrial plants in Europe.

*April 16*—W. K. Niver Coal Company sold by receiver to J. V. McDonald, of New York, for \$200,000.

*April 17*—Bald Butte Mining Company passes into hands of receiver—Federal Mining and Smelting Company passes regular quarterly dividend on common stock—J. O. Rogers appointed receiver for Lanyon Zinc Company.

*April 18*—The directors of the United States Smelting, Refining and Mining Company purchased 100,000 shares of the company's stock from R. D. Evans—Consolidated Silver Cobalt Mines, Ltd., assumed control of the Greene-Meehan Mining Company, Cobalt.

*April 19*—Pittsburgh Coal Company cancelled contract with Pittsburgh Terminal Railroad and Coal Company, to take effect October 31—Meeting of the anthracite coal operators' representatives in New York to decide upon policy toward mine-workers' wage scale—Explosion of gas at Elnora mine, Highland Coal Company,

Warnock, O. Six men injured—La Rose Consolidated Mining Company acquires control of the Lawson mine, Cobalt.

*April 20*—Judge Goff, of the U. S. Circuit Court of Appeals issues order restraining Chesapeake & Ohio railroad from increasing freight rates on coal from West Virginia points.

*April 21*—Bill filed in Common Pleas Court to have directors of the Tonopah Belmont Mining Company, held criminally liable for new stock issued last June.

*April 22*—Isabella-Connellsville Company voted first appropriation of \$2,000,000 to begin construction work of plant on the Monongahela river—Plans launched for the merger of the Isabella Coal and Coke Company and the Tower Hill Coal Company, Fayette county, Penn.

*April 23*—Cave-in of M. & B. mine, Duenweg, Mo. Three men killed.

*April 24*—Judge E. H. Sullivan appointed A. Starke Oliver as temporary receiver for the Idaho Smelting and Refining Company in place of John Mocine.

*April 26*—Judge Lacombe in the United States Circuit Court discharged A. R. Ledoux as receiver of the Harney Peak Tin Mining, Milling and Manufacturing Company.

*April 27*—Judge Hunt dismissed the "smoke" case of F. J. Bliss vs. Anaconda Copper Mining Company and the Washoe Smelter Company—Anthracite miners meet at Scranton to discuss tentative plans for settlement with operators.—The New York & Virginia Copper Mining Company was placed in the hands of receivers.

*April 28*—The Tri-district convention of the United Mine Workers at Scranton, Penn., unanimously adopted the three-year extension of the present wage agreement.

*April 30*—The three-year wage agreement between the anthracite miners and operators signed.

## The Anthracite Settlement

An agreement was finally reached last week between the operators' and miners' committees with regard to the mining of anthracite coal. The agreement was ratified by the district convention of the miners, and has been signed by the representatives of both parties. In effect it extends for three years the settlement made by the Anthracite Strike Commission in 1903, which has been in force ever since. There are some slight changes, made as a concession to the miners, but they are not of great importance. The text of the new contract is as follows:

### THE AGREEMENT

Whereas, pursuant to letters of submission signed by the parties interested in 1902, "All questions at issue between the respective companies and their own em-

ployees whether they belong to a union or not," were submitted to the Anthracite Coal Strike Commission to decide as to the same and as to "the conditions of employment between the respective companies and their own employees," and the said Strike Commission under date of March 18, 1903, duly made and filed its award upon the subject matter of the submission and provided that said award should continue in force for three years from April 1, 1903, and the said period has expired.

And whereas, By agreement dated May 7, 1906, it was stipulated the "said award and the provisions thereof and any action which has been since taken pursuant thereto, either by the Conciliation Board or otherwise, shall be extended and shall continue in force for three years from April 1, 1906, namely, until March 31, 1909, with like force and effect as if that had been originally prescribed as its duration."

Now, therefore, it is stipulated between the undersigned, in their own behalf and, so far as they have power to represent any other parties in interest, that the said award and the provisions thereof and any action which has been since taken pursuant thereto, either by the Conciliation Board or by written agreement between representatives of the employers and employees, shall be extended and shall continue in force for three years from April 1, 1909, namely, until March 31, 1912, with like force and effect as if that had been originally prescribed as the duration.

It is further covenanted and agreed as follows, viz:

First—The rates which shall be paid for new work shall not be less than the rates paid under the Strike Commission's award for old work of a similar kind or character.

Second—The arrangement and decisions of the Conciliation Board permitting the collection of dues on the company property and the posting of notices thereon shall continue during the life of this agreement.

Third—An employee discharged for being a member of a union shall have a right to appeal his case to the Conciliation Board for final adjustment.

Fourth—Any dispute arising at a colliery under the terms of this agreement must first be taken up with the mine foreman and superintendent by employee, or committee of employees directly interested, before it can be taken up with the Conciliation Board for final adjustment.

Fifth—Employers shall issue pay statements designating the name of the company, the name of the employee, the colliery where employed, the amount of wages and the class of work performed.

The Meyer & Charlton mine yielded revenue for 1908 (*South African Min. Journ.*, March 13, 1909) to the amount of £251,790; the expenditure was £147,622, leaving a gross profit of £104,167.

## Questions and Answers

Inquiries for information are answered in this department as promptly as possible, but more or less delay is often unavoidable. Many inquiries involve a good deal of investigation and these can be answered only when the general interest in the subject is conceived to justify the expenditure of the time required. Correspondents should refrain from asking for advice that ought to be obtained by professional consultation with an engineer. We will not answer questions pertaining to the value of specific mining enterprises. Inquiries should be framed concisely.

### "BLUE GAS"

What is the address of the owners of the United States and Canadian patents of this gas, which was described in the JOURNAL of Feb. 27?

A. B. C.

The Blaugas Company of America, 1 Platt street, New York; the Blaugas Company of Canada, 671 St. James street, Montreal, Canada.

### THE DEEPEST SHAFT

What is the deepest mining shaft in the United States? What is the deepest in the world?

F. B. McK.

The deepest shaft in the United States, and also in the world, is Tamarack No. 3, in Michigan, which is 5253 ft. deep. Europe has no shaft of anywhere near that depth. So far as we are aware, the deepest is at a colliery in Belgium, and is 3773 ft. deep.

### RADIUM

Please inform me if the name "radium" was not mentioned in some chemical textbook, 18 or 20 years ago, as a supposed element. Of course, I am aware that the element was not actually known previous to the Curie discovery.

D. W.

Radium was discovered by Madame S. Curie, P. Curie and M. Bemont in 1898. The word "radium" was unknown prior to 1898. It is not mentioned in any textbook, scientific journals, nor periodicals before 1898, as far as we are aware.

### TANTALUM ORE

What is the market for tantalite or other minerals containing tantalum?

R. L. G.

The demand is extremely small. So far the principal use for tantalum is as a filament for incandescent electric lamps. Inasmuch as the quantity required for a single lamp of the ordinary size is only about 1/100 of a gram, it will readily be perceived that a ton of ore will go a long way in this business. However, tantalum is a metal that appears to have some highly useful properties, and without doubt an increased demand for it in the arts will develop.

### DETERIORATION OF DYNAMITE

Does dynamite deteriorate any faster when kept in the frozen state than when kept thawed? At this mine the dynamite used is du Pont, less than six months old, but is kept frozen until a few hours be-

fore being used. We are very much troubled by gas from the "powder"—nitrogen oxides, I suppose. Good dynamite, when well thawed, has a feeling similar to that of a well ripened pear or peach—if pressed by the finger it retains the imprint. When the dynamite gets old it becomes more like soft rubber. Some of the "powder" we are using is more like this. Can you give me advice as to the proper keeping of dynamite so it will not deteriorate?

A. O. C.

If dynamite is kept in a frozen condition or kept in a dry, well ventilated magazine, whose temperature does not reach much above 80 deg. F., there is very little chance for the dynamite to deteriorate. As regards the gas from the powder, of which A. O. C. complains, it would be helpful if he would state whether he is using the nitroglycerin dynamite or gelatin dynamite, and whether he is using it in open or closed work.

### PHOSPHATE ROCK

What are the principal producing phosphate fields of the United States, and what variety of rock does each produce? What new phosphate fields have been discovered in recent years?

A. P. B.

The principal phosphate producing fields of the United States are situated in Florida, Tennessee and South Carolina, named in the order of their importance. In 1908, Idaho and Arkansas both produced a few thousand tons. Florida produces three grades of phosphate, viz.: hard rock, land pebble and river pebble. Tennessee produces brown rock and black rock. South Carolina produces land rock and river rock.

Among the new discoveries, the most important are those of the western United States and the islands of the South Pacific seas. The former embraces a large area in southeastern Idaho, southwestern Wyoming and northeastern Utah, and is reported to contain an extraordinary supply of black oolitic phosphate, much like the Tennessee rock in appearance, and carrying about 70 per cent. bone phosphate. The phosphate industry in the South Pacific islands has developed greatly in recent years, and in 1908 many important discoveries were made.

### BARYTES

What is the BaSO<sub>4</sub> content of the average commercial dry-ground and water-floated barytes? What is the lowest grade of crude barytes sent to the grinding mills? What is the average BaSO<sub>4</sub> content of the artificial sulphate, called blanc fixe? What is the approximate cost of reducing BaSO<sub>4</sub> to BaS, and what is the most economical method? Is barium sulphate legitimately used in the paint, paper and rubber manufactures? Would a lode or deposit of barytes, containing, say, 200,000 tons of the mineral assaying

90 to 94 per cent. BaSO<sub>4</sub>, and having no lime or iron as impurities, be of much value, provided it be accessible and amenable for mining at 85c. per ton?

B. T.

The BaSO<sub>4</sub> content in commercial ground or floated barytes is in the neighborhood of 98 per cent. In general, it may be said that no material containing less than 90 per cent. BaSO<sub>4</sub> is sent to the grinding mills. Of course a great deal depends on what the impurities consist of. Iron, if present in quantities greater than enough merely to stain the mineral is objectionable. Calcium fluoride (fluorite) is objectionable even in small quantities, owing to the obnoxious nature of the gas evolved in the bleaching operation. Limestone, while it has little effect upon the color of the finished product, consumes acid, and should not be present in large amount. Small percentages of minerals that do not affect the color of the barytes, or consume acid in the bleaching process, are not objectionable.

The artificial sulphate, blanc fixe, should be practically chemically pure. The usual procedure in the preparation of this material is to mix the crude barytes with coal containing little ash, in the proportion of four parts by weight of barytes to one of coal. The mixture is heated to a bright red, in a reducing atmosphere, for from 2½ to 3 hours. The charge then contains from 60 to 70 per cent. of soluble barium sulphide, the remainder being chiefly barium carbonate, which may be dissolved in either nitric or hydrochloric acid and the corresponding salt recovered. The sulphide is then dissolved in water, and the chemically pure sulphate precipitated with either sulphuric acid or salt cake. If salt cake is used as a precipitant, the purity of the final product depends upon the purity of the salt cake. We do not know the cost of reducing barium sulphate to barium sulphide.

The value of barytes as a pigment is a recognized one, and it is also used legitimately in other manufactures. Its use becomes improper only when secretly employed to give weight to different manufactured and food products.

Regarding the deposit of barytes described by B. T., we prefer not to express an opinion, as there are so many considerations entering into the question as to whether or not it is commercially available, respecting which we have not been informed. Anyway, this is a matter for reference to a consulting engineer.

According to *Engineering News*, April 29, 1909, during 14 years up to 1906 there were in Prussia, 13 firedamp explosions with 722 deaths, or 1.49 to each 10,000 workmen in each year. In England the same period shows a total of 1248 firedamp victims, or 1.2 killed each year to every 10,000 workmen.

## Personals

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

W. DeL. Benedict has returned to New York.

J. F. Erdlets, Jr., of Salt Lake City, Utah, has been in New York on business.

Alexander Agassiz, president of the Calumet & Hecla, is at the mines on his semi-annual visits.

S. M. Greenidge, of Cananea, Mexico, is examining a group of silver-lead mines near Monterey, Mexico.

C. Colcock Jones has returned to Los Angeles, Cal., from an examination of mines in the Yerington district, Nevada.

W. E. Carpenter has succeeded F. G. Goggin as superintendent of the Atlantic stamp mill in the Lake Superior district.

R. Livingstone, late assistant mines inspector of Alberta, has been appointed chief inspector in place of Norman Fraser, resigned.

Frederick Lyon has been chosen a director of the United States Smelting, Refining and Mining Company in place of R. D. Evans, resigned.

Roscoe Powers, superintendent of the St. Joseph Lead Company's mines in Missouri, was seriously injured last week in an automobile accident.

F. A. Ross, manager of the Daly Reduction Company, left Hedley, Similkameen, B. C., a short time ago on a business visit to New York.

Dr. Milton Hersey, of Montreal, has given \$100,000 to the metallurgical department of the faculty of Applied Science of McGill university.

W. H. Jeffrey has resigned his position as manager of the Chambers-Ferland mine at Cobalt, Ont. His successor is C. Watson, recently assistant superintendent of the Nipissing mine.

Prof. William Nicol, of Queens University, Kingston, Ont., has undertaken to give \$40,000 for the erection of a new mineralogy building in connection with the Kingston School of Mines.

George E. Gay, of Uniontown, Penn., has been appointed a member of the Board of Bituminous Coal Mine Inspectors of Pennsylvania, in place of George Whyel, whose term has expired.

It is reported that M. K. Rodgers, of Seattle, Wash., is about to resume the management of the Nickel Plate mine, at Hedley, B. C., which property Mr. Rodgers developed in the first place.

Walter Bean, of Denver, Colo., and A. G. Merrill, of Los Angeles, Cal., are making an examination of the Yale Min-

ing Company's (Daly estate) Nickel Plate group, in Hedley camp, Similkameen, B. C.

Rudolph Agassiz, the new president of the Osceola Consolidated and other companies that have recently come under Calumet & Hecla control, is visiting the Lake Superior district looking over these properties.

Norman Fraser, for some time one of the provincial government coal-mine inspectors, in Alberta, Canada, has been appointed superintendent of the Crow's Nest Pass Coal Company's colliery, at Michel, B. C.

W. H. Wardner, formerly general superintendent of the Bamberger-De La Mar mines at De La Mar, Nev., has been appointed general manager of the Golden Star Mines Company at Kofa, Yuma county, Arizona.

G. F. Greenwood, of Montreal, president of the Mexican Northern Power Company, has gone to Mexico, in connection with starting construction work on a plant for furnishing power to a large mining district in Chihuahua.

A. H. Reed has resigned as mine superintendent with the Longdale Iron Company, Longdale, Va., and has accepted a position as mining and mechanical engineer with the Independent Phosphate Company, Columbia, Tennessee.

James Gayley has been awarded the Elliott Cresson medal of the Franklin Institute, of Philadelphia. This was presented to Mr. Gayley in recognition of his invention of the dry-air blast process in the manufacture of steel and iron.

## Obituary

Charles E. McCullough died at Kewanee, Ill., April 24, aged 59 years. He was prominent in the organization and management of the Western Tube Company, Kewanee, from which he retired in 1908, when this company was absorbed by the National Tube Company.

## Societies and Technical Schools

*American Peat Society*—The New York section will meet at Syracuse, N. Y., May 15, when a number of papers on the utilization of peat for fuel and other purposes will be presented.

*American Foundrymen's Association*—This society and the American Brass Founders' Association will hold a joint convention at Cincinnati, O., May 18-20. Dr. Richard Moldenke is secretary.

*American Chemical Society*—The summer meeting of the American Chemical Society will be held in Detroit, Mich., June 29 to July 2. The council of the society will meet on June 28 and the

opening session of the general meeting will be on the morning of June 29.

Titles of papers to be read at the summer meeting should be sent to Charles L. Parsons, secretary, Durham, N. H., by June 7.

*Canadian Western Mine Operators' Association*—A new agreement has been made between the Western Coal Operators' Association, representing most of the coal-mine operators in southern Alberta and southeastern British Columbia, and District No. 18, United Mine Workers of America, representing practically all the men employed at the mines of those districts. The old agreement expired March 31, and all important points in the proposed new agreement were disposed of at a convention of representatives of both operators and miners held here recently. The vote of the miners afterward taken resulted in a large majority in approval of acceptance of the new agreement.

*Appalachian Engineering Association*—This society will meet in Roanoke, Va., May 8. The following papers will be read: "Lead and Zinc Ores in Wythe and Pulaski Counties," by M. M. Caldwell, of Roanoke; "Organization and Engineering Difficulties of the Virginian Railway," by William N. Page, of Washington; "The Virgilina Copper District," by Dr. Thomas L. Watson, State geologist of Virginia; "A Geologic Engineering Code of Ethics," by Baird Halberstadt, of Pottsville, Penn.; "Properties and Uses of Mineral Gypsum," by Dr. Frank A. Wilder, of North Holston, Va. At a banquet in the evening, tendered by the Chamber of Commerce, of Roanoke, President L. E. Johnson, of the Norfolk & Western railway, and others will speak.

*California Mineowners*—Mineowners in California have agreed to test in some manner the new eight-hour law which goes into effect in the mines on May 6. A judicial determination of the constitutionality of this law is desired by the mineowners. In Nevada county an eight-hour rule has for some time been enforced by the miners' unions, but in other counties this is not the case. The mineowners at first thought of contesting that portion of the law which makes eight hours compulsory in the mills. It was later determined, however, to keep on just the same as at present in the mills without paying any attention to the new law until someone started a litigation on the subject. It is in the underground work that the change will come on May 6 when the law goes into effect. Lawyers will be employed to advise the mineowners, who are arranging to stand together in any possible contest with the labor unions.

Over in Nevada, where they have a new eight-hour law for miners the Nevada Consolidated Mining Company at Ely is about to test the constitutionality of this law, where it provides for eight hours in the open cuts and drifts of mines.



# Special Correspondence from Mining Centers

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

## REVIEWS OF IMPORTANT EVENTS

### San Francisco

*April 30*—As spring opens and miners and prospectors have again commenced active work except in the higher mountain ranges where the snow still lies deep, numbers of accounts of new strikes and discoveries are printed in local newspapers in mining districts. Some strikes have been made this month in old quartz mines on which work has been continued during the winter. The most notable of these is that in the Sixteen-to-One mine at Alleghany, Sierra county, on the same belt as the Tightner. The strike was made in the main tunnel of the mine about 250 ft. from the entrance.

The Central Consolidated mine at Banner Mountain, seven miles east of Grass Valley, in Nevada county, has showed up a valuable body of ore. The "jewelry rock" is being stored. The shaft is only 400 ft. deep.

Another noteworthy strike is that in the old Chipps quartz mine at Sierra City, Sierra county, where they have recently found rich ore in a new vein. The length of the shoot is not yet determined. Still another find is that in the Independence mine in El Dorado district, El Dorado county.

The amount due on the foreclosure of liens on the Wildman-Mahoney mines at Sutter Creek, Amador county, has been paid by the Alabama people, thus redeeming the property from indebtedness. The mines were sold about a year since to satisfy judgment. W. Murphy and associates are now in full possession of the property, and the reopening of the mines is supposed to be assured.

The effect of the decision rendered by the courts at Redding last week is to give absolute possession of the Brunswick mine at French Gulch, Shasta county, to H. D. Lacey, he having won the suit. The mine is a productive one and is well developed.

On the petition of a stockholder in the Keane Wonder mine, of Inyo county, a court in this city has restrained the sale of the property under a deed given by the directors to W. Gregg to secure an indebtedness to the Frances-Mohawk Mining and Leasing Company.

A suit has been filed in Placer county by which the Long Beach Asbestos Mining Company, of Long Beach, Los Angeles county, seeks to quiet title to three asbestos claims in Green Valley, near Towle, Placer county. The claims comprise some 50 acres of mining ground.

Last week the large ore bins of the Balaklala Consolidated Copper Company at Coram, Shasta county, collapsed and dumped about 1000 tons of ore, covering the tracks and damaging the power line. Temporary repairs have since been made, and the smelter will not have to close.

The Siskiyou Dredging Company has been organized at Oroville, Butte county, to install a dredge on 225 acres of land which have been purchased in Siskiyou county. The officers are George W. Carr, president; J. J. Hamlyn, vice-president; J. C. Osgood, secretary, and H. G. Peaks and W. R. Bassick, directors. Mr. Hamlyn has had long experience in dredging affairs at Oroville.

Fred S. King, of this city, as trustee of Eastern men represented by John Filioux, of Oakland, has taken over the holdings of gypsum deposits in Death Valley, formerly owned by the Death Valley Chemical Company. A large plant is to be put up.

### Butte

*April 28*—Thomas F. Cole, of Duluth, one of the heavy stockholders and original promoters of the North Butte and Coalition companies, was in Butte several days last week, making an inspection of the properties of the companies in which he is interested. Bondholders of the Kimberly-Montana Gold Mining Company have instituted action asking that a receiver be appointed for the company and that the mortgage given to secure the bonds, be foreclosed. The complaint alleges that the company is deeply involved in litigation and in debt and that the assets of the company are being wasted.

The annual report of the North Butte Mining Company for the year ending Dec. 31, 1908, covers a period of 10 months during 1908, operations having been suspended for two months. The cost of production averaged about 8c. per lb. Of the ore shipped from the mine 35 per cent. was first class, which is an unusually high percentage for a Butte mine. The net profits for the year were \$1,863,782, which, divided among the 400,000 shares of issued stock, would make \$4.66 per share; this compares with \$3 paid out in dividends.

For the past several weeks much interest has been centered in the struggle between the Great Northern and the Chicago, Milwaukee & Puget Sound railways to secure the most advantageous right of way for a line running north from Coram, along the north branch of the Flathead river, and into the coal lands

in Alberta, Canada. Survey parties have been busy in the locality for some time past but it is only recently that steps have been taken by either road to secure the land necessary for the right of way. Options, deeds and condemnation suits are being filed by the contesting parties daily, and the entire locality is in a state of excitement owing to the keen rivalry of the two roads. It is stated that there is but one course which is feasible for the construction of the proposed branch and that each of the companies is bent upon securing this route.

### Denver

*May 1*—The mining and milling industry in the State of Colorado is very dull indeed, partly due to uncertainty of tariff legislation and the low price of metals, but more largely owing to the terrific winter experienced, and which one might say is still with us, for a blizzard prevailed yesterday. The snowfall in the mountain mining districts has been a record breaker with no signs at present of its melting, so that it will be very late this summer before everything is in full swing again.

To offset this, there is a strong feeling of optimism in the mining fraternity of the State, encouraged by the advance in metal prices, and in the various camps preparations are being made for active operations, not only on working mines, but what is more remarkable, on a large number which have been closed down for years. These preparations are at present chiefly of a financial character, as climatic conditions preclude shipping or surface work and improvements at this date. The gold mines of the State are least affected, and keep on the even tenor of their way.

The Eclipse tunnel, on Battle mountain, is said to have opened a large body of ore. In like manner, the Damon, near the W. P. H. and the Jerry Johnson, has just opened a large body of pay ore. The Black Belle, on Beacon hill, also by crosscutting from the shaft at the 300 level, is reported to have struck 2½ ft. of high-grade ore. In the Victor mine, now under lease, the ore was discovered by a level caving and exposing the vein. One of the most efficiently and economically handled gold mines in the district is the Crescent, on Raven hill, which is reported to have produced about 2000 tons during April. The production of this district for April is given at 59,700 tons of a gross value of \$1,351,675.

### Indianapolis

May 3—The United States Steel Corporation and the Brazil Block Coal Company, the latter of Brazil, Ind., are planning to open all the old mines and sink many new shafts in the territory controlled in Indiana and Illinois, which means an increase of 100 per cent. in the output of the districts separated by the Wabash river. To this end the Steel Corporation is securing titles to between 5000 and 6000 acres of coal lands in the Illinois district. Four or five new shafts will have coal rights for about 10,000 acres of unworked coal land. It is understood the prices paid for coal rights for these lands averaged \$125 an acre; and from these figures coal rights alone cost \$1,250,000.

### Salt Lake City

April 29—It is stated that the 1,705,322 cu.yd. of overburden so far removed from the porphyry ore deposits of the Utah Copper Company will average slightly under 1 per cent. copper. General Manager Jackling has proposed a leaching method for extracting the copper in this material and it is now reported that an experimental plant of moderate capacity will be constructed at Garfield, and the proposed metallurgy of this material demonstrated on a fairly liberal working scale.

Ore shipments from Tintic mines for the week were 183 carloads, 110 of which went to the Knight smelter and 73 to the valley smelters. The shipments from the individual mines were as follows: Centennial Eureka, 40; Sioux Consolidated, 14; Bullion Beck, 1; May Day, 2; Eureka Hill, 1; Eagle & Blue Bell, 1; Mammoth, 9; Black Jack, 3; Plutus, 1; Yankee Consolidated, 1; Iron Blossom, 40; Colorado, 24; Dragon Iron, 31; Brooklyn, 5; Black Jack, 3; Beck Tunnel, 7.

The stock of the Moscow Mining and Milling Company which owns the Burning Moscow and six other claims in the Star district, Beaver county, was listed on the Salt Lake Mining Exchange. In its statement to the Exchange the company reports that 25,000 tons of ore are now developed in the mine and that 20 men are employed.

It is announced that the Highland Boy smelter of the Utah Consolidated, near Murray, is to be dismantled, a force of men having started at this work recently. All furnace steel is to be sent to Tooele, together with such other equipment as can be utilized in the new International smelter.

### Goldfield, Nevada

April 27—The Nevada California Power Company has closed a contract to furnish the Bullfrog Pioneer Company with electric power. The surveys for the line have been made and construction work will commence at once. It is thought that about 1000 h.p. will be used in the Pioneer district.

Ore shipments from Tonopah mines for

the week ending April 24, were: Tonopah Mining, 3300 tons; Montana Tonopah, 1030 tons; Belmont, 700 tons; MacNamara, 350 tons; West End, 130 tons and Midway, 100 tons.

The date for the session of the American Mining Congress to be held in Goldfield has been changed to Sept. 27 in order to secure the advantages of reduced railroad rates. Tickets sold for this purpose will have a return limit of Oct. 31.

Production of the Goldfield mines for the week ending April 24, was: Consolidated, 3850 tons, valued at \$173,250; Combination mine 630 tons, \$28,350; Hampton stope, 210 tons, \$147,000; Florence, 700 tons, \$31,500, and 35 tons high grade, \$4900; other sources handled by Western Ore Purchasing Company, 890 tons of ore and concentrates, \$186,900, and by Nevada Goldfield Reduction Company, 755 tons, \$37,750, making a total valuation of \$609,650.

### Toronto

May 1—Dr. R. W. Ells, of the Canadian Geological Survey, stated, on April 29, to the Senate Committee on Mines and Minerals, at Ottawa, that the oil-shale deposits of New Brunswick were far richer than those of Scotland, from which the operators annually obtain 62,000,000 gal. of oil and 50,000 tons of sulphate of ammonia. This was admitted in Scotland as the result of experiments with New Brunswick samples. The Scotch shale produced 30 to 40 gal. of oil per ton, while the New Brunswick shale would produce from 60 to 110 gal. per ton and was far richer than the Scottish in sulphate of ammonia. The New Brunswick shale district extend for 70 miles from Dorchester to Horton, and seven seams had been discovered.

The road to Elk lake and Gowganda is now absolutely impassable for vehicles of any kind, and the post office has issued a notification that only letters will be forwarded, other classes of mail being held until navigation opens.

The government sale of Gowganda town lots by tender last month realized better prices than the first sale in March, the average being \$152.95, and the highest price \$1010 per lot.

About a month since the Ontario Department of Mines was notified of a supposed discovery of coal on the north shore of Lake Superior. Specimens were forwarded to the department and submitted to analysis. It is declared by them to be a carboniferous substance, but of little value commercially.

Hon. Sydney Fisher, Canadian minister of agriculture, has given notice that he will introduce in Parliament a bill to create a permanent commission on the conservation of the natural resources of Canada. It will give effect to the agreement arrived at during the international conference on the subject at Washington

last month. It is expected that the commission will be named as soon as the bill becomes law, and will consist of from 25 to 30 representative Canadians.

The Ontario government is offering for sale by tender 1000 acres of mining land at the northeast corner of the Gillies limit, in the Cobalt district. This does not include the 40 acres containing the Provincial mine. The land is offered in 20-acre blocks, and the sales will be on a cash basis, with a 10-per cent. royalty on the output in perpetuity. Successful bidders will be required to spend \$400 in development yearly for seven years. Tenders will be received up to June 1 next.

Prospectors are flocking into the Seine River goldfields east of Fort Frances, Ont. The country round Glenorchy is staked out for miles and discoveries of rich quartz are reported.

In the course of construction work on the Grand Trunk Pacific railway, near Portage lake, northwest from Sturgeon lake, in northwestern Ontario, a copper outcrop was laid bare in a rock cutting. A claim was registered by H. J. Mackenzie.

### Paris

April 20—New efforts are being made to find the coal seams lying under the Lorraine oolitic-iron deposits. A local company has undertaken borings in the Haute Marne, on the boundary between that and the Vosges. The Société des Houillères de la Moselle, subsidiary of the Société Lorraine des Charbonnages Réunis, has erected a drill at Jeuvoncourt, half way between Mont sur Moselle and Gironcourt, where work has begun.

The results obtained by Mortgages & Grignon at Andavakoera (Madagascar) have caused new companies to be promoted at Lille and Marseilles with a view of prospecting for further lodes. The Marseilles group will be known as Madagascar-Nord and the Lille group as Société Civile des Mines d'Or de la Loky Work will be started after the rainy season under the superintendence of the mining engineers sent over. Meanwhile the output of the Andavakoera deposits continues quite satisfactory. They have temporarily suspended the use of native labor owing to its inferior efficiency.

The International Syndicate, headed by the Solvay firm, has acquired new interests in France by becoming owner of most of the shares in the Salines de Tonnoy near Nancy.

The Compagnie Française du Platine is endeavoring to obtain closer control over the output of platinum in Russia. Next to them the chief producer is the estate of Prince Demidoff, owning the placers of Nijni Tagilsk. But the Russian government seems bent on opposing the company's efforts, in order to prevent the deposits becoming the property of a foreign company.

# Mining News from All Parts of the World

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

## THE CURRENT HISTORY OF MINING

### Alaska

#### FAIRBANKS

Fairbanks creek is holding its own after having been worked for many years. Keely & Parker are making preparations for extensive work. Wobber & McCarthy are opening up their new quartz claims on Alder creek, and Johnny Scott is assembling a large crew for sluicing which will be done night and day during the full season. Ester creek is the busiest one in the entire country, and its production will compare more than favorably with any preceding year.

### Arizona

#### COCHISE COUNTY

*Copper Queen*—Daily shipments of copper ore from Bisbee to Douglas are 35 carloads. The Sacramento shaft will be sunk from the 1200- to the 1400-ft. level. Seven furnaces are in operation. April output, 8,000,000 pounds.

*Denn-Arizona*—The main shaft is now 1265 ft. deep, 65 ft. having been sunk since work was resumed this spring.

*Calumet & Arizona*—Low-grade copper ore was encountered in the Powell shaft at a depth of 375 ft. The foundation for the new electric hoist was completed recently.

#### GILA COUNTY

*Superior & Boston*—The McGraw shaft is to be completed to the 400 level by June 1.

### Arkansas

#### JOHNSON COUNTY

W. H. Taylor has resumed operations at Spadra. He intends to enlarge the capacity of the coal mines to 1000 tons daily, and to install mining machines.

### California

#### AMADOR COUNTY

*Kennedy*—This mine, at Jackson, has been closed down some days owing to an accident in the shaft.

*Mitchell*—A year's extension has been given on the option to Cranmer Brothers; they have found a new orebody entirely distinct from the old one. The 10-stamp mill has been put in good order.

#### BUTTE COUNTY

*Big Blue Lead*—The first clean-up of this property has been made with satis-

factory results, the gravel coming about up to expectations. The force of men is to be increased.

*Mercedes Mining Company*—This company has been incorporated to work quartz mines in the Forbestown district. The directors are Geo. S. Smith, of Oakland, and R. A. Nayo and S. Lague, of Oroville.

#### EL DORADO COUNTY

*Indian Diggings*—J. J. Crawford & Brother, of Oakland, are about to commence work on the John Culick claim.

*Loveless*—This mine, at El Dorado, has been bonded to E. W. McAllister, of Kansas City. A new shaft will be sunk and hoist put up.

*Montauk*—This property has been sold for the benefit of the creditors, having been bid in by Wm. Schaw, acting as referee. This was formerly the Zantgraf mine.

#### MERCED COUNTY

*Yosemite Dredging and Mining Company*—This company at Snelling, is now operating the dredge day and night with three shifts of men.

#### MODOC COUNTY

*Hoag District*—In some of the claims they are now down 150 ft. and have good ore. A number of small tunnels have also been run. Two mills will be ready as soon as the snow disappears. There is considerable ore on the dumps ready for them to work.

#### NEVADA COUNTY

*Black Bear*—A mill, with concentrators, has been purchased, and is being put in place. Sinking is continued without interruption and the ledge is large and retains its values.

*Golden Gate*—For this mine, Grass Valley district, W. P. Martin, superintendent, a 10-stamp mill has been completed and is being put in place.

*Posey Cañon*—The clean-up of this gravel mine is thought to prove conclusively that the main gravel channel has been cut.

#### PLACER COUNTY

*Big Dipper*—This old drift mine on the Iowa Hill divide, which was profitably worked for years by the Waterhouse Brothers, of San Francisco, has been purchased and reopened by a new company under Superintendent J. E. Rose. The

name of the company is McGeachin Gold Mining Company.

*Dalhonego*—At this mine, near Emigrant Gap, Superintendent C. J. Tripp is rebuilding the mill burned some time since, and has put a force of men at work.

#### PLUMAS COUNTY

*Lone Star*—L. V. Tefft is about to work the gravel by the steam-shovel system.

*Sunnyside*—Henry Merrill, who has a lease, is commencing a long tunnel to develop it.

#### SHASTA COUNTY

*Brackett*—A valuable discovery is reported in this mine, three miles west of Redding.

#### SIERRA COUNTY

*Brush Creek and Ante-Up*—These two mines, between Goodyear Bar and Mountain House, are being reopened by a Chicago company and machinery is being supplied.

*Secret Cañon*—W. H. Weldon is preparing to reopen this gravel mine, near Forest City.

#### SISKIYOU COUNTY

*Northern California Dredge Company*—The new suction dredge at Hamburg Bar has commenced operations. J. A. Brent is superintendent, and the company has taken up many miles of the bed of the Klamath river.

*Scott Bar Hydraulic Mining Company*—This company, near Hamburg, is constructing a 25-mile ditch, 13 miles of which have been completed. This will bring a large water supply to the gravel banks.

#### YUBA COUNTY

*Northern Gold Mining Company*—This company has been organized to operate properties at Brownsville, among them the Apple Tree mine, where rich ore has recently been found.

### Colorado

#### GILPIN COUNTY

*German Gold and Uranium*—Shipments are being made of uranium ores from the German mine on Quartz hill, to New York buyers for German firms. In the 120 east level high-grade gold-copper ore has been opened as well as a body of milling ore. Robert Miller, Bald Mountain, Colo., is superintendent.

*Incidental*—Cincinnati and Denver men, interested in a lease and bond on this mine, in the Russell district, are installing machinery and erecting a new shaft building. W. L. Shull, Russell Gulch, Colo., is manager.

*Van Deren*—Gano & Co., of Denver, have taken a lease and bond on this property in the Russell district and will arrange for new buildings and machinery. W. C. Le Prowse, Russell Gulch, Colo., is in charge.

*Oro*—Harris & Co., of Central City, have put new machinery and a shaft building on the property in Quartz Valley district and are shipping regularly principally to the stamp mills.

*Sherman & Macon*—It is stated that Missouri men interested in this property intend to erect a 50-ton mill. F. L. Branham, Central City, Colo., is superintendent.

*Senator Mines*—Chicago men have become interested by purchase of the property near Black Hawk and are arranging for the active operation of their holdings.

*Alps*—Lessees on this mine in Nevada district have opened up some gold and copper ores, besides the free milling ores which are being shipped regularly.

*Fifty Gold Mines*—On account of increasing tonnage from company mines and heavier custom patronage in its mill, a Goodman 6-ton electric locomotive has been delivered for hauling ore to the mill. Some experimenting is being done with cyanide on the low-grade ores. Employment is being given to 125 men and the property is the heaviest shipper in the district. It is the intention of the management to electrify the machinery in the near future. M. D. Draper, Central City, Colo., is manager.

*Gold Collar*—Cincinnati capitalists interested in this group in Prosser gulch have authorized development of these claims. Alfred Skeels, Central City, Colo., is manager.

*Tucker Mill*—This mill in the Quartz valley district has been sold by the Lyons-Kyle Mining Company to W. H. Hearne, of Wheeling, W. Va., for the treatment of the Anchor ores. H. Irving Jones, Central City, Colo., is manager.

*Alger-Kansas*—Development of this property in Nevada gulch will be commenced. S. Harper, of Central City, will be in charge.

*Aurora*—Pittsburg capitalists have purchased this mine in the Russell district. Harry W. Kane, Central City, Colo., is manager.

*Argo*—Local operators leasing in this mine in Russell gulch have encountered high-grade ore carrying gold, silver and copper. H. C. Willis, of Central City, Colo., is manager and regular shipments will be made.

*Denver Mining and Reduction*—A lease for three years has been taken on the old

Fitz Porter rock building below Black Hawk and concentrating tables will be installed for the purpose of handling the slimes from North Clear creek.

*Frontenac Mines Syndicate, Limited*—The Penn and Iron City mills below Black Hawk are being remodeled for the purpose of treating the low-grade ores from this company's mines in the Russell district. F. C. Bowman, Central City, Colo., is superintendent.

#### LAKE COUNTY—LEADVILLE

*Tenderfoot*—The shaft on this claim in South Evans gulch is down 150 ft., and a crosscut from that point has encountered a body of ore 14 ft. thick. Shipments are now being made from three properties in this section, the Tenderfoot, the Cleveland and the Valley.

*Virginus Group*—These claims in the neighborhood of the Dinero tunnel in the Sugar Loaf district are to be worked by the Sugar Loaf Consolidated Mining Company.

*Sunday*—Connections have been made between the main shaft and the tunnel in the Bald Mountain district, and ventilation is now sufficient to permit the development of the orebody recently opened.

*New Discovery*—Lessees are sinking a shaft to a depth of 150 ft., 50 ft. of which are completed.

*Dauntless*—Work is to be resumed shortly on this and the Chance-Hilltop claims in the Horseshoe district. Zinc ore has been encountered in both claims.

*Latchaw Tunnel*—The recent clearing of the road has enabled this property in the Twin Lakes district to resume shipping.

#### SAN JUAN COUNTY

*Silverton Mining Company*—The old North Star mine on Sultan mountain has been under development for some time by this company and it is stated that sufficient ore is now blocked out to warrant operating the mill as soon as the latter can be overhauled.

#### Idaho

##### BONNER COUNTY

*Idaho Smelting and Refining Company*—Herbert Anderson, of Chicago and Winnipeg, president, went to Sand Point, Idaho, without waiting for a warrant to be served, and surrendered to the sheriff to face a charge of embezzling \$175,000 from the company.

#### Indiana

##### CLAY COUNTY

*Miami Coal*—This company is entering the Clinton field. Two new mines are being opened on its large coal-land holdings of that section. The company owns 1400 acres of coal land in this field.

#### BLACKFORD COUNTY

Petroleum operators in the oilfields of this section show a considerable gain over previous weeks. There is more activity near Montpelier than at any time since last mid-summer. There are few non-producing wells and a dry hole does not discourage operators or condemn a large space of ground.

There were eleven wells completed in the Indiana field during the week and all producers except one.

#### Missouri

##### JOPLIN DISTRICT

*Chew & Baker*—A strike of shallow lead was made near Duenweg at 12-ft. depth.

*Continental*—Operations were resumed in the Prosperity mine after a shutdown of nearly two months, due to a fall of rock on the pumps. Mules have been placed in the mine to cheapen the haul.

*De Graff*—This company has just completed the erection of a 150-ton mill on its lease on the Brooks land, west of Joplin.

*Delta*—This mine, at Spring City, has shut down on account of the long haul underground. A new shaft will probably be sunk.

*J. P. N.*—P. N. Wiggins, J. P. Newill and H. Putnam have sold this mine at Porto Rico to John Durby for \$20,000. He has bought the Egyptian mill and will move it at once.

*Old Dominion*—The Iroquois mill has been moved to the 80-acre tract in Gordon Hollow and is to be enlarged.

*Quick Seven*—At this mine, and in its neighborhood, near Neck City, there is a new camp which shows some good prospects.

*Sunrise*—The mill at Spring City was burned to the ground. The loss was covered by insurance. The company will rebuild. C. V. Miller, of Joplin, is manager.

#### ST. FRANCOIS COUNTY

The miners of the St. Joseph and Doe Run lead companies have struck for an advance of 15 per cent. in wages. None of the other mines are involved so far, but if the strikers succeed, the movement will undoubtedly spread through the district.

#### Michigan

##### COPPER

*Isle Royal*—Good progress is being made in sinking the new shaft on the Baltic lode. Some copper has appeared in the formation, but nothing of a commercial value.

*Centennial*—A much better state of mineralization is being revealed in the northern extension of the drifts from the

shaft, and particularly so at the seventeenth level drift, which is approaching the South Kearsarge lode. A gradual increase is being made in production and also in the copper contents of the rock.

*New Baltic*—This company has begun drilling. The results of this drilling will be awaited with much interest, as in the trenching work a very promising formation was revealed and the drill cores will show its contents at depth.

*Allouez*—The south drift from the fourteenth level of No. 2 shaft has again come into good copper rock, after passing through a small strip of barren ground. An improvement in the copper contents of the rock has been in evidence for the past two months.

*Mohawk*—This company has begun diamond drilling to test the overburden, preparatory to sinking its No. 6 shaft. This shaft will be put down about 2500 ft. south of No. 5, and will command the southern portion of the tract. The southern drifts from No. 5 shaft are in good ground and some are extended about 1300 feet.

## Montana

### BUTTE DISTRICT

*Butte-Alex Scott Copper Company*—Articles of incorporation of the company, a Delaware corporation, were recently filed in the county clerk's office. The capital stock is \$1,250,000 with shares of the par value of \$10 each. The directors are stated to be Walter P. Rainbow, Clarence A. Williams and Orville G. Flister, of Pittsburg.

*East Butte*—It is stated that proxies for more than 125,000 shares of stock have been received to be voted in favor of the purchase of the Pittsmtont company's property.

*Butte & Superior*—Arrangements have been made for the shipment of 2000 tons of zinc ore which is now on the dump to the experimental zinc concentrator at the Butte Reduction Works. On the 1200- and 1400-ft. levels development work is being carried on both east and west. On the 1200-ft. level the work has progressed a distance of about 300 ft., both east and west of the shaft. On the 1400-ft. level two veins have recently been cut, one 10 ft. in width and the other 14 feet.

*Elm-Orlu*—A new trestle and new ore bins have recently been completed for the handling of zinc ores.

*Copper Eagle*—Regular shipments are now being made from the mine; both first- and second-class ore being shipped. The ore carries chiefly silver and gold.

### BROADWATER COUNTY

*Ohio Group*—An option for the sum of \$100,000 has recently been given on this group to G. M. Bourquin and John N. Kirk, of Butte. The property is situated in the Radersburg district, not far from

the Keating Gold Mining Company's property.

### DEER LODGE COUNTY

*Washoe Smelter*—N. P. Pratt and W. P. Heath, Government chemists, are making an investigation of the smoke problem at the smelter with a view to ascertaining a method by which the fumes may be utilized for the manufacture of sulphuric acid and for other commercial purposes.

### FERGUS COUNTY

*North Mocasín*—A cave in a winze has seriously interfered with the working of the mine within the past few weeks. The cave has been growing and has reached such dimensions that the richest part of the orebodies have been shut off from further working.

*Barnes-King*—It is reported that a recent strike of high-grade ore has been made in the property on the 200-ft. level, at a point not far from the mill.

### JEFFERSON COUNTY

*Daly Group*—This consists of five patented claims at Wickes. It is stated that a deal is to be closed whereby an Eastern syndicate will secure control of this property. The claims are valuable, principally for silver and copper.

*Brooklyn Bridge Mining and Milling Company*—It is reported that operations will soon be resumed on this property which is situated in Lump Gulch, about six miles from Clancy. The property consists of 15 claims, on one of which is a shaft 435 ft. in depth. The officers of the company are: J. Krueger, of Helena, president; W. C. Barden, of Helena, vice-president; W. E. Durfense, of Butte, secretary and treasurer.

## Nevada

### ESMERALDA COUNTY, GOLDFIELD

*Yellow Tiger*—Crosscutting of the vein on the 700-ft. level is now being carried on. The property is equipped with a steel gallows frame and one of the largest hoists in the district.

*Florence*—An extra tube mill and several tables will be installed shortly, which will greatly increase the capacity of the plant.

*Victor-Gold Bar*—A 30-ton shipment was made last week, returns from which gave \$95 gold, a small amount of silver and 6 per cent. copper.

*Albemarle*—It is reported that work will be resumed in the course of the next few weeks. The company's holdings consist of 11 claims two miles due east of Goldfield. It is equipped with a 25-h.p. hoist and the main shaft is 300 ft. deep.

### ESMERALDA COUNTY—RAWHIDE

*Mint Leasing Company*—A rich vein of gold is reported on the 300-ft. level.

The shaft will be sunk to the 500-ft. level. Shipments of ore are made regularly.

*Marigold*—A vein 1 ft. wide and running high in gold is reported as being recently discovered.

*Dromiac*—The shaft is down 150 ft. A gallows frame and a 15-h.p. hoist are being installed.

*Rawhide Queen*—Regular shipments of high-grade ore are being made to the Dayton & Hazen samplers.

*Mint Extension*—On the 220-ft. level a vein 4 ft. wide carrying \$15 in gold was encountered.

*Dayton Toledo*—Pay ore has been encountered on the 300-ft. level.

*Royal Tiger*—High-grade ore is reported on the 450-ft. level. The vein is only 2 in. thick.

*Grutt Balloon Hill*—Malcolm L. Mac Donald has finished his examination of the mine and it is expected that his report will be ready in about 30 days.

*Sweet & Weiss Mills*—Five thousand dollars' worth of bullion is said to be missing from this mill.

*Schneider*—E. C. Klinker, of Rawhide, has purchased the controlling interest in this mine. Extensive work will be carried on and a mill has been purchased.

### ESMERALDA COUNTY—SILVER PEAK

*Pittsburg Silver Peak*—The raise from the tunnel level of the Mary to the workings on the Drinkwater claim is nearly completed. The raise will be 1400 ft. long, on the incline, and will be double tracked the entire distance. The ore will be handled by two 4-ton skips.

### HUMBOLDT COUNTY—MAZUMA

*London Syndicate*—The mill will be in operation within the next three or four days. The first ore to go through the plant will be from Wihuja lease. Teams are hauling ore from the mines to the mill. The cost of the mill, including the cyanide plant, is, approximately, \$80,000.

*Seven Troughs Coalition*—The Kindergarten vein has shown no sign of depreciating in value. The ground at the 300 level is improving.

*Wihuja*—Work is progressing on the Kindergarten and the Wihuja veins. Ore shipped to the Coalition mill averages \$65 per ton.

*Harris Lease*—The shaft on the Fairview claim is down 270 ft. A winze from the 200 level opened some high-grade and milling ore.

*Jess-Bard and Sandifer Leases*—These leases on the coalition have affected a consolidation. The Sandifer has a gasoline hoist and two pumps, and will keep the water out of both mines, and enable one or the other to explore the Harnan vein.

*Potter-Arnett Lease*—A 50-h.p. steam engine and a No. 7 Cameron pump have been installed. The shaft will be sunk to

the 300 level before any lateral work is done.

*Reagan Lease*—An extension of two years has been granted on the lease and the shaft will be sunk 200 ft. more, making a total depth of 500 feet.

*Rambler*—A 200-ft. shaft will be sunk on a 6-ft. vein, which has been opened up for 150 feet.

*Big Thing*—John G. Huntington has leased and optioned this property.

#### NYE COUNTY—PIONEER

*Bullfrog Pioneer*—Four feet of high-grade ore was disclosed last week in the raise from the 210-ft. level. A new 12-drill air compressor has been ordered, also an electric hoist, the latter to be installed on the 210-ft. level. Shipments for last week were approximately 500 tons.

*Mayflower*—A stockholder's meeting will be held in Rhyolite on May 15. Most of the ore is now being extracted from the 200- and 300-ft. levels, while development work is being pushed on the 400-ft. level.

*Indiana-Nevada*—This company operating three claims adjoining the Pioneer has a 15-h.p. hoist in place and is erecting a gallows frame preparatory to active development work. The shaft, now 65 ft. deep, will be sunk to the 150-ft. level at which point it is expected the vein will be cut. Four leases have been granted on the property, one block having been taken by Messrs. Taylor, Niven & Price.

#### NYE COUNTY—BULLFROG

*Homestake*—This property was closed down last week for an indefinite period, owing to insufficient ore to supply the mill. Nearly all the work underground was devoted to the extraction of ore and no attention given to the development of new orebodies.

*National Bank*—The Logland lease has another shipment of 20 tons ready for the smelter, which will run about \$65 per ton. In addition, a quantity of milling ore has been extracted that will be held until such time as it can be locally treated.

#### NYE COUNTY—TONOPAH

*Montana Tonopah*—The mill is again working at full capacity with a 90-per cent. extraction recorded for last week. An output of about 1200 tons per week is being maintained. The semi-monthly clean-up for April resulted in 21 bars of bullion weighing approximately 80 pounds each, and 100 tons of concentrates shipped to the smelter.

*Tonopah Mining*—The mill report for the week ending April 10 shows that 3040 tons of ore, valued at \$22.50 per ton, were crushed. Shipments consisted of 69 bars of bullion worth \$800 per bar and 20 tons of concentrates at \$525 per ton, making total shipments amount to \$67,500.

#### NYE COUNTY—ROUND MOUNTAIN

*Fairview*—Operations have been re-

sumed and an average of 20 tons is being treated daily in the mill. Development work is being pushed on the several levels and a steady output is expected.

#### NYE COUNTY—MANHATTAN

Manhattan is now the scene of much activity on account of its placer developments. The gulch from Manhattan to its junction with Smoky valley, five miles to the west is being prospected and worked by about forty different companies and leasers. Bed rock varies from 30 ft. at the east or upper end to 80 ft. at the lower end.

#### WHITE PINE COUNTY

*Nevada Consolidated*—According to James Phillips, Jr., president, the fourth unit of the Steptoe plant will cost \$162,000. The company now has over \$2,000,000 in cash, accounts receivable, and copper.

#### New Mexico

##### CHAVES COUNTY

It is reported that at a depth of 1120 ft. a flow of natural gas was struck. The well is three miles east of Dexter.

#### Oregon

##### BAKER COUNTY

*Cougar*—Theodore L. Lammers and other Spokane men have obtained a 15-months' lease, and the mine is bonded to them for \$250,000.

#### South Dakota

##### LAWRENCE COUNTY

*Custer Peak District*—The principal property is that of the Custer Peak Mining Company, with a shaft down over 200 ft. At that level crosscutting showed about 1 per cent. copper. Winzes sunk indicated a material increase with depth. The shaft is being sunk to 400 ft., where crosscutting will be resumed.

*Imperial*—This company has shut down some of its mines, and is operating the mill one shift. Notices are out of a special stockholders' meeting to increase the bonded indebtedness from \$300,000 to \$500,000 for the purpose of retiring outstanding bonds, paying off floating debt and erecting a modern reduction plant.

*Golden Crest*—A new electric pump has been installed at the 125-foot level, where work is to be prosecuted before unwatering the deeper workings.

*Hercules*—Mill construction is now well under way. The mill flow will be as follows: The ore will pass through a No. 5 Gates crusher at the mine, thence by cable tram 3000 ft., crossing Butcher gulch, to the mill. Here it will be fed from the bins to 40 stamps to pass 20 mesh, going to two Dorr classifiers. The slime overflow from the classifiers will go to a 10x30-ft. settler, the sand discharge passing through two 5x22-ft. tube

mills, Allis-Chalmers make. The tube-mill discharge passes to two hydraulic classifiers, the overflow from which is returned to the Dorr classifiers, the overflow going to two 30-ft. diameter settlers. The thick slime from the settlers will be pumped to two Brown tanks, 45 ft. high and 15 ft. in diameter, from which, after agitation, it will flow to a Butters filter plant. The solution from the filters and the overflow from the settlers will be pumped through filter presses to the precipitation room. The Butters installation at the Hercules will be the first in the Black Hills.

#### PENNINGTON COUNTY

*Rochford District*—Interest has been stimulated by the arrival of Robert Bunce, of London, who was in the Hills in 1907, to inspect the Standby and other properties on which he has an option. H. S. Denny, formerly of South Africa, now of Mexico City, is expected to arrive in a few days to make examinations.

#### Utah

##### BEAVER COUNTY

*Indian Queen*—The tunnel is in a distance of 2550 ft., and progress at the rate of 10 ft. per day is being made by two shifts. Arrangements for a complete ventilating equipment have been made. Upon its installation the progress will be increased by putting on a third shift.

*Utah Gold and Copper*—In the west tunnel the vein has widened to about six ft. A 250-ton concentrating plant is to be erected. The roads from the mine to the railroad are getting in condition to permit heavy shipping and the working force will be increased.

*Moscow*—A drift is being run on the 300-ft. level in a vein of lead-carbonate ore. Work is also being done on the 400-ft. level. The property is shipping about 2 cars per week. Twenty men are now employed.

*Newhouse*—The slimes-settling system of the mill is being doubled, and the other additional equipment includes 2 jigs, 16 Wilfley and 10 Johnston tables. Owing to a change in the character of the ore the saving in the mill had dropped from a normal of 70 per cent. to as low as 50 per cent. Samuel Newhouse, in a letter to a leading stockholder, is quoted as saying: "Personally, I am confident that when these changes are made we will increase our savings to such an extent as to enable us to meet the market conditions of copper, even though they remain bad for some time. Under Mr. Drummond's management we have introduced the caving system, which is resulting in lower mining costs, the physical condition of the mine warrants the assertion that there are many years' tonnage to be had for the mill at a very low cost under this caving system."

*Beaver Carbonate*—The new orebody on the 700-ft. level has been followed for 30 ft. The ore continues to be of a good milling grade. The drift will be continued and a crosscut has been started to determine the width of the shoot.

*Cupric Copper Company*—The steam-hoisting plant is now in commission. The shaft is now down 205 ft., but no cross-cutting will be done until a depth of 400 ft. has been reached.

#### SALT LAKE COUNTY

*Yampa*—Two converters, one blast furnace and three reverberatory furnaces are now running full blast, treating 23,000 tons of ore per month from the Yampa mine. About 350 men are now employed in the mine and smelter.

*Tintic*—The Tintic Company, which owns the Tintic Mining and Development Company and the Yampa Smelting Company, is to issue \$500,000 in convertible bonds in order to take care of indebtedness. In the readjustment made necessary by this bond issue, the company will have 900,000 shares of \$3 par value instead of 700,000 shares of \$5 each, as at present. The outstanding capital of \$3,500,000 will first be reduced to \$2,100,000 and then increased to \$2,700,000.

*Boston Consolidated*—Production in March was 1,253,926 lb., costing 10.5c. per lb. The output of the porphyry mines was 917,163 lb., costing 11.14c.

#### SEVIER COUNTY

*Jumbo Plaster Company*—The gypsum deposit in this region is of great extent and of a remarkably pure character. An 80-ton milling plant is in successful operation, and plans for increasing the capacity are being considered.

#### SUMMIT COUNTY

*Wabash*—This mine was flooded again despite the improved pumping facilities which were installed some months ago. A plan is being considered to make connections with the Ontario's original drain tunnel. Work will be suspended until an efficient drainage system can be devised.

*Daly-West*—The raise in the No. 2 Ontario drain tunnel is now up 100 ft. The total distance of the raise, when completed, will be 470 feet.

#### TOOELE COUNTY

*Boston Sunshine*—The mill is now in operation and has a capacity of 150 tons. The ore is of an oxidized character and runs from \$3.50 to \$10 per ton. Work is being done on the 200-, 400- and 600-ft. levels.

#### Washington

##### WHATCOM COUNTY

*Washington Mining and Development Company*—Plans are being made to construct a \$200,000 water-power plant on

Collins creek in the Mt. Baker mining district.

#### SNOHOMISH COUNTY

*Washington, Iowa and Edison Development Company*—A new 15-in. vein was encountered recently at a depth of nearly 1100 ft. in the crosscut tunnel, the ore carrying galena and gold. The number of miners engaged will be increased in order to expedite the early completion of the tunnel.

#### West Virginia

##### FAYETTE COUNTY

*Fire Creek Collieries Company*—This company, recently organized, has bought an old mine and 3500 acres of coal lands near Pembroke, and will increase the capacity of its mine from 600 to 1000 tons of coal per day. It is intended to install a new power plant, tippie and plane, construction work to be started immediately. Officers and directors of the company include P. M. Sharples, president; Isabel Darlington, secretary and treasurer; Thos. S. Butler and T. L. Eyre. The company's main offices are at West Chester, Penn., where the owners reside.

#### Wisconsin

##### PLATT COUNTY

*Highland*—Shipment of zinc carbonate to the Mineral Point Zinc Company is begun again after four months' stop. The Highland Mining Company is running carbonate through its 100-ton jack mill. The St. Anthony has resumed operation on its zinc deposit; by a recent decision of the State Supreme Court, this company also takes possession of the carbonate vein, located on its land, which has been mined by John Shiffra without written lease for the last 30 years. The Wallace is running its winter's output of mill dirt through the plant of the Milwaukee Mineral Company; a raw concentrate assaying between 55 and 60 per cent. metallic zinc is produced.

*Platteville*—Some interesting information has developed regarding certain mining land now in litigation between the Wisconsin Zinc Company and the Enterprise Company. In tracing back title it is found that Major Roundtree, who obtained title direct from the Government, retained the mineral rights when he sold the surface land in the year 1855. The above companies both hold lease to the tract in dispute from the surface owners. The heirs of Mr. Roundtree now claim not only the right to the minerals mined, but the privilege to make such disposition of leases as they see fit. Ten concentrators are now in operation within a radius of four miles from Platteville, and a general revival of activity is promised. The new shaft sunk at the Mitchell Hollow shows good sheet jack, and a mill will be constructed by the Wisconsin Zinc Company. This company is also developing the Kohinoor.

#### Canada

##### BRITISH COLUMBIA

During three months ended March 31, approximately 500,000 tons of ore were produced in the Boundary and Kootenay districts, in the following proportions: Boundary (copper-gold), 370,000 tons; Rossland (gold-copper), 60,000; Ainsworth and Slocan (silver-lead), 25,000; East Kootenay (lead-silver), 25,000; Nelson (chiefly gold-quartz), 20,000. By far the greater part of this ore was treated at Boundary and Trail smelting works, and of the remainder part was crushed in stamp mills and part reduced in concentrating mills, the concentrates going to Trail.

##### BRITISH COLUMBIA—ATLIN

Three large nuggets of placer gold found on Willow creek, have been taken to Seattle. The largest nugget weighing 32½ oz. and valued at about \$540, was lent to the Bureau of Mines so that the provincial mineralogist might have made a plaster cast for permanent exhibition in the mineral museum. The largest nugget known to have come from Atlin camp was found on a Spruce creek claim in 1899; its weight was 84 oz. and its value about \$1400.

##### BRITISH COLUMBIA—BOUNDARY

*British Columbia Copper Company*—The supply of coke for smelting is running short, owing to labor difficulties in the Crow's Nest section, from which fuel supplies are usually obtained. The Crow's Nest Pass Coal Company having granted the demands of the local district of the American Mine Workers, the Granby Company expects its supply of coke to be regularly maintained but other smelters have to depend upon collieries not now operating and which are resisting the coal miners' demands for closed shop and other concessions to which the operators are opposed. There is no present prospect of either side giving in.

*Dominion Copper Company*—The reorganization committee reports that there is deposited under the plan of reorganization over \$600,000 bonds out of the total issue of \$800,000. The Canadian court has ordered the sale of the properties to be held on May 28 at Vancouver rather than May 17, the day originally named.

##### BRITISH COLUMBIA—KAMLOOPS

Herman Beckman has 12 men developing the Kimberley. An orebody of good size and fair value has lately been encountered.

##### BRITISH COLUMBIA—QUEEN CHARLOTTE ISLANDS

On the Ikeda mine, on Moresby island, another shoot of copper ore has been encountered. Shipments of ore to the Tyece Copper Company's smelter at Ladysmith, Vancouver island, are being continued. The mine is owned and operated by Awaya, Ikeda & Co., of Vancouver, B. C.

BRITISH COLUMBIA—SOUTHEAST  
KOOTENAY

*Crow's Nest Pass Coal Company*—J. D. Hurd, general manager, announced publicly at Fernie recently that the company had been obliged to withdraw from the Western Coal Operators' Association owing to efforts of that body to coerce his company into insisting upon points that did not concern either it nor its employees. His company had agreed with representatives of the miners on all important matters in the scale proposed to take the place of that in the agreement to expire on March 31, and only a few minor points remained to be adjusted. He was confident the proposed new agreement would be ratified by the men, and believed there would not be a cessation of work. Mr. Hurd stated further that the record made last July of 4000 tons daily will be exceeded. October will see a daily average of 6000 tons, and by the end of the year a further increase to 8000 tons daily will have been made. One thousand more coke ovens are to be built at Fernie.

NOVA SCOTIA

*Dominion Iron and Steel Company*—This company has received an order from the Great Northern railway, of Sheffield, England, for 5000 tons of 85-lb. steel rails. This is the first English order for rails received by them, and to fill it it was necessary to make new rolls, the specification calling for bull-head rails, of a type not used in Canada.

ONTARIO—COBALT DISTRICT

*Ore Shipments*—Shipments of ore from Cobalt camp for the week ending April 26 were: Crown Reserve, 121,843 lb.; Kerr Lake, 60,000; La Rose, 261,300; Nipissing, 321,272; O'Brien, 128,598; Right-of-Way, 128,102; Temiskaming, 60,000; total, 1,081,115 pounds.

*Cobalt Central*—At the Big Pete mine the vein in the west drift on the 260-ft. level has widened. Five narrow veins are drawing together making 9 in. of high-grade and 18 in. of good milling ore.

*Consolidated Cobalt*—F. B. Chapin, president, has received confirmation of a report that a strike had been made on the Green-Meehan property. The vein was found in drifting at the 100-ft. level.

*Hargrave*—The main shaft is now down 215 ft. When it is 92 ft. deeper a level will be run into the Kerr Lake boundary to tap the vein in the sixth level of the Kerr Lake which is supposed to extend into the Hargrave.

*La Rose*—Active work has been begun on the Lawson property recently acquired. The old Silver Leaf shaft, which is down over 100 ft. and was sunk on the Lawson owing to an error in the survey, has been pumped out and drifting will be begun.

*Michigan Development Company*—This company is now operating the property

formerly known as the Coleman Cobalt, on which it secured an option from the Amalgamated. A shaft has been put down 60 ft., and 12 men are employed with S. D. Madden as manager. The company has also leased the Silver Bird property.

*Paymaster*—The Amalgamated property together with a leasehold on Saseganiaga lake has been acquired by the Paymaster company. A crosscut has been driven 150 ft. northward from the main shaft at a depth of 100 ft. to a vein about 5 in. wide carrying low silver contents. The work is in charge of Superintendent Gordon.

*Silver Queen*—The annual meeting was held in Toronto, April 28. The financial statement showed liabilities outside the capital stock (1,500,000) amounting to \$14,223. The value of ore on hand and in transit—including \$25,000 estimated value of ore on dump—with cash balance amounted to \$40,633. At the end of the previous financial year the cash on hand was \$54,861. With this balance and what the mine produced the company paid \$195,000 in dividends besides spending a considerable sum in development and installing a new plant. The 12-drill compressor is producing more air than required, the excess realizing \$1000 per month. The Northern Customs concentrator began treating ore from the dump on May 5. Diamond-drill prospecting will shortly be undertaken.

*Temiskaming*—A steel shaft house open on the sides, of a type not hitherto seen in Cobalt, is being constructed. It rests on solid concrete masonry and is over 70 ft. high. The new shaft, which is a three-compartment one, is down 350 ft., and when complete will be connected with the present workings by crosscutting.

ONTARIO—GOWGANDA DISTRICT

*Bonsall*—At this location north of Miller lake, an 8-in. quartz vein was recently encountered, carrying high-grade ore studded with free silver.

YUKON

The official records of the gold commissioner for the Yukon show that in the fiscal year ended March 30 last, 288 quartz claims were staked, and that 40 of these were located and recorded in March. The first quartz claim was located by Isabella M. Healy on the Fortymile river in 1894, and since that time 1000 quartz claims have been staked in the Dawson division.

*Klondike Dome Mining Company*—Work is being pushed on the crosscut tunnel to catch the ledge at a depth of 800 or 900 ft., when, if the values have not deteriorated, this section will boast a real quartz mine.

*Sixtymile*—Madison & Bouthlier in this new camp are in good pay dirt. Their work has stimulated considerable prospecting by others. In the Madison ground bedrock is 40 ft. deep, and owing to in-

sufficient water during the season most of the work is prosecuted during the winter.

Mexico

CHIHUAHUA

*Bullion Shipments*—The Chihuahua banks report the following receipts of bullion for the week ending April 24: Batopilas, 112 bars silver, 112,000 pesos; Watterson Gold Mining Company, 10 bars gold-silver, 20,000 pesos, and miscellaneous, entirely from Sierra Madre districts in western part of State, 8 bars silver, about 5000 pesos; total value, 137,000 pesos.

*Republica*—At a recent meeting of the directors it was decided to pay dividends beginning in May at the rate of 1 per cent. per month. The majority of the stockholders reside in El Paso and Kansas City.

*Middle Mountain*—This Naica company is opening up large bodies of milling grade lead-silver ores. D. M. Evans is general manager and A. C. Saunders is superintendent in charge.

*American Smelting and Refining Company*—An aerial tramway will be built from the Santo Domingo mine in the Santa Eulalia camp to the town of Santa Eulalia, from which latter terminal delivery of ore will be made directly to the Mineral railroad. A similar tramway has lately been completed from the Mina Vieja to Santa Eulalia, a distance of over two miles.

*Parral Output*—The production of the Parral camp for the week ending April 23 was 5040 tons of milling ore and 3995 tons of smelting ore, a total of 9035 tons.

*Hidalgo*—This large milling plant in the Parral camp was completely destroyed by fire on April 22. The loss is placed at about \$125,000, partly covered by insurance. The plant had been idle for some time.

GUANAJUATO

*Guanajuato-Jalisco Development Company*—This new company will operate a number of mines in the Guanajuato district, which have been under the control of Dwight Furness. The company is organized under the laws of New York, with a capital of \$1,000,000 preferred, and \$3,000,000 common stock. Dwight Furness is general manager. James C. Hinchcliffe, Paterson, N. J., is president.

SONORA

*Promontorio*—The Clark Copper Company, of Los Angeles, Cal., has secured this old mine, and is opening it under the management of Percy E. Barbour. The mine is full of water to the tunnel level, and preparations are being made to unwater it. Ore is being extracted from the workings above the tunnel level. A producer-gas plant, stamp and concentration mill are being installed.



# Metal, Mineral, Coal and Stock Markets

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

## QUOTATIONS FROM IMPORTANT CENTERS

### Coal Trade Review

New York, May 5—Coal trade in the West is improving steadily, but still rather slowly. The making of contracts is less in evidence than it has been for several years, but recently this kind of business has taken on a sudden increase. It looks as if large consumers had made up their minds that it was possible that the open market might be an advancing one in the second half of the year and that contract business might be safer. In the Indiana district and in the adjoining districts of Illinois there is much interest in the plans being made for extensive operations of mines to supply the large demand for fuel for the Gary plant of the Steel Corporation.

In the East the bituminous trade also shows a slight improvement, but it is not yet marked. The principal topic of discussion is the probable designs of the West Virginia operators to secure a larger share of the bituminous trade in Eastern territory. Developments are being watched very closely.

The anthracite trade has been quieted by the announcement of the settlement of the dispute between operators and miners. The new contract which has been signed by the representatives of both parties is practically an extension of three years for the present agreement, with some minor concessions intended to remove small grievances complained of by the miners. The new agreement is given on another page.

A general subject of discussion is the decision of the United States Supreme Court on the commodities clause of the Interstate railroad law. This decision reverses that of the Circuit Court insofar as it holds the Hepburn act to be constitutional, but it limits radically the application of the law. A summary of the decision and some comments will be found elsewhere in this issue.

#### COAL TRAFFIC NOTES

Tonnage originating on Pennsylvania railroad lines east of Pittsburgh and Erie, year to April 24, short tons:

	1908.	1909.	Changes.
Anthracite .....	1,671,842	1,638,367	D. 33,475
Bituminous .....	10,335,276	11,063,264	I. 727,988
Coke .....	2,207,905	3,121,117	I. 913,212
Total .....	14,215,023	15,822,748	I. 1,607,725

Total increase for the year to date was 11.2 per cent. Increase for the week was 242,091 tons.

Shipments of coal over the Huntingdon & Broad Top road for the year to April 30 were 335,448 tons in 1908, and 284,321 in 1909; a decrease of 51,127 tons.

Shipments of coal originating on the Southern railway for the two months ended Feb. 28 were: Tennessee district, 226,157; Alabama district, 383,956; total, 510,113 short tons, an increase of 119,757 tons over last year.

The Pittsburg Coal Company reports shipments for the three months ended March 31 as follows:

	1908.	1909.	Changes.
Pittsburg district..	2,704,873	2,130,389	D. 574,484
Hocking district..	205,599	160,084	D. 45,515
Total coal.....	2,910,472	2,290,473	D. 619,999
Coke.....	2,648	96,046	I. 93,398

The decrease in coal shipments this year was 21.3 per cent.

### New York

#### ANTHRACITE

May 5—The settlement of the anthracite agreement has relieved a certain degree of apprehension, though it cannot be said that the trade has shown much difference. The demand for domestic coal is still showing the effect of the summer discounts. In steam sizes supply is still a little behind demand, but it is expected that with the prospect of interruption in work removed, the companies will be inclined to ship small sizes from the mines more freely.

Prices on domestic sizes are \$4.35 for lump and \$4.60 for egg, stove and chestnut, f.o.b. New York harbor. For steam sizes current quotations are \$3.10@3.25 for pea, \$2.35@2.50 for buckwheat, \$1.70@2 for rice, \$1.25@1.50 for barley, f.o.b. New York harbor. Individual and washery pea can be had for 5 or 10c. less.

#### BITUMINOUS

The bituminous trade is still disturbed by West Virginia coals—or rather by the discussion of what the West Virginia operators may or may not do. Pocahontas and New River are still offered at low prices, delivered at tidewater. The question most in debate is whether the offers of coal delivered at Eastern ports will be continued.

Current trade is better, especially along the Sound, and it looks as if the far East was beginning to wake up, although its business so far is rather inquiry than actual buying. New York harbor is still dependent on cheap lots, but these are not

particularly plentiful. All-rail trade continues fair and improving. Car supply is good and transportation is slightly improved.

In the Coastwise trade boats are gradually becoming more plentiful, but rates remain steady, and smaller vessels in New York are not so confident about asking advances as they were a week ago.

### Birmingham

May 3—The coal situation in Alabama shows little improvement, but the operators are more hopeful as the pig-iron market improves. There is no trouble in the way of getting all the help that could be desired at the coal mines.

Coke is in steady demand though not as active as it was for a while last year. There is much coke accumulated throughout the Birmingham district.

### Chicago

May 3—Quiet but steady conditions exist in the coal market, the usual spring demand being apparent—for fine coals in preference to lump sizes and a lessened buying of domestic coals. Demurrage evils hold off from the market, only a few grades of Illinois coal, Hocking Valley and an occasional consignment of Eastern coal being sold subject to discount because of delay at the railroad terminal. The steam market is undoubtedly improving—perhaps faster than some dealers will admit, but competition is keen. Prices, therefore, are low and seem destined to continue low, on both Western and Eastern coals. Contract business is quiet, the disposition of consumers being to hold off, and on such contracts as are being made prices are low.

Illinois and Indiana lump and egg sell for \$1.75@2.25; run-of-mine for \$1.65@1.75, and screenings for \$1.40@1.70. Screenings have advanced slightly as a result of the increased demand and conditions of production. Eastern coals in general are selling well, smokeless showing slight tendencies to get back to its old condition of large supply, especially on lump which, from Pocahontas and New River mines brings \$3.20, with run-of-mine smokeless at \$2.95@3.15. Hocking Valley has been troubled with overshipments, selling for \$2.90@3.15, the latter being circular price, but with a good demand.

The anthracite market is dull again, the April rush being over and buying being chiefly in small lots for temporary use.

### Cleveland

May 4—Shipments of Lake coal have hardly begun. The late ice at the Sault has kept vessels from starting out, and few cargoes are yet loaded. The unions are trying hard to keep men off the boats, but without much success.

Steam coal is improving in demand, but there is less call for slack than there was. Prices for fair grades of steam are quoted the same as last week, about \$1.35 for lump, \$1.10 for run-of-mine and 60@75c. for slack, all at mines.

### Indianapolis

May 4—Shipments from mines are improving. Chicago dealers claim that there is too much Indiana coal going forward, but operators say that their orders and contracts warrant better working of mines. The topic of discussion just now is the extension of operations by the Brazil Block Coal Company in connection with the Steel Corporation.

### Pittsburg

May 4—The Pittsburg Terminal Railroad and Coal Company has scheduled seven of its mines to start within a few days. The Lake shipping season is now well commenced, although a large vessel capacity is not yet at command as ore shipments have not become heavy. Prices continue low and unsatisfactory, some large contracts being made at around \$1 per ton for mine-run at the mine. The effort to maintain \$1.15 on ordinary business has not been successful, and ordinary lots continue to go at around \$1.10. Slack remains at 55 to 65c. A mild freshet in the river reached its high May 2 and some empties are now being brought up as the stage recedes, and shipments should commence in a few days.

*Connellsville Coke*—Prices continue unsatisfactory and irregular, good grades of furnace coke selling down as low as \$1.40 in some cases for prompt shipment, although many operators hold their coke at \$1.50 or higher. Consumers are showing little interest in second-half contracts, on which \$1.75 is asked. Foundry coke for spot shipment is selling as low as \$1.75, contract coke being held at \$2@2.25.

The *Courier* gives the production in the Connellsville and lower Connellsville fields at 230,229 tons, a decrease of 3000 tons from the previous week. The shipments were 8985 cars, a decrease of 142 cars, and were distributed as follows: to Pittsburg district, 3323 cars; to points west of Pittsburg, 4739 cars; to points east of Connellsville, 923 cars.

### Foreign Coal Trade

*United States Coal Exports*—Exports of coal and coke from the United States, with coal supplied to steamships in foreign

trade, three months ended March 31, long tons:

	1908.	1909.	Changes.
Anthracite.....	422,865	428,974	I. 6,109
Bituminous.....	1,845,022	1,516,160	D. 328,862
Total exports..	2,267,887	1,945,134	D. 322,753
Bunker coal.....	1,461,651	1,386,902	D. 74,749
Total.....	3,729,538	3,332,036	D. 397,502
Coke.....	209,202	246,791	I. 37,589

Canada took this year 1,333,255 tons of coal, or 68.5 per cent. of the total. The coke went chiefly to Mexico and Canada.

*United States Coal Imports*—Imports of coal and coke into the United States, three months ended March 31, long tons:

	1908.	1909.	Changes.
Anthracite.....	15,023	3,115	D. 11,908
Bituminous.....	485,168	308,354	D. 176,814
Total coal.....	500,191	311,469	D. 188,722
Coke.....	39,545	54,573	I. 15,028

Canada furnished this year 257,436 tons of coal and nearly all the coke; Australia, 38,735 tons of coal. Imports are chiefly on the Pacific coast and on the northern border, into Montana and Washington.

*Welsh Coal Prices*—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on April 22: Best Welsh steam, \$3.72; seconds, \$3.60; thirds, \$3.42; dry coals, \$3.48; best Monmouthshire, \$3.30; seconds, \$3.18; best small steam, \$2.64; seconds, \$2.28.

### Iron Trade Review

*New York, May 5*—The iron and steel markets generally show a considerable increase in activity. Moreover, the general sentiment is improving and consumers seem to be acquiring more confidence in the future. At any rate they are making contracts for longer periods ahead.

In pig iron inquiries are numerous and sales are larger, running well over into third-quarter deliveries. This is especially the case in Eastern and New England territory where the foundries are buying in larger lots than for some time past. Prices are accordingly firmer for foundry iron, and furnaces are not making concessions such as were offered to buyers a short time ago. The general level of prices has not increased, but it is much better maintained. Southern furnaces are sold up to their current production for the next two or three months and are talking of advancing prices 50c. per ton. There has also been considerable buying of basic iron.

In finished material a good business continues to be done in structural steel. Building projects seem to be increasing in number and bids are being asked for some large work. Smaller contracts have made up a good aggregate business. A good business is also reported in plates and bars.

The American Steel and Wire Company has, at last, made the promised reduction in wire and wire products, for which the

trade has been waiting. This reduction varies from \$7 to \$10 per ton, and affects many articles of general use. Thus nails have been reduced from \$1.95 to \$1.60, Pittsburg basing price. It is expected that these reductions will stimulate business, which had already shown a tendency to increase, but was held back by the high prices maintained on wire.

There are reports that negotiations are quietly in progress over the price of rails. It is said that offers have been made to some of the larger railroad companies of a substantial cut, provided they will place large orders. The truth of these rumors cannot be ascertained, but they have at least an appearance of probability.

*Southern Basing Points*—It is stated that hereafter Birmingham, Ala., is to be made a basing point for steel prices. That is, prices for steel products will be made at Birmingham, and will not be the Pittsburg price, with the differences in freight added.

### Baltimore

May 4—Exports for the week included 40,000 lb. rutile concentrates to Hamburg; 36,560 lb. scrap tin to Antwerp; 145,280 lb. zinc dross and 6,677,300 lb. steel billets to Liverpool; 1709 tons steel rails and 290 tons fishplates to Buenos Aires. Imports included 200 tons ferromanganese and 1093 tons manganese ore from Rotterdam; 5800 tons iron ore from Cuba.

### Birmingham

May 3—The new month has started in with many of the furnace company officials in the Southern territory in an encouraged frame of mind. The sales during the past month aggregated considerably more than the make, with the greater number of the manufacturers, and the negotiations under consideration will require much more iron. The prices have stiffened during the past fortnight and \$11.50 per ton, No. 2 foundry, is the minimum, with \$12 being asked in some quarters. There is considerable talk now heard in this district in regard to an increase in the output and five furnaces are reported either ready or nearly so. Some good sales are reported made during the last two weeks, one company selling 10,000 in one lot. The shipments of pig iron from the South have been slack lately. There is a little accumulated iron here, but as soon as some of the companies now holding out of the market begin selling again this will be worked off.

Operations at the steel plant of the Tennessee company at Ensley are still on.

The sale of the properties of the Southern Steel Company in bankruptcy has been practically confirmed; an appeal has been taken and the litigation is still on, but steps are now under way looking to the reorganization.

**Chicago**

May 3—Quiet but firm conditions exist in the iron market, the users of pig iron having apparently determined to wait a while longer before contracting for the last quarter, in which the trading centers. For third-quarter needs, however, there is still much iron to be supplied. Purchases for current needs are increasing and there undoubtedly is a better tone to the market. Efforts to keep Southern firm at \$11.50 Birmingham or \$15.85 for No. 2 Chicago have apparently been successful and sales range 50c. above and below this price according to the need and special conditions, this basic quotation being for third quarter. Northern iron remains firm, buying being light and production well restricted. The standard quotation on Northern remains \$16.50 for No. 2, above and below which there is a range of 25 or 50c. Brisk buying for the previous week or two seems to have had something to do with the falling off in the demand for Southern iron with some of the large consumers.

In finished iron and steel the market is certainly improving, though railroad supplies are not yet in so good relative demand as other lines, and structural steel is quiet, for the present. Here, as in the pig-iron market, confidence is gaining daily. Coke is still at \$4.70 for the best Connellsville, though the demand is good.

**Philadelphia**

May 5—More buying, both of foundry and basic iron, is in evidence. Consumers are inclined to buy further ahead than for some time past. Sellers are stiffer as to prices; no advance has been asked, but there is less disposition to make concessions. No. 2X foundry can be had at \$16@16.50; No. 2 plain, \$15.50@16. For deliveries running into third quarter furnaces want 25 or 50c. more. Stocks at furnaces are being reduced in quantity.

**Steel Billets**—Little business at current prices. Any large orders could be placed at a reduction.

**Bars**—Demand is rather irregular, chiefly in small lots. Steel bars sell better on the lower price. Store trade is improving.

**Plates**—New sales are moderate, but specifications on contracts are increasing. Late in the week some large orders came in.

**Sheets**—Buying is only fair, and mills are willing to shade prices on good orders.

**Structural Material**—One or two large contracts have been placed and others are under negotiation. Small orders are coming in well.

**Scrap**—No heavy sales reported, but there are some good inquiries, especially for railroad and machinery cast. Dealers are beginning to sit up and take notice.

**Pittsburg**

May 4—The event of the week has been the reduction in wire prices by the American Steel and Wire Company, making a new market to which all interests will adhere. From previous official prices the reductions are: Wire nails, \$1.95 to \$1.60 per keg, base, or \$7 per net ton; plain wire, 1.80c. to 1.60c. per pound, base, or \$8 per net ton; barb wire, painted, 2.10c. to 1.60c.; galvanized, 2.40c. to 1.90c., or \$10 per net ton. Per gross ton these reductions average about \$9. The announcement was made in a circular dated May 1, received by the trade May 3, and the new prices are effective May 1. Orders on books will be voluntarily adjusted to the new prices, and shipments in transit on May 1 will probably also be adjusted. There had been shading of 10 to 15c. per keg in nails, the official reduction now made being two or three times as much, and there had been considerable cutting in plain wire, although not much in barb wire.

The wire reduction is merely a part of the general readjustment in steel prices determined upon Feb. 18 last. Originally it was expected the reduction in wire would be made March 1, but as the trade was in the midst of the busy spring season an effort was made to hold prices until the heavy business was put through and the material distributed, and this effort has been fairly successful. The trade is now entering upon a season which is usually dull.

All finished-steel products except standard rails have now been reduced since the open market was declared on Feb. 18, the total reductions ranging from about \$5 per net ton on merchant-steel bars, sheets and tinplates up to \$10 on some sizes of steel pipe and on barb wire.

**Pig Iron**—Inquiry for pig iron is somewhat less active than a week ago. Locally the chief activity has been in the purchases of the Standard Sanitary Manufacturing Company, which has just bought 2100 tons of gray forge for May and June delivery, the price being a shade under \$13.50, Valley. This company is just closing for 500 to 1000 tons of No. 2 foundry, at \$14, Valley. Local furnaces are stiffer in their ideas of price, a number having withdrawn quotations in the past few days, or advanced them 25c. per ton, and asking a minimum of \$14.25, Valley, on No. 2 foundry or basic, even for early delivery. There is still some iron to be had at old prices, and we continue to quote, for May and June delivery, \$14, Valley, on No. 2 foundry, basic and malleable, \$13.50 on gray forge and \$14.75 on bessemer. For third quarter, 25c. higher all around is asked.

**Steel**—The market remains firm, but quiet, consumers being covered by term contracts, on which shipments are of increased volume. Billets are \$23, Pitts-

burg, and sheet-bars \$25.50, delivered Pittsburg, Wheeling, Youngstown, etc.

**Sheets**—Demand fairly good; prices remain 2.25c. for black and 3.25c. for galvanized, 28 gage, for ordinary carload lots, these prices being sometimes shaded \$1 per ton on attractive orders.

**Ferromanganese**—The market is irregular, the minimum being about \$41, seaboard, on large lots for early delivery and \$42 on carloads, the freight to Pittsburg being \$1.75. All ferromanganese contracts are being made with a clause protecting the seller in case the duty is advanced.

**Foreign Iron**

**British Iron Production**—The British Iron Trade Association reports that the production of pig iron in Great Britain in 1908 was 9,289,840 long tons; being 634,016 tons less than in 1907, and 859,548 tons less than in 1906. The production in the first half of the year was 4,635,851 and in the second half 4,653,989 tons, an increase of 18,138 tons. The average number of furnaces in blast was 309; the average make per furnace, 29,970 tons.

**Metal Markets**

**New York, May 5**—In several directions the metal markets show some improvement, but business remains rather quiet.

**Gold, Silver and Platinum**

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
<b>Gold:</b>			
Mar. 1909..	\$21,252,462	\$ 5,161,648	Exp. \$16,090,814
" 1908..	1,447,206	3,649,407	Imp. 2,202,201
Year 1909..	37,978,632	12,158,275	Exp. 25,820,357
" 1908..	3,859,003	17,296,044	Imp. 13,437,021
<b>Silver:</b>			
Mar. 1909..	5,079,287	3,279,531	Exp. 1,799,756
" 1908..	4,329,369	3,757,027	" 572,342
Year 1909..	14,473,930	10,453,218	" 4,020,712
" 1908..	12,586,287	10,830,656	" 1,755,631

Exports from the port of New York, week ended May 1: Gold, \$2,578,100, chiefly to Paris and Brazil; silver, \$1,064,420, mostly to London. Imports: Gold, \$210,370; silver, \$226,692, both from the West Indies, Mexico and South America.

**Gold**—There has been quite a demand for gold this week and prices in the open market in London have advanced 3/8d., 77s. 9 5/8d. per oz. having been paid for bars, and 76s. 4 1/4d. per oz. for American eagles. The Bank of France is again in the market, having taken all the Transvaal gold arriving during the week. In New York the demand for gold for export continues, \$500,000 having been taken for Brazil and \$1,500,000 for Paris. There is a prospect that the outward movement will continue.

**Platinum**—Business does not show much change, being still quiet, though electrical

sales are showing a little improvement. Dealers continue to quote \$23@24 per oz. for refined platinum, \$26 for hard metal and \$19@21 for scrap.

**Silver**—Under the impulse of speculative Indian and Chinese buying, silver has had a sharp rise, and closes with good orders at 24 $\frac{7}{8}$ d. in London.

SILVER AND STERLING EXCHANGE						
Apr.-May.	29	30	1	3	4	5
New York....	52 $\frac{1}{2}$	53	52 $\frac{1}{2}$	52 $\frac{1}{2}$	53 $\frac{1}{2}$	53 $\frac{1}{2}$
London.....	24 $\frac{1}{2}$	24 $\frac{7}{8}$	24 $\frac{7}{8}$	24 $\frac{3}{4}$	24 $\frac{1}{2}$	24 $\frac{1}{2}$
Sterling Ex..	4.8730	4.8745	4.8745	4.8760	4.8760	4.8750

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

Exports of silver from London to the East, reported by Messrs. Pixley & Abell, year to April 22:

	1908.	1909.	Changes.
India.....	£ 2,310,438	£1,404,400	D. £ 906,038
China.....	506,400	983,200	I. 476,800
Straits.....	90,200	82,800	D. 7,400
<b>Total.....</b>	<b>£ 2,907,038</b>	<b>£2,470,400</b>	<b>D. £ 436,638</b>

Imports for the week £2500 from Mexico, £4000 from the West Indies, £175,000 from New York; total, £181,500; exports £228,500 to India.

**Copper, Tin, Lead and Zinc**

Apr.-May.	Copper.			Tin.	Lead.		Zinc.
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	London, £ per ton.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	St. Louis, Cts. per lb.
29	12 $\frac{1}{2}$ @13	12 $\frac{1}{2}$ @12 $\frac{1}{2}$	57 $\frac{1}{2}$	29 $\frac{1}{2}$	4.20 @4.25	4.10 @4.15	4.87 $\frac{1}{2}$ @4.92 $\frac{1}{2}$
30	12 $\frac{1}{2}$ @13	12 $\frac{1}{2}$ @12 $\frac{1}{2}$	57 $\frac{1}{2}$	29 $\frac{1}{2}$	4.20 @4.25	4.10 @4.15	4.87 $\frac{1}{2}$ @4.92 $\frac{1}{2}$
1	12 $\frac{1}{2}$ @13	12 $\frac{1}{2}$ @12 $\frac{1}{2}$	....	29	4.20	4.10	4.87 $\frac{1}{2}$ @4.92 $\frac{1}{2}$
3	12 $\frac{1}{2}$ @13	12 $\frac{1}{2}$ @12 $\frac{1}{2}$	57 $\frac{1}{2}$	28 $\frac{1}{2}$	4.20	4.10	4.87 $\frac{1}{2}$ @4.92 $\frac{1}{2}$
4	12 $\frac{1}{2}$ @13	12 $\frac{1}{2}$ @12 $\frac{1}{2}$	57 $\frac{1}{2}$	28 $\frac{1}{2}$	4.20	4.10	4.87 $\frac{1}{2}$ @4.92 $\frac{1}{2}$
5	12 $\frac{1}{2}$ @13	12 $\frac{1}{2}$ @12 $\frac{1}{2}$	57 $\frac{1}{2}$	29	4.20	4.10	4.87 $\frac{1}{2}$ @4.92 $\frac{1}{2}$

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

**Copper**—During the week April 29-May 5, business broadened materially and fairly large transactions were consummated both with domestic and foreign buyers. Overtures were made for deliveries extending into the fall, but sellers were unwilling to contract so far ahead, although sales have been made for August delivery. Electrolytic copper has continued to be freely supplied at 12 $\frac{3}{4}$ c., delivered, 30 days, or a little less than 12 $\frac{5}{8}$ c., cash, New York, but some interests which heretofore have been rather

aggressive and inclined to make concessions have receded from that position. However, many are still disposed to shade prices for prompt and near-by delivery and such business has continued to be done at concessions. The supply of Lake copper being less extensive than electrolytic, the price for that grade has advanced to the full basis of 13c., sales having been made at 12 $\frac{7}{8}$ @13 $\frac{1}{8}$  cents.

There is an impressive expansion in the requirements of manufacturers the world over and consumption appears to be rapidly reaching the point where it will take care of the output at the present rate. It is well to bear in mind that what has always been considered the normal increase in the consumption of copper has to be provided to a large extent by this country, expected supplies from Africa and elsewhere being still far in the future. There is still a great deal of room for improvement in the business of the large manufacturers, but the outlook for the gradual absorption of the surplus is now more encouraging than it has been for some time.

Meanwhile the demand is freely met at 12 $\frac{7}{8}$ @13 $\frac{1}{8}$ c. for Lake copper, and 12 $\frac{1}{2}$ @12 $\frac{5}{8}$ c. for electrolytic, in ingots, cakes and wirebars. The average of the week for casting is 12 $\frac{3}{8}$ @12 $\frac{1}{2}$  cents.

Copper sheets are 16 $\frac{1}{2}$ c. base for large lots. Full extras are charged, and higher prices—up to 18c.—for smaller quantities. Copper wire, 14 $\frac{1}{4}$ c. base, carload lots at mill. Business has been more active.

The London standard market has been firm throughout the week, showing a very strong undertone and a tendency to respond to speculative buying in spite of the large available supply. The close is steady at £57 17s. 6d. for spot, £58 12s. 6d. for three months.

Refined and manufactured sorts we quote: English tough, £62; best selected, £61@62; strong sheets, £73@75.

After some large sales at the very beginning of April the market became more quiet, the price for electrolytic settling at 12 $\frac{1}{2}$ @12 $\frac{5}{8}$ c., which continued without change throughout the month. All of the agencies offered the metal at 12 $\frac{3}{4}$ c., delivered, 30 days, equivalent to a little less than 12 $\frac{5}{8}$ c., cash, New York, and this price was shaded to consummate transactions. Lake copper was freely sold at 12 $\frac{7}{8}$ c. for good ordinary brands, while some special brands fetched 13c., the quotation of 12 $\frac{7}{8}$ @13c. remaining unchanged throughout the month. Good business in both Lake and electrolytic was done right along, but nothing of spectacular proportions. A feature of the market, in the latter part of April was the willingness of the agencies to sell electrolytic for delivery as late as August.

**Tin**—Toward the latter part of last week and the beginning of this week the London market showed a declining tendency, but notwithstanding the fact that transactions were of good-sized volume, quotations did not show a change to any

considerable extent. At the close the market has become a good deal firmer and is cabled at £131 for spot, £132 2s. 6d. for three months.

There is no change to be reported in the domestic market where business still leaves a great deal to be desired. Tin is quoted here at 29 cents.

**Lead**—Transactions have dwindled down to a retail volume, and prices have eased off to the level at which the leading sellers stand ready to supply the demand, quotations at New York being 4.20, and St. Louis 4.10 cents.

The John Wahl Commission Company reports to us from St. Louis, under date of May 5, that lead is dull, but prices remain steady. Ordinary Missouri brands are lightly salable at 4.10c., while 4.12 $\frac{1}{2}$ @4.15c. is asked for corroding lead.

The London market has also given way somewhat and closes at £13 2s. 6d. for Spanish lead, £13 5s. for English lead.

**Spelter**—The market has found its level, and there is a fair-sized business from day to day at last quotations, 4.87 $\frac{1}{2}$ @4.92 $\frac{1}{2}$ c., St. Louis, 5.02 $\frac{1}{2}$ @5.07 $\frac{1}{2}$ c., New York.

New York quotations for spelter, April 29-May 5, inclusive, were 5.02 $\frac{1}{2}$ @5.07 $\frac{1}{2}$  cents.

The John Wahl Commission Company reports to us from St. Louis, under date of May 5, that spelter is firm, but very quiet. The latest sales are on a basis of 4.90c. for prompt and 4.92 $\frac{1}{2}$ c. for late May delivery.

Base price of sheet zinc is now 6 $\frac{3}{4}$ c. per lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Reports from London are more encouraging, and prices have advanced at the close to £21 17s. 6d. for good ordinaries, £22 2s. 6d. for specials.

**Other Metals**

**Antimony**—There has been more buying, chiefly on account of the expectation that a duty will be levied on the metal. Quotations are 8 $\frac{3}{8}$ @8 $\frac{1}{2}$ c. for Cookson's; 8 $\frac{1}{4}$ c. for Hallett's; 7 $\frac{7}{8}$ @8c. for U. S. and other brands.

**Aluminum**—No. 1 ingots are 22@24c., base price; wire, 31@32c., and sheets 33@34c. base. No change in business.

**Quicksilver**—The New York quotation is \$44.50 per flask of 75 lb. Sales are improving. San Francisco sales light and prices nominal at \$44 for domestic and \$42 for export orders. London, £8 7s. 6d. per flask, with £8 3s. 9d. named by jobbers.

**Imports and Exports of Metals**

Exports and imports of metals in the United States, three months ended March 31, are reported as follows, in the measures usual in the trade:

Metals:	Exports.	Imports.	Excess.
Copper, long tons	59,982	34,151	Exp. 25,831
Copper, 1908....	81,364	20,241	Exp. 61,123
Tin, long tons....	114	11,526	Imp. 11,412
Tin, 1908.....	87	7,385	Imp. 7,298
Lead, short tons.	23,219	24,563	Imp. 1,344
Lead, 1908.....	20,297	27,946	Imp. 7,649
Spelter, sh. tons.	1,382	1,098	Exp. 284
Spelter, 1908....	453	256	Exp. 197
Nickel, lb.....	2,618,037	4,284,113	Imp. 1,666,076
Nickel, 1908....	3,545,298	3,545,591	Imp. 293
Antimony, lb.....	1,848,993	1,848,993	Imp. 1,848,993
Antimony, 1908.	2,616	1,923,190	Imp. 1,920,574
Platinum, oz.....	29,653	29,653	Imp. 29,653
Platinum, 1908.	10,084	10,084	Imp. 10,084
Quicksilver, lb...	10,303	10,303	Exp. 10,303
Quicksilver, '08	42,687	42,687	Exp. 42,687
Aluminum, value	\$22,346	\$22,346	Exp. \$22,346
Aluminum, 1908	109,890	109,890	Exp. 109,890
Ores, etc.:			
Zinc oxide, lb...	7,353,417	7,353,417	Exp. 7,353,417
Zinc oxide, '08..	6,520,625	6,520,625	Exp. 6,520,625
Zinc dross, lb....	5,014,932	5,014,932	Exp. 5,014,932
Zinc dross, '08..	7,262,612	7,262,612	Exp. 7,262,612
Zinc ores, lg. tons	2,025	18,668	Imp. 16,643
Zinc ores, 1908.	6,067	8,415	Imp. 2,348
Antim'y ores, lb.	504	3,194,390	Imp. 3,193,886
Ant. ores, 1908.	284,003	284,003	Imp. 284,003
Chrome ore,.....	7,540	7,540	Imp. 7,540
Chrome ore, '08			

Copper, lead and nickel include the metal contents of ores, matte, bullion, etc. The exports given include reexports of foreign material. Imports of zinc ores in 1909 included 8355 tons calamine and 10,315 tons other ores, against 4022 and 4393 tons, respectively, in 1908. Chrome ore was not reported separately last year.

**Zinc and Lead Ore Markets**

Joplin, Mo., May 1—The highest price reported paid for zinc was \$43.50 for sul-

SHIPMENTS, WEEK ENDED MAY 1.

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	4,013,020	778,820	\$100,248
Joplin.....	2,811,740	383,350	65,942
Alba-Neck.....	722,970	9,270	14,728
Duenweg.....	647,530	86,610	14,586
Granby.....	924,460	61,000	13,251
Aurora.....	506,940	15,860	9,210
Miami.....	601,470	86,110	12,678
Galena.....	376,370	83,400	9,486
Badger.....	433,840	7,360	8,883
Prosperity.....	305,760	66,850	7,849
Spurgeon.....	301,090	127,320	7,713
Oronogo.....	352,820		5,595
Carthage.....	261,140		5,222
Quapaw.....	191,490	10,820	3,739
Zincite.....	138,410	7,640	2,840
Carl Junction.....	90,870	4,080	1,936
Stott City.....	62,270	4,770	1,383
Sarcoxie.....	67,670		1,319
Totals.....	12,909,880	1,732,360	\$286,705

18 weeks.....203,727,350 83,130,980 \$4,539,658  
 Zinc value, the week, \$238,011; 18 weeks, \$3,673,550  
 Lead value, the week, 48,694; 18 weeks, 966,099

MONTHLY AVERAGE PRICES

Month.	ZINC ORE.				LEAD ORE.	
	Base Price.		All Ores.		All Ores.	
	1908.	1909.	1908.	1909.	1908.	1909.
January.....	\$37.60	\$41.25	\$35.56	\$38.46	\$46.88	\$52.17
February....	36.63	36.94	34.92	34.37	49.72	50.50
March.....	36.19	37.40	34.19	34.71	49.90	50.82
April.....	35.40	38.63	34.08	37.01	52.47	55.63
May.....	34.19		33.39		56.05	
June.....	33.06		32.07		60.48	
July.....	34.55		31.67		59.90	
August.....	36.53		33.42		60.34	
September..	37.63		34.44		54.59	
October.....	35.95		33.28		52.63	
November...	39.13		35.02		54.53	
December...	42.75		39.68		49.68	
Year.....	\$36.63		\$34.31		\$53.93	

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

phide ore, the base price ranging from \$38 to \$41 per ton of 60 per cent. zinc. The highest price of silicate was \$22, on a base of \$18 per ton of 40 per cent. zinc. The average price, all grades, was \$38.66, small sales of silicate advancing the average. The highest settling price of the week was \$58 per ton for lead ore purchased last week, the highest buying price of this week being \$55. The average settling price, all grades, was \$56.20 per ton.

Platteville, Wis., May 1—The highest price paid this week for zinc ore was \$43 per ton; the base price was \$39.50@40.50 per ton of 60 per cent. zinc. No sales of lead ore are reported.

SHIPMENTS, WEEK ENDED MAY 1.

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Linden.....	542,480		
Platteville.....	332,130		
Benton.....	305,200		
Strawbridge.....	220,000		
Hazel Green.....	155,600		
Highland.....	126,000		
Harker.....	98,760		
Cuba City.....	83,300	88,700	
Livingston.....	80,000		
Rewey.....	63,200	56,900	
Total.....	2,006,640	145,600	
Year to May 1.....	33,621,564	1,213,560	2,983,100

In addition to the above there was shipped to the American Zinc Ore Separating Company 159,800 lb. and to the Joplin Separator Works 161,400 lb. zinc concentrates.

**Cement Prices**

May 5—It is stated today that, because of the action of certain large interests in cutting prices, a supplementary agreement has been promulgated by the cement manufacturers of the East who are in the so-called cement trust, which calls for a reduction of 15c. per barrel, excepting in New York City, where the reduction is 20c. per barrel. In addition the market in the States of Maryland, Delaware, Virginia and the District of Columbia heretofore covered by schedule A in the agreement is thrown wide open. This decision was arrived at by the promoters of the proposed cement combination after a series of conferences which have just been concluded.

It is also said that all efforts to get the Western manufacturers to join the combination have been abandoned for the time being owing to opposition on the part of the United States Steel Corporation.

**Petroleum**

May 5—The Standard Oil Company on May 4 announced a reduction of 5c. per barrel in crude-oil prices in all the Pennsylvania districts, in the Lima field in Ohio, and in the Indiana field. This is the first change in the Pennsylvania fields since March 9, 1907; and since Feb. 26, 1908, in the Lima field.

**Chemicals**

New York, May 5—The market is improving slightly. Deliveries on contracts are better and there is a little more current business.

Copper Sulphate—Sales are only fair. Prices unchanged at \$4.60 per 100 lb. for carloads and \$4.85 per 100 lb. for smaller parcels.

Arsenic—Current quotations are 2 7/8@3c. per lb. for white arsenic. There is a slight activity owing to the possibility that a duty may be placed on this material.

Nitrate of Soda—Messrs. Mortimer & Wisner, New York, report the position of nitrate in the United States on May 1 as follows, in long tons:

	1908.	1909.	Changes.
Stocks, Jan. 1.....	5,900	9,140	I. 3,240
Imports 4 months.....	70,600	124,700	I. 54,100
Total Supplies.....	76,500	133,840	I. 57,340
Deliveries 4 months....	73,030	122,440	I. 49,410
Stocks, May 1.....	3,470	11,400	I. 7,930
Afloat for U. S.....	80,000	58,000	D. 22,000

Quantities afloat include all cargoes due to arrive at U. S. ports by Aug. 15 next.

Imports and Exports—The imports and exports of chemicals and raw materials in the United States, three months ended March 31, were as follows:

	Imports.	Exports.	Excess.
Copper sulph. lb.....	1,719,158	E. 1,719,158	
Bleach, lb.....	22,877,205	I. 22,877,205	
Potash salts, lb.....	100,166,429	I. 1,076,369	I. 99,090,060
Soda salts, lb....	3,116,504	180,826	I. 2,935,678
Acetate lime, lb.....	24,823,451	E. 24,823,451	
Nit. of soda, tons	88,592	2,051	I. 86,541
Phosphates, tons	847	247,375	E. 246,528
Sulphur, tons....	6,306	6,564	I. 258
Pyrites, tons....	157,696	I. 157,296	

Exports include reexports of foreign material. Estimating sulphur contents of pyrites, the total sulphur imported was approximately 69,384 long tons.

**Mining Stocks**

New York, May 5—The general stock market has been irregular. In the first part of the week they were rather quiet, but on Monday the announcement of the Supreme Court decision on the Hepburn law started a movement, which was not altogether confined to the railroads directly interested, but extended to other stocks. The decision was variously interpreted, but on the whole was considered favorable to the railroads.

The Curb market followed the lead of the Exchange, having been quiet during the first part of the week, but rather active and excited in the second half. Buying was pretty well distributed, the copper shares attracting quite a number. Nevada gold stocks are in rather better demand and were sold quite freely. Cobalt shares were strong and inclined to advance. The general tone of the market was good and it closed strong.

Boston, May 4—There has been a gradual broadening tendency in the mining-share market, which has asserted itself,

particularly the past week. As yet the public has not taken any great interest, but if prices continue to harden it is only a question of time.

Mass mining has been the bull card in this market, and it has been active in this specialty. From below \$9 a week back, it touched \$15.12½ today. The new lode at a depth of 1700 ft. has opened up some of the most promising ground yet seen in the mine. This strike has called attention to the South Range group and all of them have had active periods. Lake Copper is up over \$5 to \$24.62½ for the week, while North Lake touched \$8.25 today, or above its original subscription price of last summer.

North Butte has advanced over \$10 in the week's time, touching \$67. The sharp decline early in the year has had no official explanation, except that the vein at a depth seemed to split. There has been some question as to the continuance of the \$1 dividend rate, but 75c. per share is bid for the next on 1000 shares.

The Boston Consolidated underwriting syndicate, it is understood, was obliged to take about 15 per cent. of the new issue of 50,000 shares of stock offered at \$11. Application will be made to list Nevada Consolidated on the New York Stock Exchange. It is listed on the local exchange.

On the Curb First National sold down close to \$5. Activity has centered largely in the low-priced issues, but a general improvement in the tone is noted. Corbin Copper had a sharp advance to \$10 today.

STOCK QUOTATIONS

NEW YORK May 5		BOSTON May 5	
Name of Comp.	Clg.	Name of Comp.	Clg.
Alaska Mine.....	.45	Adventure.....	9
Amalgamated.....	78%	Allouez.....	40%
Anaconda.....	46%	Am. Zinc.....	26%
Balakiala.....	12 1/2	Arcadian.....	5%
British Col. Cop.....	6%	Arizona Com.....	43%
Buffalo Mines.....	3 1/2	Atlantic.....	10%
Butte Coalition.....	24 1/2	Boston Con.....	12 1/2
Colonial Silver.....	1 1/2	Calumet & Ariz.....	100%
Cum. Ely Mining.....	7 1/2	Calumet & Hecla.....	610
Davis-Daly.....	6	Centennial.....	30%
Dominion Cop.....	12 1/2	Copper Range.....	77%
Douglas Copper.....	2 1/2	Daly-West.....	19%
El Rayo.....	3	East Butte.....	14%
Florence.....	3%	Franklin.....	15%
Foster Cobalt.....	.34	Greene-Can.....	10%
Furnace Creek.....	.11	Hancock.....	10%
Giroux.....	7%	Isle Royal.....	27
Gold Hill.....	1/2	Keweenaw.....	2%
Goldfield Con.....	8 1/2	La Salle.....	14%
Granby.....	97 1/2	Mass.....	14%
Greene Gold.....	1/2	Michigan.....	13
Greene G. & S.....	6	Mohawk.....	61 1/2
Guanajuato.....	1 1/2	Nevada.....	20%
Guggen. Exp.....	179 1/2	North Butte.....	66%
Hanapah.....	15	Ojibway.....	72
Kerr Lake.....	8	Old Colony.....	.65
McKinley Dar.....	.93	Old Dominion.....	.52%
Miami Copper.....	15 1/2	Osecola.....	133 1/2
Micmac.....	3 1/2	Parrot.....	33
Mines Co. of Am.....	5%	Quincy.....	89
Mitchell Mining.....	1 1/2	Rhode Island.....	24%
Mont. Sho. C.....	1 1/2	Shannon.....	15 1/2
Nev. Utah M. & S.....	2 1/2	Superior.....	41%
Newhouse M. & S.....	2	Superior & Bost.....	14%
Nipissing Mines.....	10 1/2	Superior & Pitts.....	13
Old Hundred.....	1/2	Tamarack.....	70
Silver Queen.....	.45	Trinity.....	14 1/2
Stewart.....	3/4	U. S. Smg. & Ref.....	45%
Tennessee Cop'r.....	41 1/2	U. S. Sm. & Re., pd.....	46%
Tri-Bullion.....	1 1/2	Utah Con.....	40
Union Copper.....	1 1/2	Victoria.....	5
Utah Apex.....	6 1/2	Winona.....	24%
Utah Copper.....	47 1/2	Wolverine.....	147
Yukon Gold.....	4 1/2	Wyandotte.....	2 1/2

\*Ex. Div. †Ex. Rights.

‡Last quotation.

N. Y. INDUSTRIAL

Am. Agri. Chem.....	38%
Am. Smelt. & Ref.....	91%
Am. Sm. & Ref., pf.....	105
Colo. Fuel & Iron.....	39%
Federal M. & S., pf.....	88 1/2
National Lead.....	108%
National Lead, pf.....	110%
Pittsburg Coal.....	110%
Republic I. & S.....	25%
Republic I. & S., pf.....	84%
Sloss-Sheffield.....	78%
Standard Oil.....	670
U. S. Steel.....	55%
U. S. Steel, pf.....	118%
Va. Car. Chem.....	47%

ST. LOUIS May 1

N. of Com.	High.	Low.
Adams.....	.40	.30
Am. Nettle.....	.08	.05
Center Crk.....	1.80	1.50
Cent. C. & C.....	81.00	80.00
C. C. & C. pd.....	80.00	79.00
Cent. Oil.....	110.00	100.00
Columbia.....	8.00	5.00
Con. Coal.....	20.00	19.00
Dee Run.....	110.00	100.00
Gr. Bimet.....	.25	.18
St. Joe.....	12.00	11.00

LONDON May 5

Name of Com.	Clg.
Dolores.....	£1 5s 0d
Stratton's Ind.....	0 3 1 1/2
Camp Bird.....	1 2 9
Esperanza.....	2 16 6
Tomboy.....	1 1 3
El Oro.....	1 6 6
Oroville.....	0 10 9

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. May 5. Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick.....	.18
Belcher.....	.49	St. Ives.....	.13
Best & Belcher.....	.40	Triangle.....	.02
Caledonia.....	.15	BULLFROG STOCKS	
Chollar.....	.08	Gibraltar.....	.06
Comstock.....	.29	Homestake King.....	.02
Con. Cal. & Va.....	.69	Mont. Shoshone C.....	1.75
Crown Point.....	.50	Tramp Cons.....	.06
Exchequer.....	.28	MISCELLANEOUS	
Gould & Curry.....	.10	Bonnie Clare.....	...
Hale & Norcross.....	.19	Lee Gold Grotto.....	...
Mexican.....	.84	Potosi.....	15
Ophir.....	1.35	Savage.....	.23
Overman.....	.12	Sierra Nevada.....	.30
Nevada Hills.....	1.37 1/2	Union.....	.36
Lee Gold Grotto.....	...	Utah.....	.05
Nevada Smelting.....	.87 1/2	Yellow Jacket.....	.60
Nevada Wonder.....	.65	TONOPAH STOCKS	
Nevada-Utah.....	2.68 1/2	Belmont.....	.95
Penn-Wyoming.....	.02	Extension.....	.51
Pittsburgh S. Pk.....	.60	Golden Anchor.....	17
Rawhide Coal'n.....	...	Jim Butler.....	.26
Round Mt. Sphinx.....	.14	MacNamara.....	.23
		Midway.....	.74
		Montana.....	.03
		North Star.....	7.00
		Tono'h Mine of N.....	7.00
		West End Con.....	.30
		GOLDFIELD STOCKS	
		Adams.....	.02
		Atlanta.....	.14
		Blue Bell.....	.04
		Booth.....	.18
		Columbia Mt.....	.13
		Comb. Frac.....	.90
		Con. Red Top.....	.06 1/2
		Cracker Jack.....	.04
		Dia'dfield B. B. C.....	.06
		Goldfield Belmont.....	.04
		Goldfield Daisy.....	.35
		Great Bend.....	.15
		Jumbo Extension.....	.14
		Kendall.....	.06
		Lone Star.....	.05
		May Queen.....	.04
		Oro.....	.10
		Red Hill.....	.10
		Roanoke.....	.62
		Sandstorm.....	.12
		Acacia.....	.06%
		Black Bell.....	...
		C. C. Con.....	.03
		Dante.....	.06%
		Doctor.....	.08%
		Elkon.....	.63%
		El Paso.....	.45%
		Findlay.....	.14%
		Gold Dollar.....	.10
		Gold Sovereign.....	.08
		Isabella.....	.20%
		Jack Pot.....	.06%
		Jennie Sample.....	.07
		Jerry Johnson.....	.05%
		Mary McKinney.....	.37
		Pharmacist.....	.03
		Portland.....	.89
		Un. Gold Mines.....	.05%
		Vindicator.....	.62
		Work.....	.06

COLO. SPRINGS Apr. 30

Name of Comp.	Clg.
Acacia.....	.06%
Black Bell.....	...
C. C. Con.....	.03
Dante.....	.06%
Doctor.....	.08%
Elkon.....	.63%
El Paso.....	.45%
Findlay.....	.14%
Gold Dollar.....	.10
Gold Sovereign.....	.08
Isabella.....	.20%
Jack Pot.....	.06%
Jennie Sample.....	.07
Jerry Johnson.....	.05%
Mary McKinney.....	.37
Pharmacist.....	.03
Portland.....	.89
Un. Gold Mines.....	.05%
Vindicator.....	.62
Work.....	.06

Assessments

Company.	Delinq.	Sale.	Amt.
Blackjack Con., Utah.....	Apr. 15	May 7	\$0.01
Blue Wing, Ida.....	May 8	June 5	0.005
Carney Copper, Ida.....	Mar. 25	May 1	0.003
Confidence, Nev.....	May 18	June 8	0.20
Crown Point, Nev.....	Apr. 18	Apr. 28	0.10
Echo, Ida.....	May 1	June 1	0.002
Elk M. & M., Ida.....	Apr. 20	May 20	0.001
Exchequer, Nev.....	May 5	May 26	0.05
Helvetia.....	May 15	.....	0.50
Imlay, Nev.....	Apr. 6	Apr. 28	0.03
Julia Con., Nev.....	May 24	June 17	0.03
Laclede, Ida.....	Apr. 7	May 1	0.003
Mexican, Nev.....	Apr. 8	Apr. 29	0.10
Nev. Superior.....	Apr. 10	May 1	0.07 1/2
N. Y. Bonanza, Utah.....	Apr. 7	Apr. 28	0.03
Reindeer C. & G., Ida.....	Apr. 28	May 28	0.005
Savage, Nev.....	Apr. 8	May 5	0.10
Sierra Nevada, Nev.....	May 4	May 25	0.10
Union Con., Nev.....	Apr. 8	Apr. 30	0.10
Utah, Nev.....	May 6	May 27	0.03
Yerington Gold, Nev.....	Apr. 8	May 12	0.005

Monthly Average Prices of Metals SILVER

Month.	New York.		London.	
	1908.	1909.	1908.	1909.
January.....	55.678	51.750	25.738	23.834
February.....	56.000	51.472	25.855	23.706
March.....	55.365	50.468	25.870	23.227
April.....	54.505	51.428	25.133	23.708
May.....	52.795	.....	24.377	.....
June.....	53.663	.....	24.760	.....
July.....	53.115	.....	24.514	.....
August.....	51.633	.....	23.858	.....
September.....	51.720	.....	23.877	.....
October.....	51.431	.....	23.725	.....
November.....	49.647	.....	22.933	.....
December.....	48.769	.....	22.493	.....
Year.....	52.864	.....	24.402	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

Month.	NEW YORK.		LONDON.	
	1908.	1909.	1908.	1909.
January.....	13.726	13.893	13.901	14.280
February.....	12.905	12.949	13.098	13.295
March.....	12.704	12.387	12.875	12.826
April.....	12.743	12.56 1/2	12.928	12.93 1/2
May.....	12.598	.....	12.788	.....
June.....	12.675	.....	12.877	.....
July.....	12.702	.....	12.933	.....
August.....	13.462	.....	13.639	.....
September.....	13.388	.....	13.600	.....
October.....	13.354	.....	13.646	.....
November.....	14.130	.....	14.386	.....
December.....	14.111	.....	14.411	.....
Year.....	13.208	.....	13.424	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909.
January.....	27.380	28.050	July.....	29.207	.....
February.....	28.978	28.290	August.....	29.942	.....
March.....	30.577	28.727	September.....	28.815	.....
April.....	31.702	29.445	October.....	30.444	.....
May.....	30.015	.....	November.....	30.348	.....
June.....	28.024	.....	December.....	29.154	.....
			Av. year.....	29.465	.....

Prices are in cents per pound.

LEAD

Month.	New York.		St. Louis.		London.	
	1908.	1909.	1908.	1909.	1908.	1909.
January.....	3.691	4.175	4.025	14.469	13.813	13.813
February.....	3.725	4.018	3.868	14.250	13.438	13.438
March.....	3.838	3.986	3.835	13.975	13.438	13.438
April.....	3.993	4.168	4.051	13.459	13.297	13.297
May.....	4.263	.....	.....	12.938	.....	.....
June.....	4.446	.....	.....	12.600	.....	.....
July.....	4.447	.....	.....	13.000	.....	.....
August.....	4.590	.....	.....	13.375	.....	.....
September.....	4.515	.....	.....	13.125	.....	.....
October.....	4.351	.....	.....	13.375	.....	.....
November.....	4.330	.....	.....	13.538	.....	.....
December.....	4.213	.....	.....	13.166	.....	.....
Year.....	4.200	.....	.....	13.439	.....	.....

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

SPELTER

Month.	New York.		St. Louis.		London.	
	1908.	1909.	1908.	1909.	1908.	1909.
January.....	4.513	5.141	4.363	4.991	20.563	21.425
February.....	4.788	4.889	4.638	4.739	20.875	21.563
March.....	4.665	4.757	4.527	4.607	21.075	21.438
April.....	4.645	4.955	4.495	4.815	21.344	21.531
May.....	4.608	.....	4.458	.....	19.906	.....
June.....	4.543	.....	4.393	.....	19.000	.....
July.....	4.485	.....	4.338	.....	19.031	.....
August.....	4.702	.....	4.556	.....	19.350	.....
September.....	4.769	.....	4.619	.....	19.563	.....
October.....	4.801	.....	4.651	.....	19.750	.....
November.....	5.059	.....	4.909	.....	20.875	.....
December.....	5.137	.....	4.987	.....	20.625	.....
Year.....	4.726	.....	4.578	.....	20.169	.....

Mining and Metallurgical Companies—U. S.

Table listing Mining and Metallurgical Companies in the U.S. with columns for Name of Company and Location, Shares (Issued, Par Val), Dividends (Total to Date, Latest Date, Latest Amt.), and various company details.

Coal, Iron and Other Industrials—United States

Table listing Coal, Iron and Other Industrials in the United States with columns for Name of Company and Location, Shares (Issued, Par Val), Dividends (Total to Date, Latest Date, Latest Amt.), and various company details.

\*Since 1894. †Since 1907. ‡Since 1890. zStock div. \$6,130,000 Mar. '09

Canada, Mexico, Central and South America

Table listing companies in Canada, Mexico, Central and South America with columns for Name of Company and Location, Shares (Issued, Par Val), Dividends (Total to Date, Latest Date, Latest Amt.), and various company details.

\*Previous to consolidation \$1,436,250 were divided. †Amalgamaed.

\*Mexican Currency. †Since reorganization. ‡Since August, 1905.

## Industrials

Traylor Engineering Company, Allentown, Penn., has received an order for a 46-in. by 160-in. blast furnace complete from the Bankers Mining and Development Company, 50 Wall street, New York City. This is to be installed as the first unit of a very large equipment.

The Denver Fire Clay Company has completed arrangements to carry a complete stock of assayers' and chemists' supplies, heavy chemicals, microscopical goods, school and college apparatus, etc., in Salt Lake City, Utah, and expect to be able to make deliveries from there by May 1.

The Wood Drill Works, of Paterson, N. J., has issued a special circular printed in two colors, entitled "You can't drill rock with wood, but you can do it with a 'Wood' rock drill," which treats on the material used in the machines and that repair parts are now carried in stock at New York City. These circulars are being distributed through their agents, Harold L. Bond Company, 42 Broadway, New York City, and 140 Pearl street, Boston, Mass.

The Sprague Electric Company, New York, is sending out a new catalog, No. 424, describing its various types of conduit, conductors, boxes, fittings, etc. Among the newer types may be mentioned the single-strip flexible-steel conduit which is designed especially for fire-proof construction. Special mention is also made of the new multilet box, which is one box with many uses. The catalog is covered with an imported stock known as cloud paper, which gives it an attractive appearance. A copy will be sent to anyone upon request.

The Crocker-Wheeler Company, of Ampere, N. J., recently received an order through its Denver office for a number of small motors which will be installed in the plant of the Cox-Clark Engraving Company, Barclay building, Denver. The motors will be used for individual drive on engraving and electrotyping machinery as follows: A 3-h.p. motor driving a planer; a 1-h.p. motor driving a router; a 1-h.p. motor driving a saw;  $\frac{1}{2}$ -h.p. each on a trimmer, a beveler and a tub rocker, and a  $\frac{1}{2}$ -h.p. motor driving a jig saw and drill. These are all 230-volt direct-current motors of the celebrated form L type, which is built in sizes from  $\frac{1}{10}$  to 7 $\frac{1}{2}$  h.p.

A novel style of slide rule capable of performing a wide variety of calculations, and on this account called the Polyphase slide rule, will be of interest to all whose labors involve arithmetical or trigonometric computations. It is made in a similar form to the ordinary Mannheim slide rule, being a little wider in order to accommodate an extra scale upon the slide, and has been pronounced by all who have seen and used it to be an especially serviceable rule, and one upon which a wide variety of calculations may be readily handled. In addition to the regular a, b, c, d and trigonometrical scales of the ordinary slide rule, the polyphase has on the face of the slide an inverted c scale between the b and c scales, and on the edge of the rule in place of the millimeter scale is placed a scale of cubes. This arrangement enables squares and square roots, cubes and cube roots and a wide variety of combinations, such as the 4th, 5th, 7th and 11th powers and 6th roots to be taken with one setting of the slide, and the position of the inverted c scale on the slide enables many problems involving three factors to be performed at one setting also. The advantage of this arrangement lies not alone in the lessened time required to work an example, but also in the increased assurance of accuracy due to a fewer number of settings. In a circular which is furnished with this rule 70 different examples showing a wide variety of problems involving roots, powers and combinations illustrate the manifold uses to which the polyphase slide

rule may be put. Nor are these difficult either, as the arrangement of the scales is so simple that their relations may be readily grasped and new combinations especially applicable to the particular work in hand easily worked out upon them. This slide rule has just been brought out and placed upon the market by Keuffel & Esser Co., New York City.

It is always interesting to chronicle the half century of development and continued success of any concern, for it means not alone that the business has run along for 50 years, but that the line of manufacture has stood the test of time, has secured a permanent place as an integral part of the world's working tools, and has kept pace with the mechanical advancement of the times. Fifty years ago, two brothers, Philander H. Roots and Francis M. Roots, operated a woolen mill by water power. Conceiving the idea of using the rotary pump principle as a water motor, they built one of wood—case, impellers and all, except the shafts and bearings. Naturally, the machine swelled on being introduced to its driving element and it was taken to a small stove foundry to be loosened up. On re-testing with a belt drive, the foundryman noticed the air coming from the discharge pipe and remarked that he believed the machine would melt iron. The suggestion was adopted and the "grand-daddy" of Roots blowers built and put in successful operation. The clearances were, let us say, liberal, but the type, with minor modifications, endures today. Changes in impeller forms, modifications in bearing design, convenience of adjustments, and standardization are all improvements that might be said to be due to the improvement in shop methods and machine design—making the close clearances of the present day's design not only possible, but practical. The original use, for foundry work, soon ceased to be the only field. New uses constantly sprang up and an era was reached when the blower was first used as a foul-gas exhauster. Copper blast furnace furnished the next incentive to better machines for heavier duty, then trunk-line distribution and high-pressure pumping, together with air for filtration beds, are among the later developments. Now comes the vacuum-cleaning business, with its market for small machines, at vacuums ranging from 6 in. to 18 in. mercury. Thus, during 50 years have new problems constantly come up, just as regularly solved, and each has added its quota to the development of the high grade, serviceable and efficient machine of today. The business has always been in the hands of the original Roots Brothers, or their descendants, just as the design varies little from the original conception. Many men have given many masterpieces to the world, and not the least of these is the evolution of a type of machine that has endured for 50 years and so far shows no sign of decay, but rather, gathers life and usefulness as its age increases.

But a few months ago science celebrated the tercentenary of the birth of Evangelista Torricelli, mathematician and scientist, of Florence, Italy. About the year 1641 he made known one of the greatest scientific discoveries—a method of ascertaining the weight of the air by means of a mercury column. This mercury column was for a long time called the "Torricellian Tube," after its inventor, and the vacuum it includes is still known as the "Torricellian Vacuum." As soon as observations of this instrument were made it was found that the rising and falling of the mercury column had an evident connection with the weather. Otto Von Guericke, of Magdeburg, is the first on record who used the barometer as a weather glass. In 1747 Benjamin Franklin divined that certain storms had a rotary motion, but it remained for Redfield, Espey and Abbe in about the middle of the 19th century to gather the data and completely establish the truth of that which the great Franklin had dimly yet wonderfully outlined. With time, changes have been made in the instrument, and today the mercurial barometer is the accepted standard instru-

ment for determining atmospheric pressure, and the highest grade instrument is capable of determining it to the third point of a decimal. Since this instrument must be about three feet in length, it is very cumbersome and not at all portable, so for obtaining gradients on railroads, elevation of hills and mountains, depths of mines, etc., one has to resort to an instrument that is compact, light, portable and above all things, accurate. This is the "Aneroid" barometer. An instrument containing no fluid, as its name implies. It was originally the invention of a French instrument manufacturer, Vidi, but has been perfected by English makers, and today an aneroid of high grade can be depended on at all pressures to 15 in. In the most portable forms for engineers or tourists they are made in two sizes, 1 $\frac{1}{4}$  in. and 2 $\frac{1}{4}$  in. in diameter, but preference should be given to the larger size, since in this size the vacuum and different levers on which the movement depends can be made larger, consequently the instrument is capable of finer adjustment. The altitude scales vary from 3000 ft. to 20,000 ft., and the subdivisions of these scales are governed by the altitude scale itself. The 3000-ft. dials are subdivided to 10-ft. divisions, while the 20,000-ft. dials are in 100-ft. divisions. The value of these instruments cannot be gaged by their external appearance. Accurate and consistent readings depend upon many things, the chief of which, as with all technical instruments of high class, is the skill of the workman. More depends upon his knowledge of the relation of each part to the whole and their technical adjustment to each other, than upon any other factor. High grade barometer manufacture calls for labor equally skilled with the highest class watchmaking. One of the difficulties to overcome is the tendency of the metal forming the vacuum chamber to "creep," which means that when exposed to a sudden change from a high altitude to a low altitude the metal, owing to the strain resulting from the difference in atmospheric pressure, will not return quickly to its normal state, causing appreciable error in barometric reading. This is overcome by expert knowledge of the character of metals and being able to test and select for high grade instruments only such vacuums as show a negligible degree of "creep" under varying pressures. The metal employed in the forming of vacuum chambers for the best instruments measures but .004-in. in thickness. Compensation is an essential feature in all instruments of this character. It is accomplished by making the main lever of two different metals, steel and brass. Many instruments bear the word "compensated" on the dial, yet when examined *inside* no trace of such can be found. Since the air is subject to great changes in temperature it is necessary to compensate against these changes or the unlooked-for errors will mean useless results and waste of time. Instruments of the highest grade have the regulator (where the final adjustments are made) working in a cupped-out-brass screw, into which works a hardened-steel point, insuring greater delicacy and consequent accuracy. The writer had the opportunity some time ago of visiting the factory of Short & Mason, Ltd., London, Eng., whose reputation for high grade barometers of any description is world-wide. Some of the chains used in the fine instruments were so small that 30 links covered but an inch of space. Some of the instruments had the official certificate of the National Physical Laboratory with them, at times showing errors of only 0.002 inch. The types known as surveying or mining barometers having dials from 3 in. to 5 in. in diameter are made to read by means of vernier to single feet of elevation and are so sensitive to changes in pressure that when lifted from the floor the change in elevation is readily detected in the movement of the hand. The table of equivalent altitude compared to inches of pressure as laid out by Prof. Airey, the astronomer royal of Great Britain, has been accepted as a standard scale and all barometers having altitude scales are divided and figured according to it.