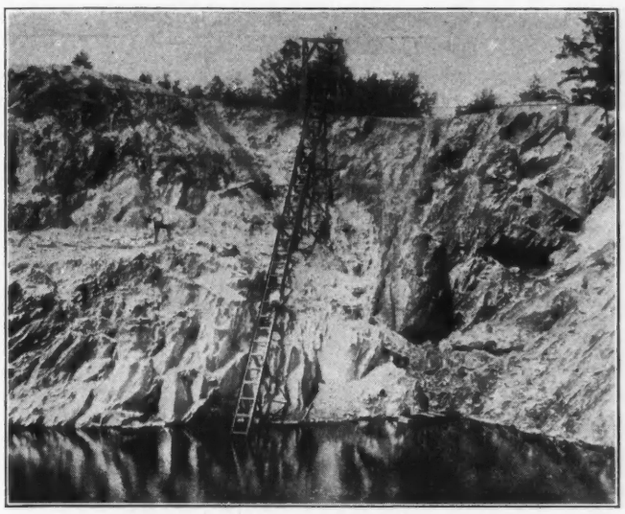
Engineering and Mining Journal

McGraw-Hill Co., Inc. Price, 20c. New York, September 21, 1918

Engineering and Mining Journal

September 21, 1918

Volume 106 *Number* 12



BUMALO PIT, HAILE MINE, KERSHAW

HAILE PIT, SHOWING DIABASE DIKE

Pyrite Mining at Kershaw, South Carolina

By JOEL H. WATKINS*

The old Haile gold mine, at Kershaw, S. C., is being worked by a newly organized company for the production of pyrite ore. The mill has been remodeled and is producing about 25 tons per day of concentrates running 47% S, labor shortage hampering operations. The pyrite ore occurs as lenses in schist and in zones of mineralized schist. Several hundred thousand tons of milling ore has already been proved, and surface indications in unproved ground are excellent.

IN THE last 12 months the attention of every patriotic engineer has been directed toward an increase in domestic production of a group of essential materials popularly known as war minerals. The shortage in these minerals has been due to increased consumption and to decreased imports. Efforts to remedy this condition, which in some instances has become serious, are being concentrated along several lines, and the situation is demanding the coöperation of both the Federal and state geological surveys, as well as the U. S. Bureau of Mines and the War Industries Board. Operating mines are being equipped to handle a greater output; some abandoned mines have been reopened, and a number of undeveloped deposits are being explored. One of the most interesting and promising of recent developments is the conversion of the old Haile gold mine, near Kershaw, S. C., into a pyrite mine.

The Haile gold mine is of historic interest to the engineering profession, as it is the most systematic and successful gold-mining operation, as well as the largest single producer of gold, in the Appalachian region. It was at the Haile mine, also, that Adolph Thies, for many years the manager, invented and established the barrel-chlorination process, which was afterward successfully operated in other parts of the country. Actual mining was begun about 1830, and the mine was operated almost continuously from that time until 1908, when Ernest Thies, then mine manager, was killed by a boiler explosion. The Haile mine has been visited by many geologists and engineers, who may therefore be interested in its present condition.

The rocks of this area are for the most part extremely old volcanic tuffs and porphyry, which have been mashed and recrystallized until they now appear as alternating bands of almost pure sericite and highly siliceous quartz-sericite schists. The strike of these schists varies between 50 and 70° east of north, the dip being from 50 to 65° northwest. These rocks have been cut at about right angles by a series of large and small diabase dikes, though a few small dikes cut the schists at oblique angles. The only other eruptive rock that I saw is a feldspar porphyry exposed in a road about a quarter mile southeast of the Haile pit. The width of this porphyry could not be determined,

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but it is older than the diabase dikes. It is parallel with the schist, and is slightly mashed.

Overlying the high ground in this area are Cretaceous sands which cover a large part of the country rock. The schists are highly jointed, and some movement has occurred along shear zones parallel with the strike, but only one well-defined fault plane was observed. This fault is vertical and cuts the rocks at the north end of the Bumalo pit in a direction about N 20° E. There seems to have been considerable movement along this fault, and, though the exact direction of the throw has not been determined, it is probably from northeast to northwest. The formations on Red Hill, which is northeast of the fault, do not seem to conform to those worked in the Haile and Bumalo pits, which are on the southwest side, although they are directly in line. It was from these two pits, together with the Beguelin pit, that most of the ore mined by the Haile Gold Mining Co. was taken.

Graton has described the orebodies of the Haile mine as replacement deposits similar in origin to those which occur associated with the older volcanic rocks in other parts of the Appalachian region. Such deposits are more common in the fragmental tuffs, which afford easy passageways for ore-bearing solutions. In the recrystallization of the interbedded volcanic tuffs and porphyry flows under pressure, these rocks have been squeezed into alternating parallel bands of almost pure slaty sericite, and highly silicified schists. Pyritization, which has taken place in both the sericitic and siliceous rocks, is widespread and deep seated.

Some have been led to believe that the presence of intrusive igneous rocks, in the form of large diabase

OLD HAILE STAMP MILL, REMODELED BY KERSHAW COMPANY TO PRODUCE PYRITE CONCENTRATES

dikes, which cut the schists at right angles to the strike, has played an important part in ore deposition. Though these dikes may have influenced the secondary enrichment of the ore to a limited extent along their contact with the inclosing rocks, the original deposition of the pyrite in the form of disseminated crystals, which has partly replaced the schists over a wide area, is probably much older than the dikes. In the foot walls of the Haile and Bumalo pits, the strike and dip of the schists vary a few degrees from the strike and dip of the original bedding planes of the tuffs. Here the outlines of large and small fragments of tuff are well preserved, and in some places the fragments are completely replaced by pyrite, exhibiting a striking example of selective replacement.

It is natural to suppose that in an old series of mineralized schists, which have been subjected to the processes of weathering and erosion over a long period

ANOTHER VIEW OF KERSHAW COMPANY'S MILL

of years, descending solutions, which have always kept the weathering well ahead of the erosion, have acted as agents of secondary enrichment in the sulphides. The increase of sulphides with depth, as revealed in a general way by the development work and by the filling in of small crevices and partings along joint planes with pyrite at the depth of 100 ft. below the surface, is strong evidence that there has been secondary enrichment.

Schists All Impregnated With Pyrite

The whole series of schists is more or less impregnated with pyrite, and along some zones this mineral is highly concentrated. Gold, however, seems to favor the more siliceous zones, whereas sulphides are richer in the sericitic zones. In some places, the schists will yield from 25 to 30% sulphur, though wide belts may contain from 15 to 20% sulphur. In a few spots, massive pyrite occurs in lenses around which the schists are folded. These lenses, as far as they have been developed, are short, thick bodies which pinch abruptly both laterally and vertically. Two of these lenses on Red Hill, which were stoped out by A. K. Blakeney, measured roughly 20 x 30 ft. and 18 x 25 ft., respectively, in horizontal section, and pinched out at a depth of about 100 ft. below the surface. Together, they are reported to have yielded 8500 long tons of lump

pyrite which carried an average of slightly more than 48% sulphur.

Quartz lenses and stringers which conform roughly to the strike of the schists are frequent, but carry neither gold nor sulphur, except in small quantities. According to Graton,[1] the gold-bearing orebodies are lenticular in form, and are influenced in their positions by the structure of the rocks in which they occur. Their longest horizontal dimension lies in a northeast-southwest direction, and they dip to the northwest. The gold content of these bodies has proved variable, ranging from $2 to $40 per ton. Records of the old workings show that the quantity of gold was larger in the zone of oxidation and decreased steadily with depth in the sulphides. In 1883, the average value of the gold, which was then mined to a depth of 75 ft., is reported to have been $11 per ton; in 1887, it was $6; in 1900, $4; and in 1904, about $3 per ton.

An interesting occurrence of molybdenite with plates of free gold is noted in both the Haile and the Bumalo pits. The molybdenite seems to be concentrated along an almost vertical shear zone parallel with the strike of the schists and shows in highly slickensided faces, upon which thin plates of native gold have been deposited. I also observed small groups of needle-like crystals of rutile, associated with pyrite and inclosed in sericite, and occurring in the northeast end of the Bumalo pit.

As already stated, where the pyrite contents was high, especially in the soft sericitic schists, gold was in general correspondingly low. For this reason, the highly pyritic zones have been avoided, and little mention has been made of them, even as a possible source of pyrite. Recent developments, however, have shown that on Red Hill, on the northeast side of the 192-ft. diabase dike and in line with rocks of the Haile and Bumalo pits, the schists are less siliceous and are highly pyritized. In fact, it is difficult to orient the rocks of Red Hill with those of the Haile pit, and a study of the surface exposures in this area, as stated, leads me to believe that there has been a horizontal displacement of the rocks from northeast to northwest between Red Hill and the Bumalo pit.

Red Hill has been so named on account of the large amount of gossan float in the form of red hematite. The decomposed schists, wherever uncovered, are stained with iron oxide, but the indications of the presence of rocks rich in pyrite are more abundant on Red Hill than elsewhere. Another hill about 400 ft. southeast of the mill also has gossan outcrops, but has not been drilled or developed. North of the reservoir and northwest of Red Hill, a third and similar outcrop, which has not been developed, occurs.

The Haile and Bumalo pits are now about half filled with water, but by using a boat I could examine the walls of the pits just above the water line. In the southeast corner of the Haile pit is a belt of sericite and pyrite, about 20 ft. wide, which will yield about 25% sulphur, and which grades into leaner material on either side. This belt does not appear north of the 32-ft. diabase dike, which cuts the pit about midway. Near the hanging wall in the Bumalo pit is another zone of soft sericite, about 15 ft. wide, which will probably yield about 30% sulphur. Old records of the underground workings show that this last body of ore is about 25 ft. wide at the 200-ft. level and is rich in pyrite.

OFFICE AND MACHINE SHOP, KERSHAW MINING CO., KERSHAW, SOUTH CAROLINA

New Orebodies Found on Reopening Old Mine

In the summer of 1915, A. K. Blakeney, a resident of Kershaw, reopened an old shaft on Red Hill which had been sunk to a depth of about 100 ft. on a body of massive pyrite before it was abandoned. As this was about the vertical limit of the pyrite lens, the shaft was not continued below this depth. This mine was operated by Mr. Blakeney continuously from August, 1915, until June, 1917, during which time he stoped out the orebody developed by the shaft as well as another massive pyrite lens which was discovered by crosscutting on the 50-ft. level about 50 ft. to the southeast. As stated, about 8500 tons of pyrite was taken from these two lenses. After the lump ore was worked

[1]Graton, L. C. U. S. G. S. Bull. 293, "Gold and Tin Deposits of the Southern Appalachians."

out, underground development work was continued on the 50-ft. and 100-ft. levels in the hope of striking another lens of massive pyrite. This work, which consisted of about 600 ft. of crosscuts and drifts, did not encounter new lenses, but developed a zone of good milling ore about 130 ft. wide, which has a general northeast-southwest trend and conforms roughly to the strike and dip of the inclosing sericitic schists. During this period, 28 Calyx-drill holes, varying in depth from 75 to 140 ft., were also put down on Red Hill. These holes penetrated some small bodies of lump ore and partly developed another zone of good milling ore about 110 ft. wide, running parallel with the 130-ft. zone developed from the Blakeney shaft and separated from it by about 50 ft. of pure sericite, low in sulphides.

Old Drill-Hole Records Available

A Keystone-drill hole, put down on Red Hill by Ernest A. Thies in 1904, was started in the lean zone which separates the two parallel bodies of mill ore, and reached the orebody developed from the Friday shaft about 125 ft. below the surface. From this point to a depth of 275 ft., which is the bottom of the hole, the daily records read as follows:

Aug. 30—Well No. 7, 125 ft.; material harder, with more pyrite; no free gold.
Aug. 31—135 ft.; heavy sulphurets resembling material taken from 60-ft. shaft.
Sept. 1-2—No progress.
Sept. 3—157 ft.; quite heavy in pyrite, but no free gold.
Sept. 5—163 ft.; still quite heavy pyrite; resembles ore, but carries no free gold.
Sept. 6—178 ft.; quite heavy pyrite; hard and soft streaks.
Sept. 7—195 ft.; from 180 to 190 ft., very heavy sulphurets and quite soft; at 195 ft., somewhat harder and not so heavy in pyrite.
Sept. 8—207 ft.; material continues soft and quite heavy in pyrite, at times as high as 50 per cent.
Sept. 9—221 ft.; material continues about the same; soft, heavy sulphurets.
Sept. 10—235 ft.; heavy sulphureted material; same as it has been.
Sept. 12—251 ft.; material is soft and very heavy in pyrite.
Sept. 14—275 ft.; material soft and very heavy in pyrite.
This is as deep as 300-ft. rope will permit. Drill has been moved to place for No. 8 well. It looks very much as if we have here a vein of pyrite material of immense size.

Keystone-drill hole No. 9, situated about 300 yd. southwest of Haile pit, daily records read as follows:

Sept. 22, 1914—23 ft.; very heavy sulphurets; resemble those of No. 5 shaft.
Sept. 23—53 ft.; very heavy sulphurets, but not so hard.
Sept. 24—85 ft.; very heavy, somewhat harder, carrying at least 90% sulphides. If it does not contain any gold and continues heavy in sulphides, it may be of value as a sulphuric acid proposition.
Sept. 26—105 ft.; from 80 ft. on, the material has been very changeable, hard and then soft, but at all times very heavy in sulphurets.
Sept. 27—120 ft.; material is of medium hardness, quite heavy in pyrite.

Calyx-drill hole No. 28, situated between Bumalo pit and 192-ft. diabase dike:

Aug. 26, 1917—Well No. 28; 20 ft.; heavy oxidized material.
Aug. 27—60 ft. deep. From 20 ft. down to 60 ft. very heavy sulphides, with some good bodies of massive pyrite. Material quite soft.
Aug. 28—87 ft. deep. Continues in heavy pyrite, with some lump pyrite. Bottomed at 87 feet.

Haile Property Taken Over by New Company

In June, 1917, the Kershaw Mining Co., a close corporation, was organized for the purpose of mining and milling pyrite ore. The new company took over the entire Haile gold-mine property and began development work at once. By this time, the stopes in the Blakeney workings, which were poorly timbered, had caved badly from the surface, leaving two large open pits and crushing the shaft timbers. A new shaft, known as the Friday shaft, was started about 200 ft. south of the Blakeney shaft, from which a crosscut was driven to the southeast at the 80-ft. level for a distance of 100 ft., and to the northwest for a distance of 50 ft. Parallel drifts were driven to the northeast and southwest from the crosscut, making in all, up to this time, about 750 ft. of development work on the 80-ft. level. A crosscut is now being driven from the north end of one of these drifts to connect with the Blakeney workings. All this work has been in the 110-ft. zone, which was partly developed by the Calyx-drill holes. In the new work, several lenses of massive pyrite were encountered, but none of them has as yet proved to be of large dimension. Five raises have been put up from the 80-ft. level to the oxidized zone, and one raise was driven through to the surface. On Red Hill, the zone of oxidation varies from 10 to 30 ft. in thickness, the contact with the underlying schists and sulphides being sharply defined.

The Haile gold mine, which was operated successfully

CLEANING UP DUMP AT FRIDAY SHAFT, KERSHAW MINING COMPANY

for such a long period, had accumulated a large amount of equipment, such as boilers, engines, hoists, compressors, stamp batteries, crushers and tables, besides about one mile of light rail, one small saddle-tank locomotive, a number of ore cars, a machine shop and a number of good houses. Much of the material is in good repair and is being used, though a large amount is obsolete and has gone to the scrap heap. The stamp batteries in the old 60-stamp mill have been replaced by jigs, rolls and crushers, the new mill now having a capacity of 300 tons of ore in 24 hours. On account of a labor shortage, however, the mill, which was started on Mar. 18, 1918, has been running only about nine hours out of every 24 since that time.

The mill thus far has been fed entirely with ore taken from the Blakeney shaft and from the Friday shaft in development work, all of the run-of-mine material going to the mill, which has been producing about 25 tons of concentrates in nine hours. The run-of-mine ore from the development work has yielded about 25% pyrite. The sulphur content of the concentrates has been about 47%, and the fines, which are not dusty, are giving entire satisfaction. The pyrite, being disseminated in large and small crystals, separates readily from the soft sericitic schist and makes an ideal mill ore. The sludge from the jigs is recovered in two

large settling tanks, from which it passes over four Wilfley tables. Each of these tables is making about one ton of concentrates in nine hours.

An interesting feature of the milling operation is that the overflow from the settling tanks is a finely divided white powder that feels like talc powder. This material represents the sericite in the schist after most of the free silica has been taken out, and is fairly high in potash. The potash, of course, is in the form of a silicate and is insoluble, but the material is a byproduct, and, being extremely finely divided, should be in about the right condition for heat or chemical treatment by some of the potash-extraction processes. When the mill is running 24 hours a day, there will probably be produced from 50 to 75 tons of this finely divided sericite daily. An analysis of these tailings, made in the McCandless Laboratory, of Atlanta, Ga., is as follows: Moisture on air-dried sample, 0.78%; SiO_2, 47.25%; Al_2O_3, 35.30%; K_2O as silicate, 8.52 per cent.

The mine is about three miles from the railroad, but the sand-clay road is good most of the year, and the concentrates are now being hauled with two three-ton trucks. By direct line on an easy grade, a spur connection could be made with the Southern Ry. at Kershaw, which would not be more than two and one-half miles long, but this is not contemplated at present.

Mining by Steam Shovel Probably Best for the Red Hill Deposits

All of the development work on Red Hill leads to the conclusion that the most economic way of mining the ore will be by an open-cut method involving stripping and mining with steam shovel, though for the present some ore may be taken from the Friday shaft by millhole operations. The ore is so badly jointed and is of such a greasy talcose character that it has been found dangerous to stope except in limited volume. An open cut has been started over the old Blakeney workings, taking advantage of the two large surface caves, which have carried the overburden to several feet below the zone of oxidation, making an excellent entry for the steam shovel. As the ore varies somewhat in richness within the workable orebodies, open-cut mining will make possible easy selection of the better grades, allowing the low-grade streaks to be sent to the dumps.

Good mill ore now blocked out on the two parallel zones of mineralized schists is estimated to be not less than 300,000 tons. In this estimate no allowance was made for ore below the 100-ft. level, or beyond the horizontal limits of the development work. An additional ore reserve is partly developed in the highly pyritized sericite belts, mentioned previously, in the Haile pit and in the Bumalo pit. This ore is known to reach a depth of more than 250 ft., but has not been sufficiently developed to warrant a fair estimate of tonnage. Besides this, I feel that the ground underlying those heavy gossan outcrops which have not been developed must represent a large tonnage of workable ore.

A significant feature of the work thus far is the fact that all of the material taken from crosscuts and drifts in the Blakeney shaft and the Friday shaft has been sent to the mill without selection, and has yielded about one ton of concentrates to four tons of ore. There is every reason to believe that if care be taken to waste some of the leaner streaks, the ore sent to the mill can be made to average one ton of concentrates to three tons of ore with little additional cost.

So far as is known, there is no other body of pyrite in this country, or certainly in the East, which can be worked profitably from open cut and be made to produce high-grade concentrates. Now that the shortage in pyrite has become critical, the factor of great importance in connection with this mine is that the daily output can be doubled or tripled on short notice.

Novel Method of Making Copper Plate*

As the export of copper from Great Britain was practically prohibited soon after the outbreak of the war, goods manufactured from this metal have become scarce in Rhodesia, and the price has advanced greatly. The difficulty of obtaining copper plates for amalgamation purposes in batteries is an instance. The attention of the Rhodesia Munitions and Resources Committee was called to the shortage in connection with the requirements of a mine which consumes a large number of battery plates per annum. Crushing is conducted in cyanide solution, and a considerable proportion of pulp passing over the plates is coarse, the result being that the plates wear away, partly by attrition but largely by the action of cyanide.

Inquiries showed that one or two small pieces of copper plate had already been produced experimentally at the Falcon mine. These, however, had been made by the ordinary electrolytic refining method, and, on account of the coarse crystalline and striated deposit, would have been unsuitable for battery purposes.

The Falcon company is the only producer of blister copper in Rhodesia, and with its large electric power plant was therefore best able to produce the finished article.

It was considered that the making of the plates on a revolving mandril offered the best prospects of success, and this method was decided on. It was first introduced by the Elmore brothers about 1888 for the making of copper tubes and other hollow copper articles by electrodeposition. In their scheme the mandril, which was the cathode, was revolved in the electrolytic bath, and the smooth dense deposit obtained by agate burnishers traveling slowly backward and forward over the length of the mandril.

The first experiment at the Falcon mine was made with a revolving mandril. Finely ground silica was used in the electrolyte to obtain the necessary skin friction, but the result was not satisfactory. Hide hanging over the mandril was next tried, but with unsatisfactory results.

The third experiment was made on the same principle as the original Elmore process, but, instead of using agate burnishers, an oil-stone was kept traversing to and fro along the mandril.

This was successful, and the first plate was produced at the end of April of this year. The dimensions are 5 ft. x 4 ft. x $\frac{1}{2}$ in. thick, which is the size required for the copper plates. The electrolyte is kept in sufficient agitation by the action of the revolving mandril, which is coated with a mixture of stove polish, turpentine and a small quantity of beeswax. This allows the finished copper to be removed from the mandril without difficulty. It is cut longitudinally and rolled flat ready for use.

*Abstract from 1918 Report of the Rhodesia Munitions and Resources Committee.

Ore Car Designed at Hecla Mine

By C. T. RICE

A car having a capacity of 82 cu.ft. that can be lowered through a 4 x 5-ft. shaft compartment and pass around a 28-ft. curve on a 24-in. track is described in detail. It can be built with the equipment ordinarily found in the machine shop of a mine large enough to be using train haulage underground and is economical and efficient.

THE best car for train haulage at shaft mines that I have ever seen is the one designed by J. B. Sloan, master mechanic, and C. H. Foreman, engineer, of the Hecla Mining Co., which has now been in use at the Hecla mine, Burke, Idaho, for several months. This car not only has a capacity of 82 cu.ft., and holds approximately 5½ tons of Hecla ore, but is so built that it can readily be taken down a 4 x 5-ft. shaft compartment, and yet will easily go around a 28-ft. curve on a 24-in. track.

The car is of entirely new design. The body, instead of being carried on longitudinal sills with the trucks fastened to the latter, is mounted, so as to lessen the height, directly upon the wheel trucks by means of truck plates. Extraordinary flexibility, though the car is about 10 ft. long and 24-in. gage, is obtained by using a bolster and turntable truck at each end. This, together with the use of 14-in. wheels, makes it possible to keep the top of the car 4 ft. 8 in. from the rails, and prevents the car from being top-heavy. By a slight modification of the truck and the use of 12-in. wheels, the same body is used on an 18-in. track and works equally well.

Owing to the absence of longitudinal sills, the car body is reinforced in several ways to prevent telescoping in case of wreck. This reinforcement comes partly from a 2 x 2 x ⅜-in. angle iron top rim of the body, partly from 1¼-in. bumper rods and 2½ x 2½ x ⅜-in. angle irons riveted to the side plates of the body to carry the hinges of the bottom doors, but mainly from the 3-in. lapping of the top and bottom side plates upon each other about one-third way up the car body.

Method of Lowering Car Into Mine

In lowering the car down a shaft, the body is dismounted from the trucks, which are placed on the cage. Suspended from a yoke by chains, it is then swung under the cage and slowly lowered in that manner. The dismounting of the car body is simple. The cotters are removed from the king pins that hold the trucks and body together, and the body is lifted off. The assembling is almost as easy. When the level is reached, the trucks are properly positioned on the turn sheets, and the car body is swung into place on them as the cage is slowly lowered. By doing away with sills, full advantage is taken of free space in the shaft to obtain car capacity.

The bottom doors of the car, as shown in Fig. 1, are closed by means of chains passing around a ratchet shaft. A quick discharge of ore is obtained by pulling the locking arm and releasing the ratchet wheel. A keep on the chains stops the doors when they are almost flush with the inside faces of the rails. In this way the ore, as it discharges, is kept from getting on the track and causing subsequent derailment.

By using four wheels on each truck and cottering the king pins so that the bolsters have a half-inch vertical play on the turntables of the trucks, enough flexibility is provided between body and truck to make the car ride well even when the track is very uneven. Consequently the car is not easily derailed. This is important, as the car weighs, when loaded, about eight tons, and, when empty, about 2½ tons. But compared to its capacity the dead weight is not large for a mine car intended for train haulage.

In building the car no machining of parts is required, as trucks and bolsters are rough-cast and used in that form, being bolted together with two-ply belting between to insure a tight fit. Moreover, except for the wood blocks that are put between the truck plates and the bumping blocks to act as shock absorbers, all work

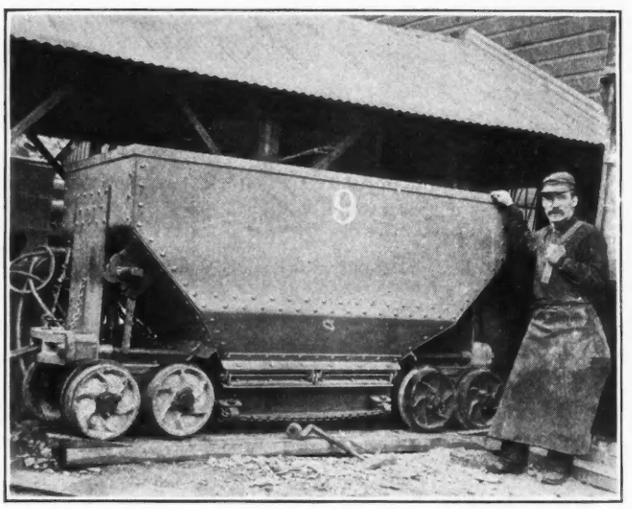

FIG. 1. HECLA ORE CAR—BOTTOM DOOR OPEN

on the car is ordinary blacksmithing. True, the end plates and the bottom side plates of the car body must be bent to shape, but this is easily accomplished in any shop having power shears, such as the 26-in. Improved Doty, with the aid of a few special tools that I will describe later.

The body of the car is made up mainly of ¼-in. plates. Each end plate is a single piece bent to shape. Each side consists of a bottom and top side plate lapped and riveted together so as to obtain a double thickness for stiffening the car body lengthwise and to enable ordinary sizes of plate to be used. The side and end plates are brought together by means of 3 x 3 x ⅜-in. angle irons. Ninety-degree angle irons are used for fastening the end and top side plates together. Special angles are needed to join the end plates and the bottom-side plates. All rivets are driven hot.

The hinges for carrying the bottom doors are bolted to angle irons riveted to the side plates of the car body near their bottom edge. The doors consist of

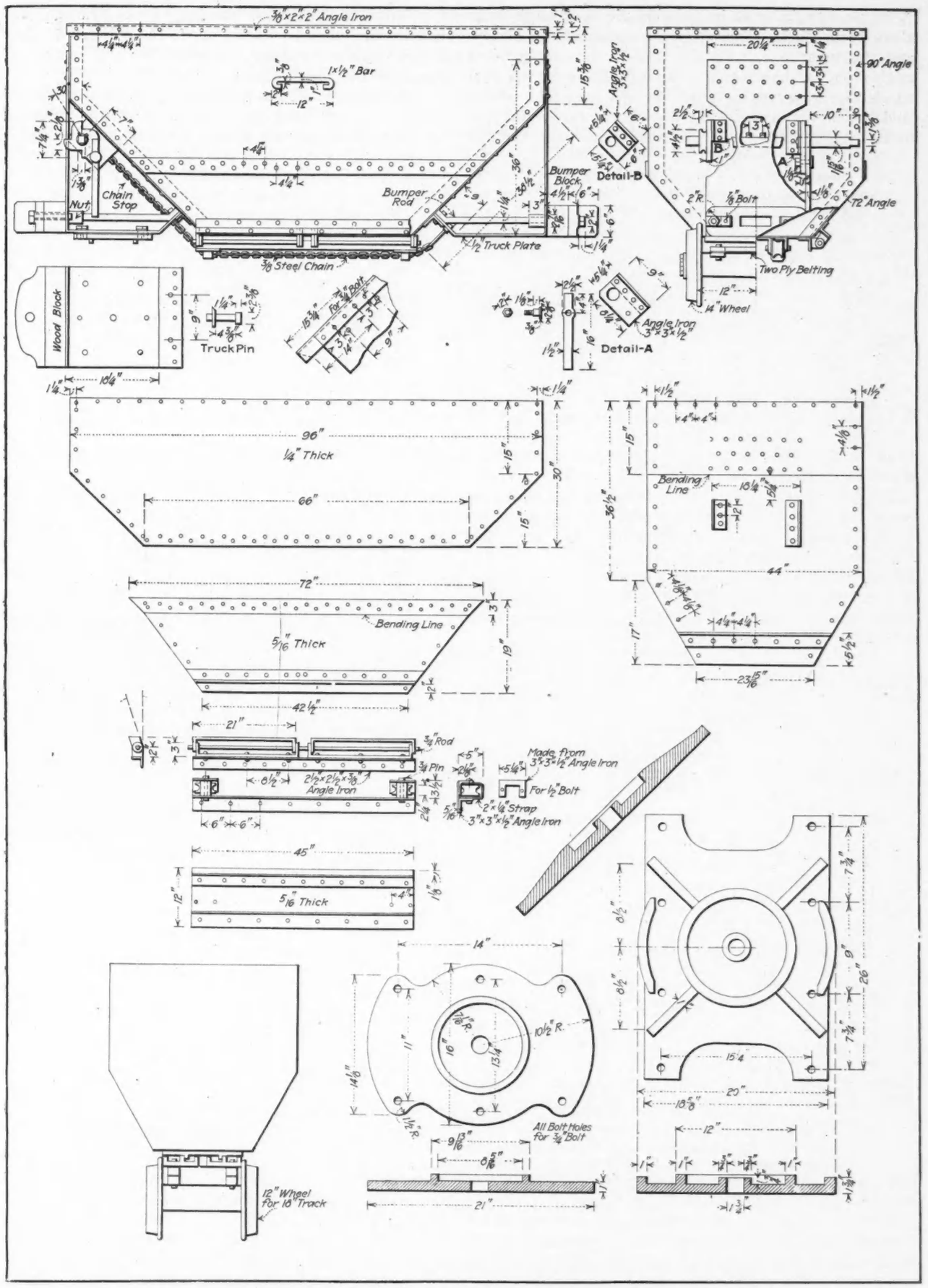

FIG. 2. DETAILS OF ORE CAR DEVELOPED AT THE HECLA MINE, BURKE, IDAHO
The car has a capacity of 82 cu.ft., but can be taken down a 4 x 5-ft. shaft compartment. It will take a 28-ft. curve on a 24-in. track

$\frac{5}{16}$-in. plates reinforced by riveting pieces of angle irons along both edges. The outer piece carries the hinges, and the inner one, with the aid of short lengths of angle iron, as shown in Fig. 1, carries the wheels over which the door chains run. Straps over the wheels hold the chains in position. At one end the chains bolt to the truck plate. At the other they pass through holes in the truck plate and bolt to the chain shaft, which is carried on the end plate.

The only thing to be noted in the design of the turntable truck is that the outer ribs for catching the bolster plate, as well as the king-pin boss, are made $\frac{1}{4}$ in. lower than the turntable ring. This enables the bolster to rock on the turntable, the king pin being cottered to give $\frac{1}{2}$-in. vertical play between the two plates, just enough to give flexibility between car body and truck, and yet keep the turntable ring of the bolster from jumping out of its seat on the truck.

The bolsters of the car shown in the drawing, which is made for a 24-in. track, are bolted crossways to the truck plates. But when the car is to run on an 18-in. track, the bolsters are bolted lengthwise to the truck plates with 2-in. plates between the wheel housings and the turntable plates, and 12-in. wheels are used, their tops coming flush with the top of the trucks. This enables the trucks to swing under the bolsters on sharp turns. Slight recesses for receiving the wheels are also ground in each truck.

The bending of the end and bottom-side plates is done in a 26-in. improved Doty power shears by means of specially designed forming tools that are bolted to its jaws. The fuller tool used is shown in Fig. 3. When bending the plate, this fuller is bolted lengthwise to the upper jaw of shears; on the other hand, when taking out the fluting that develops in the plates while the bend is being formed, it is fastened at right angles to the jaw. In the same cut are shown the bending and straightening blocks, which are used by bolting them to the lower jaw of the shears. As the jaws of the 26-in. Doty shears that are used have a maximum movement of only $1\frac{1}{4}$ in., the bending block used is made in two parts, *A* and *B*, to make it possible to get sufficient bend in the plates. First the plate is bent as much as it can be, using block *A*, the bending block proper. Then block *B*, the shimming block, is put under block *A* to raise it higher with respect to the jaws, and the desired bend in the plate is finally developed. The first bend in the plate is, of course, carried clear across

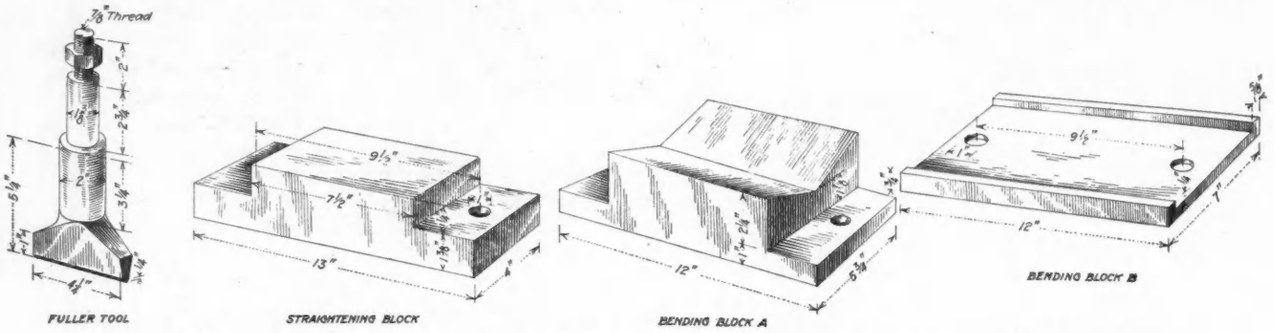

FIG. 3. TOOLS USED FOR BENDING END AND BOTTOM-SIDE PLATES WITH POWER SHEARS EMPLOYED

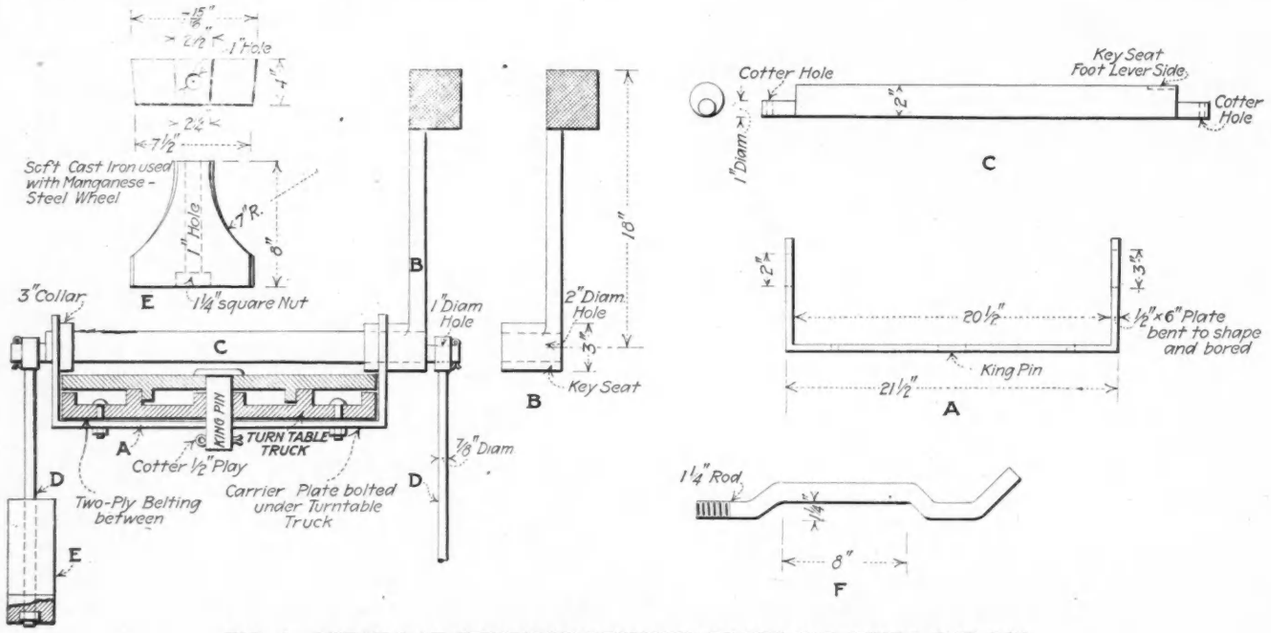

FIG. 4. DETAILS OF SPECIALLY DESIGNED BRAKE FOR HECLA ORE CAR

A—Carrier plate. B—Foot lever. C—Brake shaft. D—Brake rod. E—Brake block. F—Bumper rod on brake car as bent to clear brake shaft

from side to side before the shimming block is put under block *A*.

In such a makeshift method of bending the plates with the machinery available, a fluting tends to develop in them. This is taken out by replacing the bending block with the straightening block and turning the fuller tool at right angles to its former position. Then the plate is worked back and forth under the jaw, and the fluting worked out. The wings often tend to warp or bend at the point where they overhang the bending block, and this kinking is also worked out of the plate at the same time that the fluting is removed.

Specially Designed Brake Used on Hecla Car

The cars described are run in trains of seven or eight at the Hecla mine. The last car of the train is therefore provided with a brake at its rear end, which is of rather clever design. It consists of a carrier plate *A*, Fig. 4, that bolts under the rear truck with a piece of two-ply belting between. One arm of this carrier plate is bored to receive the 2-in. brake shaft. The other wing is bored to receive the 3-in. collar of the foot lever *B*, which is keyed to the brake shaft *C* in such a way as to be positioned properly for being carried by the carrier plate with minimum overhang. The brake shaft is turned down at each end to form a 1-in. arm, having an eccentricity of ½ in., for carrying the brake rods. As the foot lever is 18 in. long, a strong braking action is obtained. The brake rods *D* are cottered on the eccentric arms of the brake shaft. Each rod screws into a nut carried in a square recess cast in the brake block *E*. These blocks, which are made of soft cast iron to permit a good braking action on the manganese wheels of the car, have two brake faces, so that all four wheels of the truck are braked at the same time. By screwing up the brake rods, wear is taken care of in the brake blocks.

In order to permit the brake truck to swing sufficiently in making turns, the bolster at that end of the car is machined down to 20 in., and the carrier arms are kept as far apart as possible; for as the carrier plate is made of ½-in. iron, little play would be left to the truck on a 24-in. track if the bolster remained full width.

The carrier arms are bored so as to carry the brake shaft just clear of the top face of the truck plate of the car. This necessitates a bending of the bumper rods at that end, as shown at *F* in Fig. 4, so that they will clear the brake shaft. In order to give the truck ample play, this offset in the bumper rods is made 8 in. long.

The advantages of a bottom-dump car, having a capacity of 82 cu.ft., for underground train haulage at shaft mines are so many and so obvious that it is unnecessary to enumerate them. When the car is so simple in its design and construction and is so carried on its trucks that it can go around curves of 28-ft. radius, as is possible with the Hecla car, it will be apparent that an almost ideal car for train haulage has been developed. Moreover, the car runs easily and smoothly, as it is fitted with Taylor-Hyatt roller-bearing axles, and it should find favor at larger shaft mines where electric haulage is employed, as its use will reduce the man-power required to handle the ore, as well as the cost of haulage. At a time of labor shortage such as now confronts the mining industry, this is no small recommendation.

Enemy Technical Periodicals Available

Following the passage of the Trading-with-the-Enemy Act, the enemy publications committee of the American Library Association was granted a license by the War Trade Board, whereby universities, colleges, and public bodies of approved character might secure enemy publications of importance to research in science and scholarship, provided the Department of State approved the method and the Censorship Board sanctioned the admission of such material. Two hundred and fifty-five magazines have been approved by these bodies, and approved institutions may enter subscriptions for any of them through the secretary of the committee of the American Library Association, M. L. Raney, Johns Hopkins University, Baltimore, Md. The list of periodicals of interest to technical men here given is abstracted from the report of the committee:

CHEMISTRY

Annalen der Chemie.
Chemisches Zentralblatt.
Deutsche chemische Gesellschaft, Berichte.
Journal für praktische Chemie.
Kolloid-Zeitschrift.
Zeitschrift für analytische Chemie.
Zeitschrift für angewandte Chemie.
Zeitschrift für anorganische und allgemeine Chemie.
Zeitschrift für physikalische Chemie.

GEOLOGY

Deutsche geologische Gesellschaft, Zeitschrift.
Geologische Rundschau.
Geologisches Zentralblatt.
Internationale Mitteilungen für Bodenkunde.
Internationale Zeitschrift für Metallographie.
Mineralogische und petrographische Mitteilungen.
Neues Jahrbuch für Mineralogie.
Zeitschrift für Gletscherkunde.
Zeitschrift für Krystallographie und Mineralogie.
Zeitschrift für praktische Geologie.
Zeitschrift für Vulkanologie.
Zentralblatt für Mineralogie.

TECHNOLOGY

Archiv. für Eisenbahnwesen.
Archiv. für Elektrotechnik.
Armierter Beton.
Beton und Eisen.
Die chemische Industrie.
Deutsche Bauzeitung.
Dingler's polytechnisches Journal.
Elektrotechnik und Maschinenbau.
Elektrotechnische Zeitschrift.
Ferrum.
Gesundheits-Ingenieur.
Glückauf.
Journal für Gasbeleuchtung.
Metall und Erz.
Der Oelmotor.
Prometheus. Illustrierte Wochenschrift über die fortschritte in Gewerbe, Industrie und Wissenschaft.
Rauch und Staub, Zeitschrift für ihre Bekämpfung.
Stahl und Eisen.
Verein deutscher Ingenieure, Zeitschrift.
Zeitschrift für Architektur- und Ingenieurwesen.
Zeitschrift für Bauwesen.
Zeitschrift für das ges. Turbinwesen.
Zeitschrift für Elektrochemie.
Zeitschrift für Instrumentenkunde.
Zeitschrift für komprimierte und flüssige Gäse.
Zeitschrift für Transportwesen.
Zeitschrift für wissenschaftliche Photographie.
Zentralblatt der Bauverwaltung.

It is impossible to secure these publications through any other source than that above indicated.

Mechanical Screening of Wet Pulp

By H. E. MEGRAW*

In this paper the author discusses screening and classsifying, draws attention to the desirability of preparing feed for table concentration by direct screening, rather than by any system of hydraulic separation, and outlines the features to be adopted or avoided in design of apparatus.

ALTHOUGH mechanical screening has been practiced for a long time, and the principles involved are by no means new, results have not reached the height of perfection that might have been expected from such an extended experience. There are, it is true, reasonable excuses for such lagging; and, however much one may differ from conclusions reached, the conditions must be recognized.

Screening is, of course, a form of classification. It is the separation of ore or rock particles according to size, in contradistinction to hydraulic classification, which arranges according to the specific gravity. Hydraulic classification has been much more popular during the last few years than screening. This is due largely to the excellence and simplicity of the classifiers, mechanical and purely hydraulic, that have been invented and widely adopted. Hydraulic classification does away with the wear of the screening medium, and, with the simple mechanical arrangements now in use, is a system that can be adopted at an exceedingly low per-ton cost.

Though the applicability of hydraulic classification in certain cases must be recognized, there is also a field for definite particle-size classification. This question has not been investigated to any considerable extent, however, because it has been difficult to induce operators to depart from long-established practice, which is unfortunately more expensive than it ought to be.

There can be no argument about the necessity for coarse screening. The utility of the grizzly, the trommel, and other appliances for classifying ores between steps in breaking and crushing operations is widely recognized and sanctioned; and, in some form or other, such devices are practically universally used. There is little objection to them, because the particles to be separated are comparatively large and correspondingly large apertures must be used; and it is easy to construct the necessary apparatus in so substantial a manner that the wear is small when calculated upon a per-ton basis.

Coarse screening is usually a dry process. It is when the screening of finely divided wet ore pulp is attempted that difficulties arise that lead the operator to prefer hydraulic classification whenever it is possible to substitute that method for screening.

Hydraulic classification separates the particles in a pulp according to their specific gravities—the product is a pulp with particles which fall at approximately the same rate through water, are of approximately equal weight, and may be, and usually are, of widely varying sizes. Though such a product may be admirably suited for some purposes, it is most inappropriate for further separation by gravity concentration, which is designed to separate gangue particles from mineral-bearing particles on the basis of their different rates of falling through a water medium. Of two particles of equal size, that which has the greater specific gravity will fall the more rapidly; of two particles of equal specific gravity, the larger will fall the faster. It follows, then, that a product separated from a run-of-mill pulp by hydraulic classification will consist of particles of various sizes. Mineral-bearing particles of a certain size will be mixed with gangue particles, of much greater size, but falling through water at the same rate as the mineral-bearing particles. Evidently such a product is not well adapted to securing efficient results from gravity concentration, where the particles fed to the same concentrating machine should be of approximately the same size; consequently the mineral-bearing and non-mineral-bearing particles could be sharply separated by taking advantage of their different rates of falling through water. As practically all gravity-concentration appliances depend upon this principle, it is evident that a screen-separated product is better adapted for efficient concentration than a material separated by hydraulic means. This, then, is the reason for screen separation.

Capacity of Screens

A point of importance in considering screens and screening machines is capacity, which does not depend in any way upon the machine, its form, or, in general, the manner of its operation. Capacity depends upon the screen-aperture size and the character of the feed, the percentage of oversize and undersize and the dilution being important factors. A screen of given aperture size will have one capacity on feed of a certain class, and an entirely different one upon a different feed. Of course, if the screen becomes blinded, its capacity is reduced, but that is a matter of efficiency, and not of capacity. The tonnage capacity of a screening machine or a unit area of screen surface cannot be stated except in terms of undersize and oversize percentages of pulp of certain dilution and particle-size character.

Ideals of Screen Separation

Screen separation of finely ground wet pulp has not been an unqualified success, because there are several mechanical defects in the machines that have not been overcome. These have been such that efficient separation is difficult and costly. It has been difficult to prevent screen-aperture blinding, which, beginning with the first application of pulp, gradually increases to such a point that the capacity of the screen is seriously reduced. Attempts to provide means for preventing blinding have led to the utilization of vibrating devices and other schemes for minimizing the lodgment of particles in the screen apertures. These, however, inevitably induce wear and promote the more or less rapid deterioration of the screening medium, or the machine, or both.

Without a discussion of wet-screening appliances in greater detail, it may be possible to outline the ideal

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characteristics of a perfect screening machine. The rate and manner of feeding the wet pulp to the surface of the screen should be a primary consideration. In the first place, the feed should be delivered gently, to prevent forcing particles into the apertures of the screen, and thus blinding it. This point is disregarded in many screening devices, with results that are detrimental to the maintenance of uniform capacity. The second essential in feeding is the rate, and this is a detail that seems to have received an extremely small amount of study. At any rate, I have never seen a discussion of what I believe to be the only sound theoretical basis.

It will probably be generally admitted that perfect separation can be obtained only by taking each particle and separating it from the mass, a result that can be approximated by mechanical means. The principle is the delivery of a bed or layer of the material or pulp just one particle thick, on the surface of the screening medium. There must be no piling up of the particles, one above another, because this condition would inevitably obstruct the passage of the undersize through the screen apertures. After depositing the layer of feed one particle thick, which would permit the undersize particles to pass freely through the screen, the oversize must be removed before another layer of feed is delivered to the same screen surface.

In order to appreciate the desirability of the single-particle thickness of bed in feeding screens, it is only necessary to consider the properties of the sand filter, so largely used in the cyanide process, as well as other engineering undertakings, where a clear effluent is desired. A comparatively thin bed of sand will hold back appreciable quantities of slime and find sand. In a similar way, a thick bed of feed to a screen defeats the purpose for which the screen has been designed. A bed one particle thick will permit each particle to move freely—the undersize passing through the screen and the oversize being held upon the screening medium. The oversize must be removed before further feed is delivered, in order to avoid building up a bed, by successive applications of feed, that will act as a filter and retain a proportion of the undersize.

Mechanical Qualities of the Screening Machine

In order to approximate the theoretical ideal of screening, which has been outlined in the preceding paragraphs, it is necessary, in addition, properly to design the machine so that it will accomplish the desired method of feed delivery and oversize removal, and, in addition, embody simplicity of operation with low cost. The latter includes the cost of the attention required, labor, and also that of repairs and renewals.

To comply with the feeding requirements, it is necessary that the screening machine be so designed that either the feed delivery or the screen surface be movable, so that the rate of feed may be correlated in the proper proportion to the screen surface. In this way the thin bed may be obtained. Then the mechanical arrangement must be such that the oversize may be discharged and the screen surface cleaned before another charge of feed is delivered.

After this has been accomplished, it is essential to assure a low maintenance charge, which means that the wear, both on the machine itself and on the screen, should be reduced to the minimum. It is obvious, of course, that any screening material used for separating finely ground wet pulp will eventually wear out. What must be assured, however, is that the unit cost for screen cloth shall be low enough to compare favorably with the maintenance costs of hydraulic-classifying apparatus.

This is not easy to accomplish. A traveling-belt screen is efficient, so far as actual performance is concerned, but the constant bending leads to breaking of the wires. Particularly with a fine-screen cloth, where the wires are very small, the screen will soon crack or break, making renewal necessary. A traveling screen belt made upon the conveyor-pan system, consisting of a number of units in each of which the screen cloth is stationary (with regard to that particular unit), occasionally performs useful service. In such cases, however, it has been found that the design is complicated, and that the wear on link-belt pins, links, etc., is high, owing to the abrasive character of the sand customarily handled.

Screening machines of the type that require oversize material to slide or roll over the screening surface for considerable distance or for an appreciable length of time are faulty in that this procedure tends to wear out the screen surface. Because of the inherent characteristics of freshly crushed or ground ores, sharp edges predominate in the pulp; and the abrasive quality of an oversize consisting of hard, sharp-edged rock can well be imagined. The ordinary trommel-type machines and inclined screens have this fault, as, in general, have all of those in which oversize discharge is effected by sliding it over the screen cloth to a discharge point.

A third source of wear arises from the shaking, bumping, or vibrating methods sometimes employed with the object of keeping the screen apertures open. Often these alternatives lead to an aggravation of the condition they are designed to avoid. Shaking or bumping may result, rather, in wedging particles of rock firmly in the screen openings. Even when this possibility is reduced to a minimum, such methods decrease the life of the machine and of the screen material. To secure minimum maintenance costs, any movement which leads to damage ought to be eliminated, and this applies with even greater force to cases where exceedingly fine screening media are used to make separations on finely ground wet pulp.

Summary

In summarizing, it is possible to lay down at least a few of the requirements for a satisfactory machine to be used for the fine screening of wet pulp, and features to be avoided. They are: (1) the delivery of a bed of pulp one particle thick to the screening machine; (2) the removal of the oversize before delivery of additional feed; (3) elimination of sliding the oversize on the screen; and (4) elimination of shaking, bumping, or vibrating devices.

There are, of course, other items of convenience or economy, or both, that may be incorporated in a machine to be used for the purposes now under consideration. In such measure as they succeed in promoting screening efficiency and reducing maintenance costs, they will be successful; but they must include, at least in some degree, the essentials discussed in this paper.

Differential Flotation of Lead-Zinc Tailing at a Small Plant

One of the few instances in which differential flotation has been practiced successfully in the United States is at the small plant operated by George Crerar and C. L. Hewitt with an accumulation of lead-zinc tailing impounded years ago at South Fork, between Wallace and Mullan, Idaho. Several attempts had been made to treat the material when flotation was less understood than it is today, but all resulted in failure until Crerar and Hewitt tackled the problem in the summer of 1917.

Approximately 10,000 tons of tailing assaying 5.5% lead, 5.5% zinc and 2 oz. silver per ton had been caught in a pond having an area of about 18,000 sq.ft., but in the years that had intervened since it was first impounded a considerable amount of oxidation had taken place, which added considerably to the difficulty of treating it. It was found, however, that by adding enough sodium sulphide to the feed whenever the material was so oxidized that trouble resulted in flotation, the difficulties were minimized and that the lead and zinc could be saved by differential flotation.

The tailing, 10% of which was plus 48 mesh and 60% minus 200 mesh, is hydraulicked directly to the boot of a small bucket elevator at a dilution of about 6½ to 1, and raised high enough to flow by launder directly to the 8 x 10-ft. equalizing tank which feeds the mill. The pulp is agitated slightly in this tank to keep it in suspension; and at the same time just enough No. 5 G.N.S. pine oil and occasionally a little hardwood creosote are added to give a good stiff froth in the lead machine.

Modified K. & K. Machine Used

The lead-flotation machine used is of the general K. & K. type, but has been divided into five cells, so that the entire feed flows through these in series. The collecting chambers of the machine are equipped with scrapers to take off the top three inches of lead froth, which is carried 14 in. deep in treating this material. Ample stratification of froth is thereby insured. This depth of froth is maintained constant, as the water level in the cells is regulated by means of a gooseneck overflow. A fairly well-defined differential separation of the galena froth on top of the blende froth is obtained, and most of the blende is kept down by choosing the proper oil to lift the galena. Some of the finer blende would lift almost as readily as would the coarser galena particles, so that a proportion of the former would find its way into the lead float; whereas the coarser and less flotable lead had to be left to come up later with the zinc float on the next machine.

Lead Froth Goes to a Deister-Overstrom

The lead froth is broken down with a little No. 5 pine oil and high-pressure water sprays, and then sent, at a dilution of 7 to 1, to a Deister-Overstrom table for cleaning. The tailing from the lead machine is taken by launder to the zinc machine. Enough No. 350 Pensacola and coal-tar oil is added to the pulp in the launder to make a thin, emollient froth in the zinc machine; and a little copper sulphate was also dripped into the pulp to encourage the lifting of the zinc blende.

The zinc machine is of the same general construction as the lead frother, with the exception that the float is permitted to overflow continuously from the five collecting cells, instead of being scraped off (as was done in the lead machine) with the top of the lead froth. This zinc froth is not carried as deep as the lead froth, being purposely made more unstable. Enough water is added at the overflow launder to dilute the zinc concentrate to a consistence of about 7 to 1, and it is then taken to a Deister-Overstrom table to be cleaned. The tailing from the zinc frother, assaying about 1.2% zinc and 1% lead, goes directly to the creek.

Froth Concentrates Cleaned on Deister-Overstrom Tables Suitably Adjusted

Much of the success of the operation, from a commercial standpoint, is due to the fact that the galena and blende could be separated from one another fairly well on the Deister-Overstrom tables by giving them proper slope and by adjusting the speed and character of the stroke. It is impossible to obtain very clean froth concentrates, either of lead or zinc, when raising the float only once.

The lead table is set so that the front end of the table is about ½ in. higher than the feed end, thus forcing the concentrate to travel slightly uphill. The table is run with a short and sharp stroke, and at a high speed, so as to throw the lead ahead of the zinc. Frayed burlap is tacked along the edge of the feed box, to submerge the froth concentrate as it drops on the table. Little trouble has been experienced from floating of the concentrate on the surface of the table water.

At the front of the lead table a fairly broad band of galena, assaying from 70 to 75% lead and 3% zinc, is made. Then a middling streak assays 40% zinc and 10% lead, and the back water of the table carries 30% lead and 12% zinc. The back water and the lead band from the front of the table are settled together in concrete bins near the railroad track, together with the lead band that was taken from the front of the zinc table. The zinc band joins the zinc band from the zinc table and is settled in the zinc bins.

The table taking the froth from the zinc machine is set about level and given a medium-speed, long stroke. From this table a narrow lead band is obtained, assaying 60% lead and 3% zinc, which is sent to the lead bin. The zinc band, which was fairly broad, carries about 35% zinc and 12% lead. The zinc concentrate is granular, and little trouble is experienced in settlement; but the lead concentrate is very slimy and difficult to settle to a reasonably low moisture content suitable for shipment.

Capacity of Plant and Operating Cost

The plant can treat about 90 tons of tailing a day, and produce about 4½ tons of lead concentrate and five tons of zinc concentrate. Water power is used, and two men are needed on each of the three shifts to operate the plant—one to do the hydraulicking at the settling pond, and the other to attend to the flotation machines. The entire cost of treating the pulp was 52c. per ton in 1917. The consumption of oil was, approximately ½ lb. coal-tar oil, ½ lb. No. 5 Pine oil and ½ lb. No. 350 Pensacola per ton of feed. About two pounds of copper sulphate was used per ton of ore treated. The concentrates were shipped to Anaconda, and about $40,000 gross was obtained for them during the year.

Today is an opportune time to send a check for the Comfort Fund of the 27th Engineers.

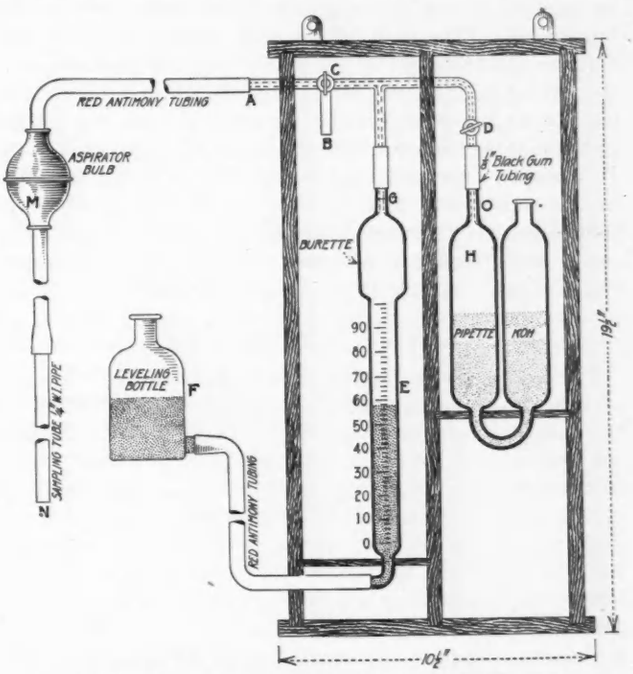
Coal Economy in Mine Boiler Firing*

The question of scientific control of flue gases receives scant attention in the majority of plants. The comparatively few large mining installations have complete organizations for control and research, and engineers who attend to such details; the small mining proposition cannot give the matter the attention it would deserve if operations were being conducted on a large scale; but among the number of medium-sized plants there are many installations where economical firing is little understood and scientific control believed to be an outside consideration. The following account of the underlying principles of fuel combustion and the description of a carbon dioxide recording apparatus should lead to a better realization of the feasibility of closer fuel control.

THE combustion of coal in a furnace is essentially a chemical process. The combustible in coal consists of carbon, hydrogen and sulphur. During the progress of combustion these elements unite with oxygen to form carbon dioxide, steam and sulphur dioxide, respectively. The air, which furnishes the oxygen for this process, consists of a mixture of 21% by volume of oxygen and 79% of nitrogen. Oxygen is the active element as affecting combustion, the nitrogen being inert and taking no part in the process. Every cubic foot of oxygen used in the combustion of carbon is replaced by one cubic foot of carbon dioxide. For this reason, the percentage by volume of CO_2 in the flue gas is an indication of the amount of excess air present in the furnace. A given amount of CO_2 will be formed for every pound of carbon burned. If just enough air is used for the complete combustion of the carbon, the oxygen will be replaced by the CO_2 formed and the latter will be the same percentage, by volume, of the mixture as the original oxygen. If twice as much air as necessary is used, the same volume of CO_2 will be formed as before, but this will replace only one-half of the oxygen used, and hence its percentage of the mixture will be only one-half as great as in the former case. These relations are affected somewhat by the fact that hydrogen and sulphur are present, but their amounts are too small to have an important bearing on the result.

If less than enough air is furnished for complete combustion, part of the carbon in the coal, instead of being burned to carbon dioxide, will form carbon monoxide. Under these circumstances the amount of heat liberated per pound of carbon, instead of being 14,600 B.t.u., will be only 4500 B.t.u. The difference, 10,100 B.t.u., will represent the heat lost for every pound of carbon burned to carbon monoxide.

A study of the amount of carbon dioxide (CO_2) in the flue gases affords the only practical means of obtaining a knowledge of conditions existing within the furnace on the basis of which correction or regulation to obtain the best results may be made. The importance of making CO_2 determinations, therefore, warrants a discussion of the methods by which these determinations may be made. Every plant should be equipped with some form of CO_2 analyzing apparatus, and the fireman or other employee taught to use it. As it is comparatively inexpensive, the outlay will be returned many times by the gain in efficiency and the consequent saving of fuel. For this purpose an Orsat apparatus or some of its modified forms should be used. The complete Orsat apparatus provides a means of analyzing for carbon dioxide, oxygen, and carbon monoxide; but as the CO_2 content gives a sufficiently accurate indication of the amount of excess air passing through the fire, the analysis for the other two gases may be omitted and the apparatus used in its simplest form, as shown in the accompanying illustration. This consists merely of a pipette, *H*, to hold the solution (potassium hydroxide), a measuring burette, *E*, of 100 c.c. capacity, a leveling bottle, *F*, containing water, and an aspirating bulb, *M*. The solution may be made by mixing equal weights of potassium hydroxide (KOH) and water. In the absence of this chemical, concentrated lye may be used.



APPARATUS TO DETERMINE CO_2 IN FLUE GAS

Method of Operating the Recorder

In using the CO_2 apparatus, the liquid in the pipette, *H*, is first brought to the mark, *O*, just below the cock, *D*. This can be done by lowering the leveling bottle, *F*, after which the cock, *D*, should be closed. The three-way cock, *C*, is then opened to the burette, *E*, and to *B*, and by raising the leveling bottle, *F*, the water in the burette is brought to the mark, *G*, and the cock, *C*, closed to the burette, and opened through *A* and *B*. The aspirating bulb, *M*, is now worked, drawing gas from the sample tube, *N*, in the setting and forcing it out through *B*. When sufficient gas has been forced through to clean out the air and dead gas from the sample tube, the cock,

*Abstracted from Circular No. 7, April, 1918, issued by the University of Illinois Engineering Experiment Station.

C, is turned so that *B* is closed, and *A* is in communication with the burette, *E*. The sample is then pumped into the burette, thus driving the water into the leveling bottle and more than filling the burette. The leveling bottle is then raised until the water in the burette stands exactly at 100 c.c., the rubber tubing between the leveling bottle and the burette is clamped between the thumb and finger so that no change in the level at 100 c.c. can take place, and the cock, *C*, momentarily opened to the atmosphere, through *B*, and then closed to the burette. If this has been done correctly when the two surfaces, *E* and *F*, are brought to the same level, *E* should stand at 100 c.c. An alternate method of obtaining 100 c.c. at atmospheric pressure is to have the three-way cock open through *A* to *C* and closed to *B*. The gas may now be forced out through the liquid in the leveling bottle, *F*. The water at *F* and *E* may now be brought to the same level and the cock closed to the burette, *E*. The cock, *D*, is now opened and the gas driven into the pipette, *H*, by raising the leveling bottle. It should be driven back and forth between the burette and pipette several times, and then the liquid in the pipette brought back to the mark, *O*, and the cock, *D*, closed. The surfaces, *F* and *E*, are again brought to the same level, and the amount of CO_2 in the gas sample is read from the burette at *E*. This operation is easily performed, and a fireman of ordinary intelligence can analyze a sample in about two minutes.

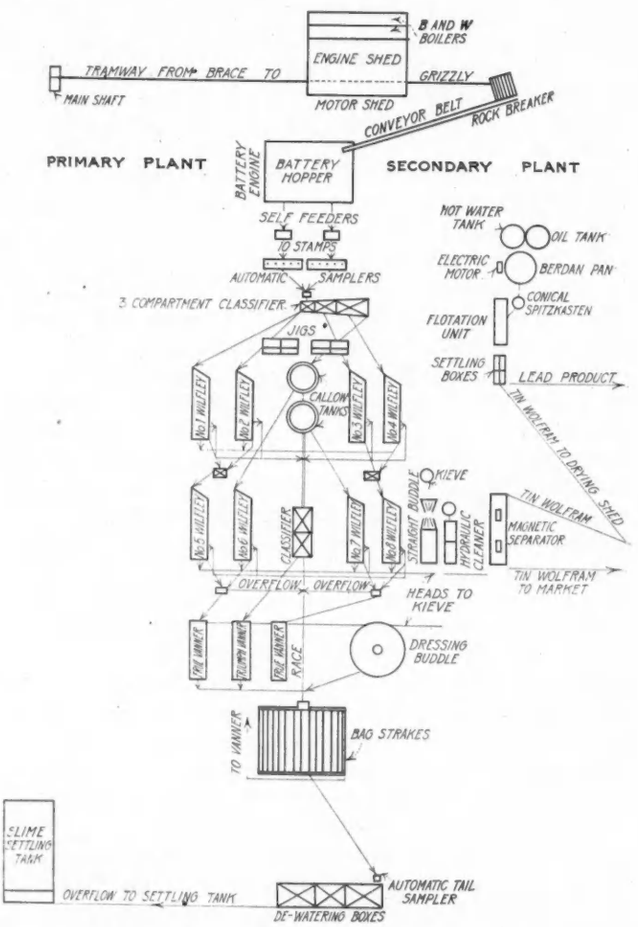
Details To Be Observed

There are several precautions which should be observed in taking samples. There must be no leaks in the rubber tubing or connections. If air leaks in during the analysis, it invalidates the result. The sole object in making an analysis is to determine what the fire is doing at the time the sample is taken; hence the apparatus should be hung on the setting at a point as near as possible to where the sample is taken, in order to reduce the amount of piping and rubber tubing between the sampling tube and the analyzer, and to insure a sample representative of conditions at the time. If the sample is conveyed through tubes of considerable size and length, as is usually the case with a CO_2 recorder or even with a CO_2 indicator, the analysis is made from 5 to 15 min. after the sample is taken. Thus a hole in the fire may be disclosed by the analyzer 5 or 10 min. after its initial occurrence and even after its disappearance by filling up. The CO_2 recorder, therefore, is useful for giving an idea of the average operation over a long period, but is not satisfactory as a means of determining the proper relation between load, draft, fuel-bed thickness, and other conditions. The determination of such relations involves simultaneous readings.

Tube-Mill Pebbles, Linings and Dimension Blocks are made from a fine-grained, hard quartzite, quarried near Jasper, Minn., and containing, besides quartz, only very small amounts of silicates and a little iron oxide, according to the U. S. Geological Survey. This is worked into cubical or roughly rounded blocks comparing favorably in hardness, toughness, specific gravity and grinding efficiency with imported flints. Use of a full load of such blocks undoubtedly reduces the capacity of a tube mill until the square edges are worn off, subsequent reduction being rather slow. By feeding such blocks in small quantities, they may undoubtedly be used more efficiently.

Triple Concentration Practice For Tin-Wolfram-Lead Ore*

Three methods of concentration—table, flotation, and magnetic—are in use at the Butler mine, near Torrington, N. S. W., where a tin-wolfram-lead ore is being treated. The lode is worked by an adit level 920 ft. long, and also by a main shaft. The deepest point in the workings is 315 ft. from the surface. Payable ore has been opened up above Nos. 1 and 2 levels and at No. 3 intermediate level, 300 ft. A considerable amount of development had been done before the company now operating the mine took over the property and started to erect the plant for the treatment of tin ore. When milling began in July, 1916, it was found that the percentage of lead in the ore made the concentrates unsalable. The average assay of the concentrates was 53% Sn, 12% WO_3 and 5% Pb. In order to overcome the trouble, it was decided to install a Minerals Separation flotation unit for the recovery of the lead, and a magnetic separator to take out the wolfram. The accompanying flow sheet shows the complete course of treatment in the mill.



FLOW SHEET OF TRIPLE CONCENTRATION PLANT AT THE BUTLER MINE

The primary treatment section includes a 10-head battery of 1250-lb. stamps. The crushed ore, after passing the automatic sampler, goes to a three-compartment

*Abstracted from "Chemical Engineering and Mining Review."

classifier. The first compartment feeds Nos. 1 and 2 Wilfley tables, the second compartment No. 3 Wilfley, and the third compartment No. 4 Wilfley. The overflow from the classifier goes to two Callow tanks, from which the thickened product is fed to Nos. 5, 6 and 7 Wilfleys. The overflow goes to the setting box and thence to the vanners. The heads from 1 and 2 Wilfley go to hydraulic cleaners, and the heads from 3 to 4 to keeve. The seconds from 1 and 2, also 3 and 4, are re-treated on Nos. 5 and 8 Wilfleys. The heads from Nos. 5, 6, 7, 8 tables go to keeve on buddle, the seconds to vanner, and the tails to race.

The tails from the race pass into a V-box with 1½-in. opening 3 in. from the bottom for the escape of coarse sands, and the overflow is distributed over bag strakes. The fine material from the strakes is re-treated on the Triumph vanner. Below the strakes the overflow joins the coarse sand discharged from the V-box, before passing through the tail sampler and into the three-compartment dewatering box, thence going to the slime-settling tank. The overflow from the slime tank is returned by pump to the battery feed tank. The extraction given by the wet-concentration plant, Wilfley tables, Frue and Triumph vanners, is 80.0% Sn, 67.7% WO_3, 66.0% Pb. Owing to the high percentage of slime, the result is considered excellent.

In the secondary treatment, after being dressed, the tin-wolfram-lead concentrates are sent to a Minerals Separation flotation unit. The leady concentrates are floated off into settling boxes for subsequent re-treatment, and the tin-wolfram product remaining is dried and treated by magnetic separator. A Berdan pan is installed for regrinding any portion of the leady concentrates considered too coarse for flotation. The flotation unit gives a lead extraction of 98%. The magnetic separator, which is of the motor type, gives a marketable product when working on a fairly coarse tin-wolfram concentrate, but it not comparable to the Wetherill type in dealing with fines, owing to the amount of re-treatment required.

C. Lonsdale Smith is the mine manager, and James Mackay, of Melbourne, is legal manager.

Amalgamation as a Preliminary To Cyaniding*

One of the chief advantages accruing from the practice of milling in cyanide solution is the intimate contact resulting between coarse metal and solvent, caused by the action and operation of the grinding machinery. This advantage shrinks in importance in the case of amalgamable ore when consideration is paid to the fact that milling in cyanide precludes the possibility of the practice of amalgamation, or renders its function only partly effective. If any quantity of the metal in an ore can be obtained by a simple and direct method, an explanation is needed for the substitution of a complicated solution alternative which actually recovers only a proportion.

In the case of gold ores, and in spite of clear enunciations of the actual facts disclosed by milling results, a good deal of misapprehension exists; and the question has been complicated and the issue beclouded by reference to the efficiency of amalgamation with unamalgamable gold ores. Such considerations do not affect the question. If a proportion of the gold in an ore is amalgamable, then practically 100% of this proportion is recoverable. If cyanidation replaces amalgamation as a treatment process for this proportion, then only from 90 to 95% is usually recovered.

The arguments advanced in favor of part amalgamation have, as far as I am aware, been used only as referring to amalgamable gold; and it is therefore untenable to claim that this gold may not amalgamate. In special but exceptional cases the recovery of gold by cyanidation may reach 97%, but in no single instance has a recovery of 100% been recorded with any professional claim to verisimilitude. These facts may be substantiated by milling barren material similar in physical characteristics to the ore usually found in gold-treatment plants, and mixing with this a proportion of coarse gold recovered by the amalgamation process. No matter how fine the ultimate division of the mixture, there will remain a small percentage of the original amount of gold, associated with the gangue, after complete milling in cyanide and filtration treatment on a working scale.

A second method of beclouding the issue is to draw attention to the total amount of gold dissolved or extracted by cyanide and to ignore the question of recovery. Finely divided gold may be completely dissolved in a cyanide solution, and thus completely extracted from the ore; but when associated with gangue as an average grade material, such extracted gold cannot be completely recovered by any combination of known metallurgical processes operating on a working scale. All or nearly all the gold may be dissolved and a high percentage may be recovered as bullion. The loss of the balance influences the contention in favor of efficient amalgamation of gold ores.

*Excerpt from an article on "Milling in Cyanide Solution," by A. W. Allen, Met. and Chem. Eng., May 15, 1918.

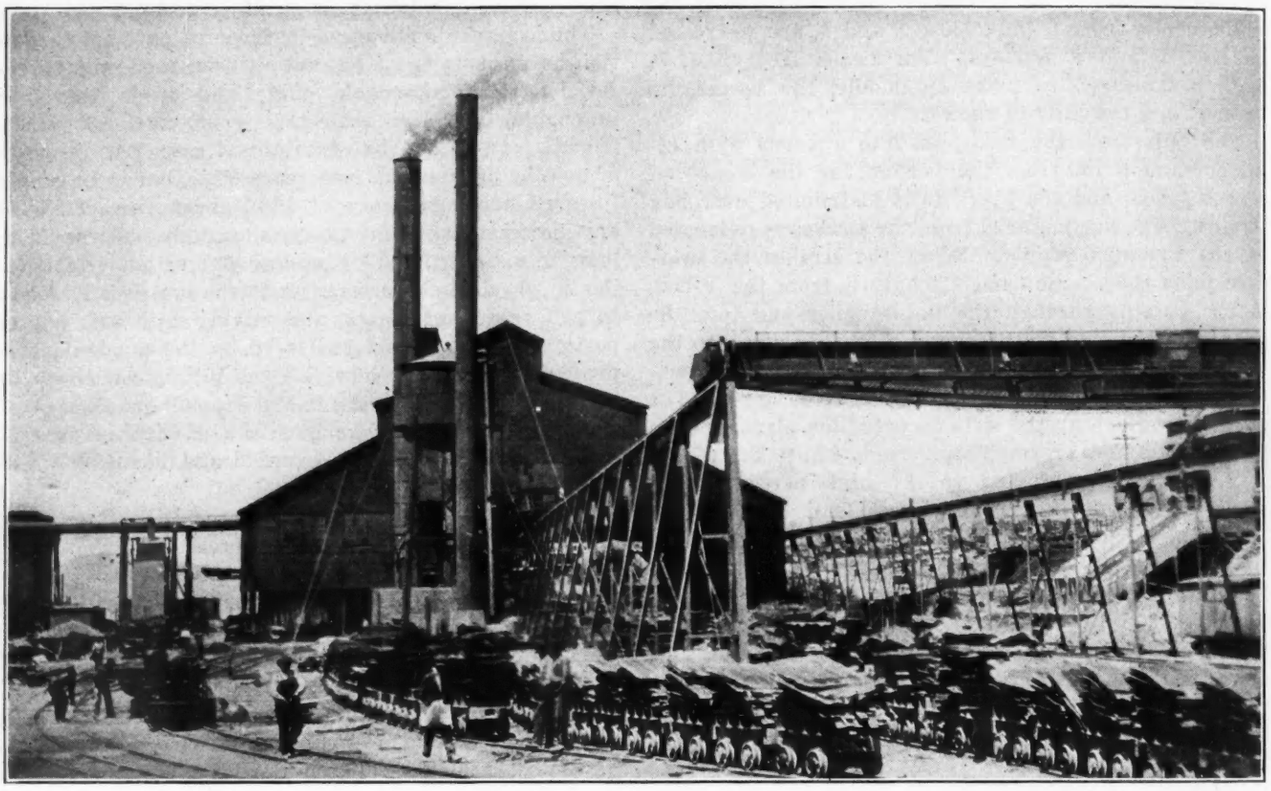
Negligence in Blasting Operations

BY A. L. H. STREET*

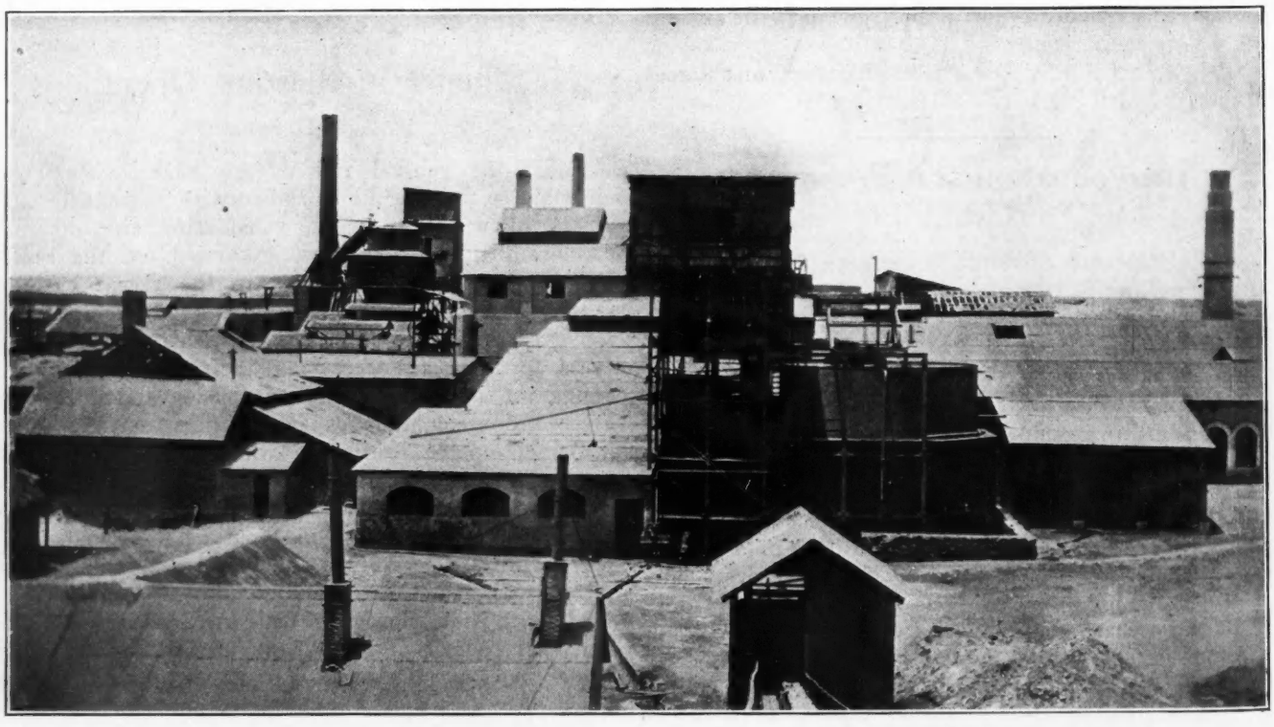
Under the general rule of law that an employer is bound to provide his workmen with reasonably safe places in which to work, considering the inherent dangers incident to the work carried on, the South Dakota Supreme Court holds in the recent case of Peterson *vs.* Otho Development Co., (*166 Northwestern Reporter, 147*), that failure to furnish reasonably good fuses for blasting operations, thereby increasing the danger of shots remaining unexploded and of miners afterward accidentally exploding them, may be found to be actionable negligence which renders the mine owner liable for resulting injuries. But the same opinion holds that, under the laws of South Dakota, any such negligence is wiped out as a ground for a personal-injury action when it appears that the injured miner was experienced, and voluntarily remained at work with full knowledge that fuses used were poor and that there had been many misfires in the mine. Under such circumstances, the miner is held to have assumed the risk thus voluntarily encountered.

*Attorney at law, 820 Security Bldg., Minneapolis, Minnesota.

Cottrell Precipitation in South America

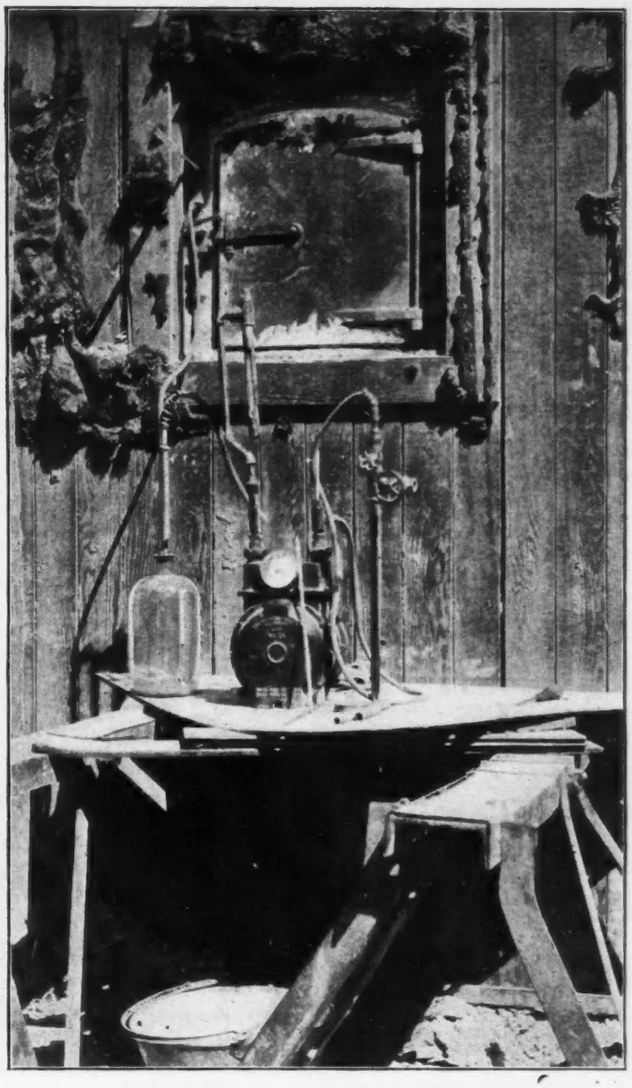


PRECIPITATION PLANT OF CHILE EXPLORATION CO. AT CHUQUICAMATA, CHILE, SHOWING STACK AND FUME

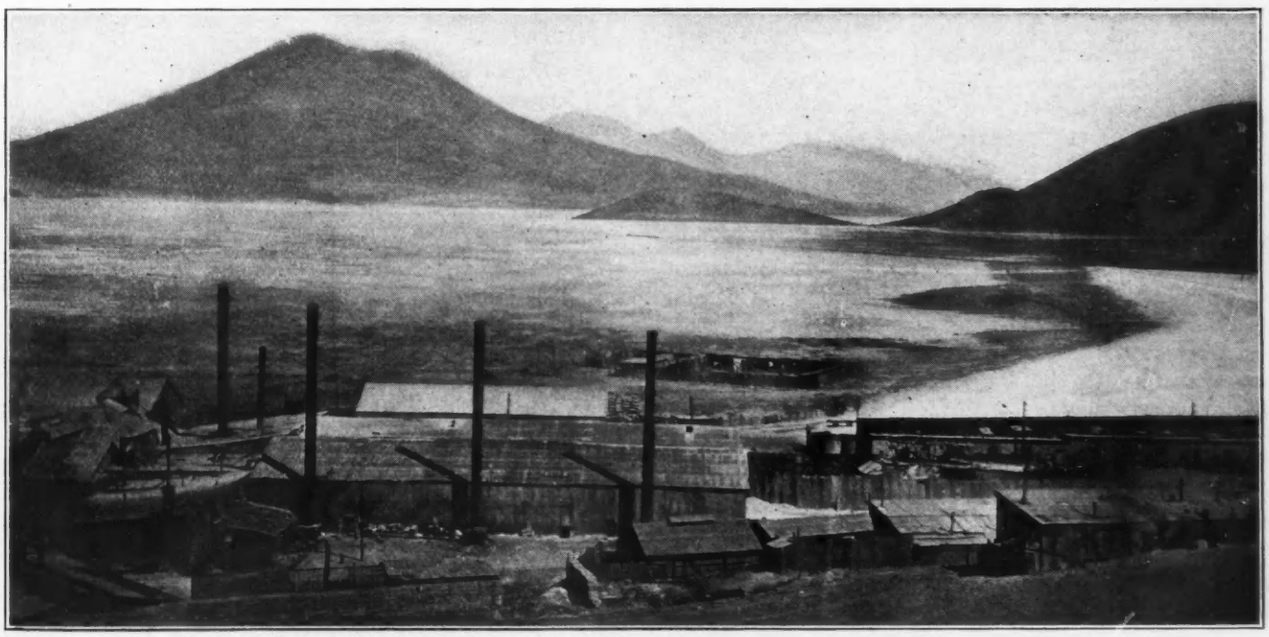


GENERAL VIEW OF TIN CONCENTRATOR OF CIA. MINERA DE ORURO, MACHAMARCA, BOLIVIA

TESTING REVERBERATORY STACK GASES AT CIA. MINERA DE ORURO, MACHAMARCA, BOLIVIA



DUST DETERMINATIONS AT DUST CHAMBER, BORAX CONSOLIDATED, LTD., CELLOBAR, CHILE



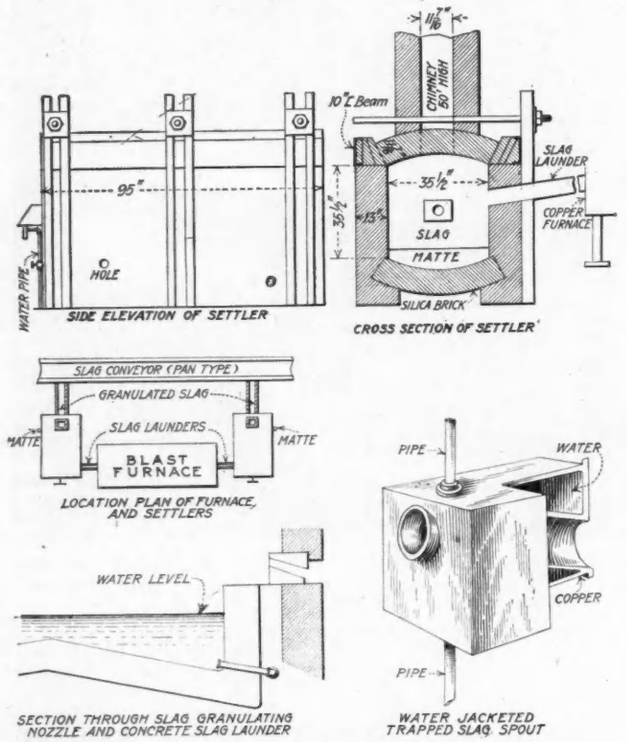
PRECIPITATION PLANT OF BORAX CONSOLIDATED, LTD., CELLOBAR, CHILE

Reverberatory Fore-Hearths

By Lindsay Duncan*

The copper ores treated in the blast furnaces of the smeltery of the Compagnie du Boleo at Puerto Santa Rosalia, Mexico, are exceedingly refractory, running high in silica and alumina and low in iron and sulphur. Furthermore, no fluxing ores are available at reasonable cost, nor have the company's engineers been able to discover any barren flux within a convenient distance from the plant. These conditions were partly overcome by maintaining a narrow smelting zone in the furnaces and a high temperature (1500° C.) of the slag.

The cuprous products are mattte containing 62% copper and black copper assaying about 96%. It was inevitable that slag losses under these conditions should be high, as particles of matte were entrained in the viscous slag. Settlers of the ordinary type were of little use, on account of the high temperature at which the slag solidified. At times the copper in the slag ran higher than 2%, and the general run was between 1.2% and 1.8%, with an average, over a considerable period, of 1.35%. It occurred to me that it would be possible to build a settler in the form of a small reverberatory, and extract a considerable part of the copper which was entrained in the slag in the form of matte and black copper globules.



DETAILS OF REVERBERATORY FORE-HEARTHS

The installation was absurdly simple and resulted in reducing the copper content of the slag to 0.9%, with a metal recovery of between 5000 and 6000 lb. of copper per day for the entire plant. The fuel oil consumed was insignificant in amount, and no additional labor was required. The slag flowed continuously from the furnace through a trapped water-jacketed outlet made of cast copper and was led through a cast-iron launder directly into the settler.

Under good conditions the furnaces handled 250 tons of charge per day and made 180 tons of slag in that period. There were two slag spouts, one at each end of the furnace; and a settler was built at each end to handle 90 tons of slag per day, or 3.75 tons per hour. The molten slag weighed about 80 lb. per cu.ft. The settlers were designed to contain $\frac{9}{10}$ ton of slag, giving an average settling period of about 15 min. A water-jacketed orifice was built into the settler, and the slag flowed continually from the settler into the granulating launder. The matte recovered was dirty, and it was necessary to recharge it into the blast furnaces.

A diagram of the general arrangement of the plant is reproduced, together with details of the settler, slag granulating nozzle and water-jacketed slag spout.

*Mechanical engineer, Nevada Consolidated Copper Co., McGill, Nevada.

New 7000-Ft. Shaft for a Transvaal Mine

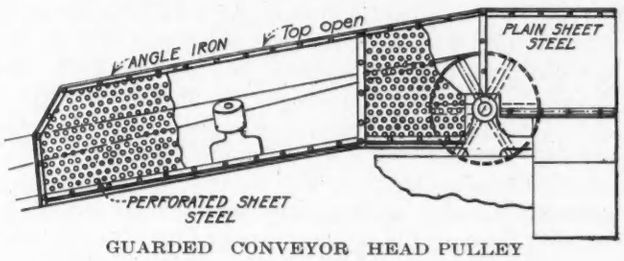
The question of the best method of working the lowest portion of the City Deep mine, a considerable area at 6000 ft. or more, has received careful consideration by the technical advisers and by the board, stated the chairman at the recent annual meeting. There are two methods—the first to develop the area by continuation of the present inclines, and the second to sink a new vertical shaft from the surface in the southern portion of the property. Experience has shown that the sinking, equipment and operation of long incline shafts at great depths are extremely expensive; in fact, there is doubt as to the practicability of keeping a large incline shaft open at a depth of 6000 ft. or thereabouts. The problem of ventilation is difficult of solution, and, further, it would be extremely difficult—probably impossible—to get a sufficient volume of air through the incline to the lowest workings of the mine to keep the temperature down satisfactorily. It would be necessary, to achieve this essential object, to have direct communication to the surface. The incline shafts are designed to work to a depth of 3500 ft. on the incline—that is, at No. 2 shaft to the 21st level, and at No. 1 shaft to the 24th level, leaving in each case a further length of about 3000 ft. on the dip to reach the southern boundary.

It has been decided that, on the score of both cost and efficiency, a new circular shaft from the surface is the best method of dealing with the problem. The cost of sinking and temporary equipment is estimated at £239,000; and for permanent equipment for a large tonnage a further £192,000 would be required. The exact depth of the shaft cannot be estimated until the reef is intersected, but provision will be made to reach a depth of 7000 ft. if necessary. The time required for sinking the shaft will be about five years, and another two years beyond that will be necessary for development connections—that is, a period of seven years will elapse before stoping operations can be started. Any attempt effectively to develop this southern area with the present inclines would fail. The slowness of incline-shaft sinking, and its eventual expense; the cost of added equipment underground for the rehandling of the ore; the heavy maintenance costs of the shafts at depth, and the ventilation difficulty are all factors which, combined, point to the distinct advantage of a new vertical shaft from the surface.

Conveyor Pulley Guards

BY GEORGE M. DOUGLASS*

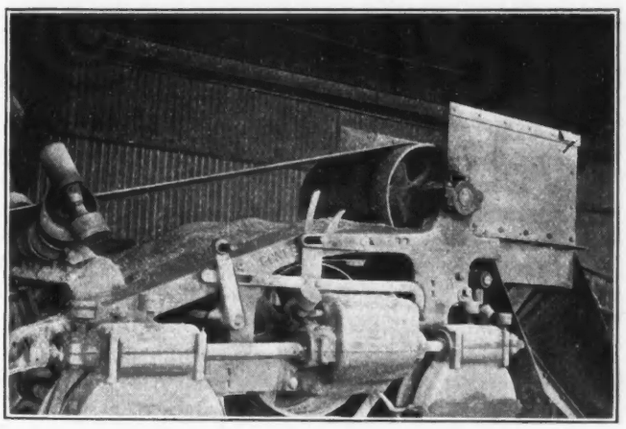
Conveyor-belt head pulleys and trippers should always be carefully protected. An unguarded intake or point of contact between pulley and belt is a menace to life and limb of not only the ignorant workman but of those who are considered expert and familiar with their work. It is not that a workman places his hand or any other part of his body near these danger points knowingly or purposely. He may be so intent on his work that he is oblivious to any danger. He may stumble; and it is common knowledge that when a person stumbles he invariably and involuntarily throws out his arms to protect himself, often with disastrous results.



GUARDED CONVEYOR HEAD PULLEY

It is well to cover the surface of head pulleys with a layer of rubber or leather belting, securely riveted, especially where there may be possibility of slippage. When the belt slips on the head pulley there is something wrong with the design, or the belt is being improperly fed or loaded.

It is a simple matter to guard such a danger point. There is seldom any condition, restricted space, for example, that would interfere, but this cannot always be the case when it comes to the guarding of drives for conveyor belts. Often these seem to be put in as an afterthought and jammed into as small a space as possible, which may create an unsafe or dangerous condition. Plans should be laid out in such a way that there will be ample room for attendants to get at every part in perfect safety; and this can be accomplished only when plenty of room is allowed. A simple and efficient type of conveyer pulley guard is shown in the accompanying cut. The halftone illustrates an unguarded and dangerous tripper.



UNGUARDED TRIPPER

*General safety inspector, American Smelting and Refining Co., 120 Broadway, New York.

Madagascar Graphite Exports

Shipments of graphite from Madagascar to France are now prohibited, except on notice to the contrary, and inasmuch as there is no indication that they may be resumed soon, considerable anxiety is felt in graphite-mining circles, says a consular report. Practically no purchases or new contracts are being made, and mining operations are being greatly curtailed.

Several weeks ago it was officially stated that 2000 tons of graphite per month would be needed for the national defence before the quantities for direct exportation to the United States could be considered. Subsequently, the restriction in the importation of graphite into the United States was announced in Madagascar. This has had a discouraging effect upon the local industry, inasmuch as it had been expected for some time that the prohibition of the direct shipment of graphite to America would be raised.

Although it would not appear that any authorization for the exportation of graphite to the United States has yet been given, the governor general states that of the 2000 tons of this mineral to be reserved monthly, 1450 tons is intended for England, to be shipped by the Graphites Maskar Co., affiliated with the Morgan Crucible Co., of London, and the remainder is to be shipped to Marseilles. He also advises that requests for shipment to the United States will receive, as far as the quantities are available, favorable consideration from the French Ministry of Armaments, provided such requests are sustained by the War Trade Board.

The estimated production of graphite in Madagascar in 1917 was 35,000 tons, and the exports amounted to 27,838 tons, of which 16,506 went to England and 11,332 tons to France. Although no direct shipments have been permitted to go forward to the United States, it is understood that 8000 tons reached that country from Marseilles in 1917, and a considerable quantity has also been shipped from that port during the present year, principally through a consortium of French firms which, up until now, has controlled the bulk of the output of Madagascar graphite other than that shipped to England. Inasmuch as the French firms belonging to this consortium are represented in Madagascar, it is not unlikely that they will endeavor to control such graphite as may be now shipped to the United States direct from the island, though it would appear that various independent producers are endeavoring to form direct connections with the American importers.

The present state of the industry does not warrant the belief that large quantities of the 1918 production of graphite will be available for shipment to the United States. On the other hand, 10,000 or 15,000 tons of graphite is said to be available in the colony from the 1917 production, and may be exported to America. If the French authorities continue, for any considerable time, to prohibit the exportation of graphite to France, and release the 550 tons per month said now to be reserved for that country, the quantity available for exportation to the United States will be even greater, provided that there is a demand for it in the United States and that licenses may be obtained for its importation. Direct shipments continue to go forward to England at the rate of about 1500 tons per month, and this rate will no doubt be maintained.

Correspondence and Discussion

Recent Developments in the Chilean Nitrate Industry

Since the autumn of 1917 important events have occurred with regard to the production and marketing of nitrate. The price of oil has continued to rise, so that users have been looking to the possibility of burning Chilean coal. The selling price of nitrate rose likewise, which developed a local "bull" market. This quickly carried the price to impossible figures; and the Allied governments decided to centralize their purchases by means of one agency in Chile. The effect was instantaneous in reducing the price. The "bull" contingent was demoralized, and the head of it, a wealthy Chilean, was badly hit financially.

Production cost and selling price have been coming nearer; in the case of some nitrate plants they are identical. This is due to the high cost of supplies. The exchange ratio of the Chilean peso in terms of foreign money during the last year has greatly increased, so that costs of labor and local supplies are liquidated in Chilean currency, purchased by drafts on London, for example, at a serious discount. Those oficinas which are not prepared to meet the situation by technical improvements and greater general economy are now faced with the prospect of closing their plants, if conditions do not soon change.

During the last winter an interesting transaction took place in Chile whereby a large tonnage of refined nitrate was sold, involving the Chilean government, the du Pont powder company (through its Chilean branch, the du Pont Nitrate Co.), the German government, and the Allied governments. In 1914, Chile had a reserve of gold in Germany, and after the war broke out was unable to obtain its release until recently, when Chile arranged to purchase the stock of accumulated nitrate in the idle German oficinas, paying for this by means of the gold in Germany. This nitrate was then resold to the du Ponts for use in making munitions for the Allied governments.

The erection of synthetic-nitrate plants in the United States is said to be proceeding rapidly, and in a reasonable time there will probably be a supply of nitrate within the United States for military needs. The German nitrate plants are now idle, without fuel, means of transport, or possibilities of resuming work. The Chileans have become disturbed over the serious situation, and Chilean publicists are today much concerned over the future of the Chilean nitrate industry and how they may reduce operating costs so as to compete with the much-dreaded synthetic nitrate and at the same time permit the Chilean government to live its previous life of ease, with money derived from the heavy export tax (and, lately, the super-charge) on nitrate.

The latest proposal is that the nitrate producers are to pool their production, to be disposed of by one selling agency, operated under the supervision of the Chilean government, in order to counteract the effect of the purchasing agency maintained by the Allied governments. The results will be awaited with interest. Unless radically altered, most oficinas can effect only minor economies, but the adoption of more modern treatment methods would provide a great increase in nitrate recovery for a small increment in cost of operation. Oficinas taking this step will be on a war footing and can continue safely; the rest either hope to "find a big nugget," figuratively speaking, or an opportunity to appeal to the government for legislative action and subsidy. Within the last six months the complacency of the Chilean nitrate producers and the Chilean government has been shaken, and there is much searching of soul among those who hitherto have confidently trusted in a so-called "natural monopoly" that is rapidly losing its characteristic of monopoly before the threat of an artificial product.

DONALD F. IRVIN.

Antofagasta, Chile, June 12, 1918.

Protect Mining and Smelting Enterprise

A short time ago a representative of the Magnolia Metal Co. was granted an interview at Washington by Senator Charles B. Henderson, of Nevada, who is chairman of the Mines and Mining Committee of the Senate. We were anxious to know what hopes there were for smelters who are not in the protected class.

For several years we have been endeavoring to discover a way to smelt antimony in competition with the Chinese, and we are about to enter the field of tin smelting in this country. Before doing so, however, we wanted to know, if possible, whether such a large investment of capital would be justified. As most miners and smelters know, a bill of vital importance to the industry, No. 11,259, has been passed by the House. This bill is now in the Senate, being considered in committee under the chairmanship of Senator Henderson. Our reception by Senator Henderson was most cordial, and we could plainly see that, if he has his way, the American miner and smelter of the metals controlled by the above bill will have nothing to fear as a result of investing capital and time in trying to increase the supply of the several much-needed metals that the bill mentions. Senator Henderson patriotically gave up all hope of a vacation, and consented to remain in Washington during the summer to whip the bill into shape for early consideration.

It occurs to me that the producers and smelters of the ores and metals under discussion should help Senator Henderson's committee to the utmost by gathering the fullest information concerning these metals. It is only by united action that true help can be given. Each individual, when acting alone, can only hope to treat the matter inefficiently; but if the miners of all these ores and the smelters could get together and form an association, it would be possible to maintain a secretary at Washington whose business it would be to gather the

minutest details of the whole question, and be ready at any minute to answer a call from Senator Henderson or from Congress itself, and furnish immediate information on any part of the subject. This would be immensely helpful to Congress, and, at the same time, no good argument in favor of these metals would be allowed to escape notice.

I recommend this idea to the earnest and immediate consideration of miners and smelters of antimony, tin, arsenic, bromine, chromium, abrasives, graphite, magnesite, manganese, molybdenum, mercury, platinum, pyrite, potash, sulphur, tungsten, vanadium, and mica, and to any others who may take a personal interest in the great helpful work now being undertaken by Senator Henderson.

E. C. MILLER,
President, Magnolia Metal Co.

New York, Sept. 6, 1918.

Mine Sampling and Mining Method

Mine sampling is interesting in its details, but one point of view has to a considerable extent escaped attention, although it is of primary importance in such mines as the Alaska Gold and the Alaska Juneau. In some mines the nature of the ore is such that the grade of ore mined must approximate the grade shown by the sampling, but in other deposits the grade of the ore that comes from the mine is determined by the man in charge of the stoping. For example, in such deposits as those in the Cœur d'Alene, the grade of ore sent to the mill depends almost entirely upon the method of mining used and the man who is in charge of the work.

My personal experience leads me to believe that examining engineers are too prone to sample an orebody without first having decided upon the method of mining that will be best suited to winning the ore. I believe that the "method of mining" should be decided upon before sampling begins, as unless the ore can be mined so as to obtain an approach to the grade indicated by the sampling, the results based upon the examination are of doubtful value.

It would not only be interesting but also highly important if readers of the *Journal* would send in data showing how the grade of ore sent to the mill compares with the grade indicated by the sampling of the stope when different methods of mining are used.

Salt Lake, Utah, June 16, 1918. C. T. R.

Drill-Steel Punching Machine

Several years ago an article was published in the *Journal* describing a drill-sharpening shop which had been established at the Gardner shaft of the Copper Queen mine. In that article a machine was described, operated by compressed air, for punching out the bits of hollow steel, which was first built in our shops. This has since been copied by other manufacturers, and I note particularly in your issue of Aug. 3 a description of one made by the Denver Rock Drill Manufacturing Co. I believe both the Ingersoll-Rand Co. and the Sullivan Machinery Co. manufacture others of generally similar design for the same purpose.

This device was originated and built at the Gardner shop. It is impossible to say now who was the inventor, but the credit should lie mainly with George Mieyr, master mechanic at that time, although it is probable that studies made by two engineers, A. F. Simpson and E. R. Rice, in calling attention to the time spent in punching by hand and the need of such a machine, may have led to it.

In none of the articles describing other punching machines have I seen credit given to the men who developed a device of great importance to every user of hollow drill steel. As it was not patented, the inventors made a present of it to the mining industry. I believe they have credit due them from the mining profession. If some reference could be made, in the same department of your publication, to the first article, with the date, and others following it, I believe it would be very acceptable. An article on the tool-sharpening shop at Jerome might be compared with the original.

It is interesting to note that most of the manufacturers perpetuate an unnecessary feature of the machine. The machine for the Gardner shop was made from a pair of cylinders from a hoisting engine, used in operating brakes, and consisting of an air or steam cylinder and an oil-cataract cylinder. That was used for no other reason than that it was available. Equally good results could be obtained with the single cylinder.

Bisbee, Ariz., Aug. 21, 1918. GERALD SHERMAN.

Use of Coke-Oven Gas in Zinc Smelting

I have read with a great deal of interest the description of the zinc-smelting works of Vado Ligure in the *Journal* of Aug. 3, and the editorial note regarding the use of coke-oven gas for heating zinc furnaces.

In the early part of 1914 I was in Germany, and while there visited the Hamborn works of the Actien Gesellschaft für Zink-Industrie, where a Rhenania roasting furnace was being operated, as well as a distilling furnace, with coke-oven gas. This gas was piped several miles from the coke ovens of the Gutehoffnungs Hutte. The retort furnace in use was a typical Rhenish furnace, the gas and air burning up between the center walls, and the products of combustion coming down around the retorts and thence into counter-current recuperators, where the air for combustion was preheated. The furnace, as I remember it, contained 240 retorts. A gas holder was used, as in the Italian works, but even with this gas holder, which acted more as a pressure regulator than as a reservoir, great difficulty was experienced with changes of pressure, which increased or deceased the flow of the gas. Though this would not be so important with ordinary producer gas of relatively low calorific value, it was much magnified with the coke-oven gas, which contained something over 500 B.t.u. per cubic foot.

The furnace when I saw it had been operating about six months, and it was planned to equip the entire works, containing 12 such furnaces, with coke-oven gas, if the difficulties in regulation of temperature in the laboratory could be satisfactorily overcome. There was considerable talk in Upper Silesia of this same method of firing, and, I believe, with the tremendous development of the byproduct coke oven in Germany primarily for the byproducts, that it is not at all improbable that some of the large producer gas-fired Silesian smelteries have gone over to the use of coke-oven gas.

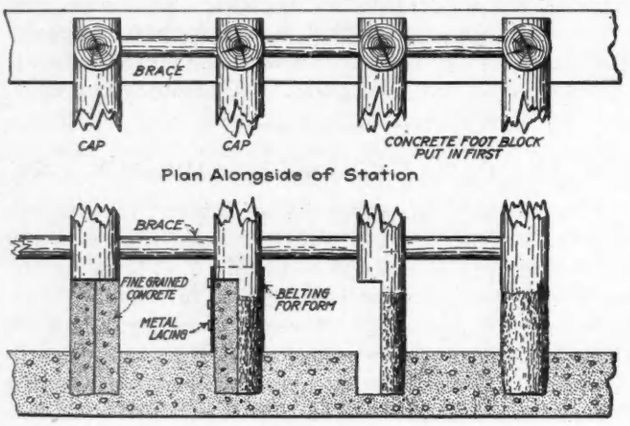
New York. Aug. 7, 1918. J A. SINGMASTER.

Details of Practical Mining

Concrete Foot Blocks for Station Posts

BY C. T. RICE

The station at the 1200 level of Hecla shaft, Burke, Idaho, is 35 ft. wide, 80 ft. long and 20 ft. high, and in the rear are situated the pumps and the charging station for the storage-battery motor, used in hauling ore trains. This station is timbered with round posts and caps put in with 5-ft. centers. Center posts are placed about 20 ft. out from the shaft to reinforce those sets that extend across the full width of the station in the pump portion. The posts at the shaft side of the



RE-FOOTING STATION POSTS WITH CONCRETE

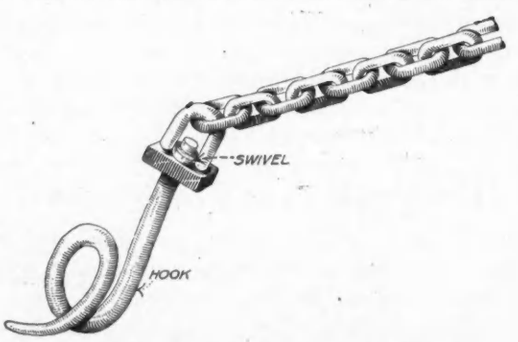
station are 25 ft. long, and those at the other side about 20 ft. The back is strong and gives little trouble, although a slight slabbing tendency has developed, and about a year ago it was noticed that some of the timbers were settling. Examination showed that the posts, which were about seven years old, had started to rot at the foot, and, in some instances, the wood was badly affected as high as 18 in. up on the post. The problem of re-footing this timbering throughout the station in a permanent manner, without disturbing it, finally led to the placing of cement under the lines of posts.

The ground between the posts was first picked and cleaned down to solid rock and then braces were put in between the posts at the bases. Molds were then made and coarse concrete was poured in to form the main part of the foot block. After this application had set, the work of getting the concrete under the posts was begun, and this was done one post at a time. First, the timber was sawed half way through, well above the rot, so as to chip out half of the post in a vertical direction. As soon as the wood had been chipped out, and the half crater in the concrete foot block cleaned down to solid rock, a piece of old mill belting was nailed to the remaining half of the post to make the form while concreting in the portion of the post that had just been removed. A coarse-sand cement batter was rammed into the hole. When this half had set thoroughly, so that it could take the weight of the post, the other half of the timber was cut away, the belting laced together and shifted around to make the form for this half, and the remainder of the post was concreted in. In this manner, all of the posts of the station were sawed off and replaced at the bottom with a concrete foot that formed an integral part of the concrete foot block along each line of posts. No trouble with the timbering is expected for several years, as the stations are dry and well ventilated, and it was only at the bottom that the posts were decaying. But in timbering stations cut in rock, where decay rather than ground weight will probably determine the life of the timber, it is well to put in concrete foot blocks under the posts of the set when they are first placed.

Device for Stopping Runaway Mine Train

Many a mule has been killed in a mine by a runaway train on a steep grade. Grades should not be so steep as to cause trains to accelerate to a speed that cannot be controlled by the mule, aided by brakes; but often it becomes necessary to connect up with old drifts that cannot be graded to the best tramming advantage.

Brakes will sometimes fail to hold a train when applied by a new mule skinner, who will not always realize just where the train must be braked strongly to hold it under control. Sometimes a car will dump in transit, and if the train is coupled with side chains over car hooks, the cars that do not dump are likely to



"PIG-TAIL" HOOK, SWIVEL AND CHAIN

become unfastened and run away, creating a source of constant danger to mule, men and mine supports.

This menace can be easily avoided by simply passing a chain over the top of the cars from the front of the rear car to the back of the front car of the train. As the cars making up a train often have to be gathered from separate chutes, the chain must be made so that it can be attached and detached easily and quickly. This is affected by the use of a Missouri "pig-tail" or worm hook, shown in the illustration, which is at-

tached to each end of the chain. This hook is dropped over the door rod of an end-dump car, and is thus effectively fastened, yet in such a way as to be quickly detachable.

With a chain thus attached to a train, all that need be done when a runaway is threatened, is to unlatch the door of the rear car—the cars being coupled with the gate end foremost—and the brakeman, when jumping off, gives the rear car a slight push. This push dumps the car, and the train is snubbed up effectively without any other inconvenience than cleaning some ore off the track, for in all probability the rear car will only partly dump. Even if the trainman does not give the car enough of a push to dump it, the pull of the chain on the front gate rod will cause it to dump almost as soon as the door is unlatched.

The chain need not be especially heavy, and, as it is easily attached and detached from the cars, little inconvenience is experienced from its use.

This simple but effective method of stopping a runaway train is used in hauling the ore on the upper levels of the Hecla mine, at Burke, Idaho, where the mule skinner running over the bad grade was one of the most earnest in its praise. His rule, he said, was to take no chances, but to dump early if his brakes began to slip, for then he generally did not have much shoveling to do in cleaning up, as the rear car probably would not dump completely.

Better Dies Make Better Drill Bits*

The increased efficiency to be obtained by proper forming and treating of drill bits is so marked, and so little attention is paid to this end of the ordinary day's work by mine officials, that one is led to believe they

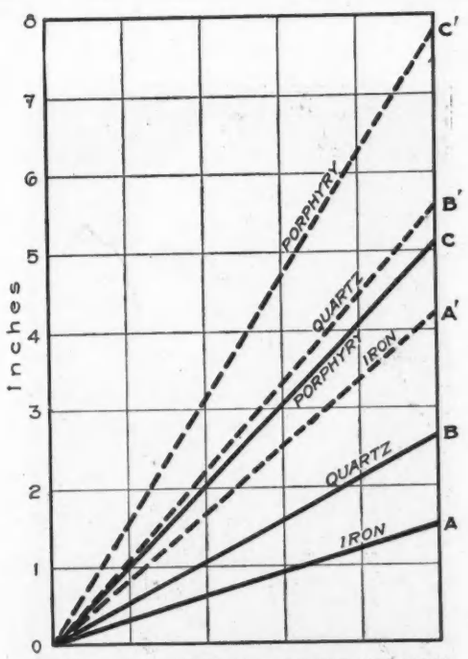


FIG. 1. RELATIVE DRILLING SPEEDS

do not realize what can be accomplished with little effort on their part. Some are beginning to give their drill-steel situation serious consideration and are paying dividends from this end of their work which they little believed possible.

The accompanying chart shows results that were accomplished by one of the largest copper mines in this country. Lines *OA, OB, OC* show drilling speed in inches per minute obtained with their standard machine-sharpened drill bits using $\frac{1}{8}$-in. changes in gage. Lines *OA', OB', OC'* show results obtained by using bits with proper reaming edges and faces and a $\frac{1}{16}$-in. change in gage. In addition to increased drilling speed, their steel breakage has decreased from

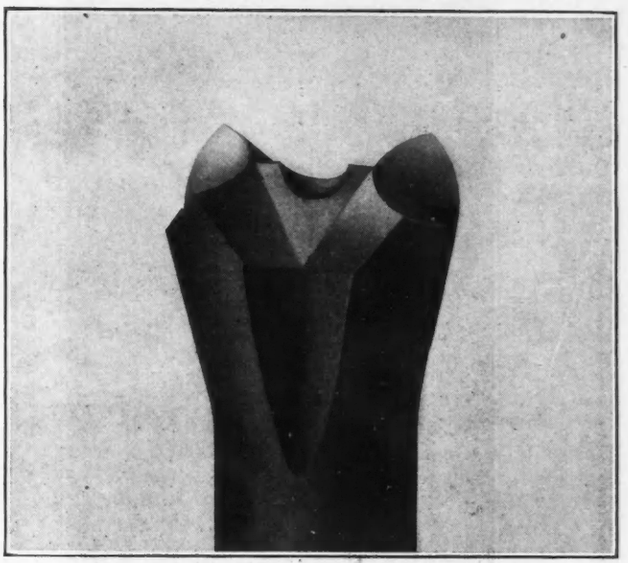


FIG. 2. "DOUBLE ARC" BIT

10.5% to 1.5% and the amount of footage obtained from each steel before resharpening was increased 50%.

A number of vertical gaging dies, furnished with the Sullivan sharpeners, may be used in forming bits with correct reaming edges and faces. These dies are equipped with a positive gaging device arranged for $\frac{1}{16}$-in. changes in gage. If any mine official will go into this situation carefully, he may expect approximately the following results: Increased drilling speed from 40 to 100%; decreased steel breakage; increased footage from each steel sharpened; lower sharpening costs; less time lost underground; and life of drilling machines increased.

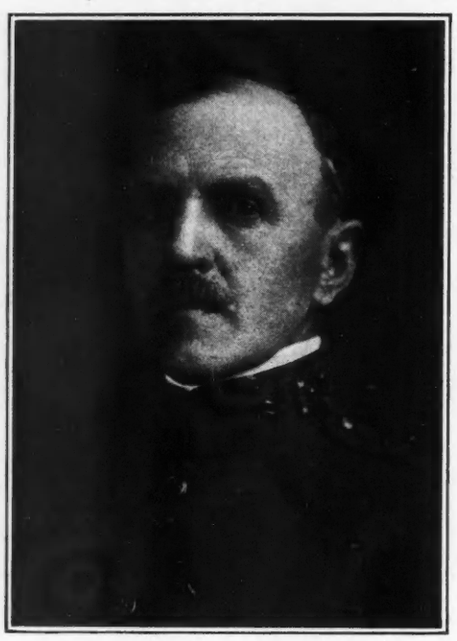
An extra minute used in the drill shop is better than 15 minutes wasted underground. This waste can be largely avoided. One should not try to see how fast he can make drill bits, but how well he can make them. Much labor will be saved in the end.

In using the gaging dies, the bit is upset in the clamping die by the horizontal hammer and dolly in the usual manner. The vertical dies are adjusted to the proper gage by means of the key and thumbscrew. The proper gage, reaming edge and wing taper are applied by hammer action under the vertical swaging hammer. Changes in gage for the different steels in a set are made in a few seconds.

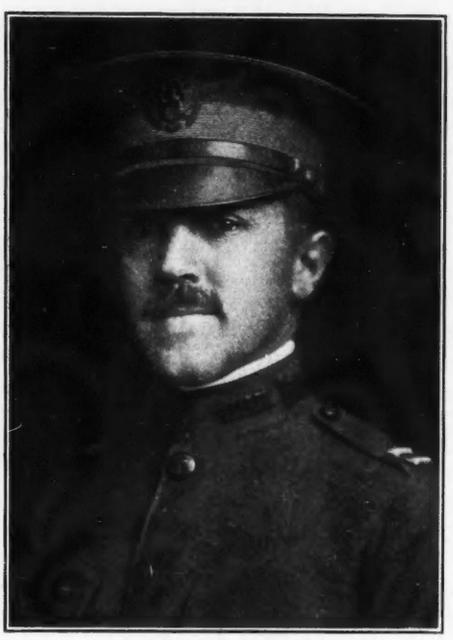
The popular "bull" bit, the familiar "cross" bit or the new "double arc" bit (Fig. 2) can be made in these dies rapidly and cheaply. The all-hammer process and the alternation between the dolly and vertical swages compact the metal and improve its wearing quality.

*Howard T. Walsh in "Mine and Quarry."

Four Officers of the 27th Engineers



LIEUT. COL. O. B. PERRY,
Commanding Officer



CAPT. E. S. BERRY,
Adjutant

CAPT. NORVAL J. WELCH,
Company A

CAPT. JOHN W. BALCH,
Adjutant

The Power of Money

"Might makes right," the Prussians said, speaking more truly than they thought, for back of the power that will ultimately crush the things that are wrong lies the financial might of this country and the Allies. The power of money for good was never better exemplified, and similarly, though in a smaller way, that fact is likewise true of the Comfort Fund.

The argument has been advanced that the mining regiment needs nothing, as the Government takes care of all. It is true that never were soldiers as well cared for as they are by Uncle Sam, but no one has yet heard of a soldier's family that stopped sending him things on that account. The sum thus far expended from the Comfort Fund (over $10,000) for the 27th has been spent in the various ways that the men's own folks would take. And those who have contributed have been moved by goodfellowship alone.

Mr. Manager, why not bring the Comfort Fund to your employees' attention, especially on pay day, when the money is moving fast? Show that your camp is alive and that the men know there is such a thing as a real mining regiment at the front. Put your company on record as back of the 27th.

HOW THE COMFORT FUND STANDS

Previously acknowledged	$14,436.50
H. Foster Bain	10.00
Marc Bailey	10.00
Charles Le Vasseur (second contribution)	10.00
William Wraith	25.00
H. A. Wheeler	10.00
Nevada Mine Operators' Association	100.00
Louis R. Wallace	50.00
H. P. Bowen	5.00
H. L. Brown and M. W. Hayward	16.00
Iron Cap Copper Co.	50.00
W. N. Smith	10.00
E. S. Geary	5.00
H. J. Wolf	10.00
F. H. Siebold	10.00
H. A. Kee	10.00
W. S. Grether	5.00
Marion J. Thomas	10.00
E. F. Eurich	10.00
Liberty Bell Gold Mining Co.	200.00
H. De Witt Smith	15.00
Associated Miners of the University of Idaho	10.00
New Idria Quicksilver Mining Co.	100.00
F. P. Burrall	25.00
Livingston Wernecke	5.00
E. P. Mathewson	50.00
Interest to June 26	82.61
H. W. Hixon	10.00
R. C. Canby	10.00
S. R. Guggenheim	10.00
Richard Tavis	5.00
Simon Guggenheim	100.00
J. V. Kelley	10.00
Algernon Del Mar	4.00
Sumner S. Smith	5.00
Will H. Coghill	10.00
Lincoln Crocker	10.00
C. E. Dewey	10.00
Plymouth Consolidated Gold Mines, Ltd.	100.00
United Eastern Mining Co.	50.00
W. A. Wilson	20.00
Oscar Lachmund (fifth contribution)	10.00
W. Rowland Cox	10.00
L. D. Huntoon	5.00
Alaska Mining and Engineering Society	50.00
W. R. Benedict	3.00
Etheredge Walker	25.00
Fritz Mella	25.00
Richard McCarthy	100.00
J. N. Houser	10.00
Weedon Mining Co.	50.00
William H. Kinnon	30.00
A. P. O'Brien	10.00
Lester W. Strauss	10.00
Montana Society of Engineers	50.00
W. R. Atkeson	2.50
Charles Le Vasseur (third contribution)	5.00
Frank Carroll	10.00
V. P. Hastings, Jr.	5.00
D. E. Woodbridge	5.00
Harvey B. Small	10.00
J. C. Porter	10.00
A. F. Taggart	10.00
G. E. Farish	25.00
H. K. Sherry	10.00
T. M. Hamilton	50.00
George O. Argall	10.00
C. T. R.	15.00
Oscar Lachmund (sixth contribution)	10.00
P. M. Arnold	10.00
W. A. Wolf	5.00
Employees of Utah Leasing Co., Newhouse, Utah	20.50
Employees of Braden Copper Co.	112.50
Charles A. Mitke (second contribution)	10.00
G. M. Colvocoresses	25.00
Charles Le Vasseur (monthly)	5.00
A. H. Wethey	25.00
S. Ford Eaton	25.00
H. H. Hunner	5.00
N. G. Thomson	25.00
Members of the A.I.M.E. meeting in Colorado Springs, Sept. 4, 1918	215.00
Glen Miles	25.00
J. B. Wilmarth	25.00
Frederick MacCoy	5.00
Balance of a certain Joplin contribution received through Lieut.-Col. Gilmore	590.36
Total	$17,312.97

Make your checks payable to W. R. Ingalls, treasurer of the Association of the 27th Engineers.

The Tin Control

Formation of the international monopoly to control the price and distribution of pig tin is told by Bernard M. Baruch, the chairman of the War Industries Board, in the following statement:

Under an inter-allied pooling agreement reached by representatives of the United States, Great Britain, France and Italy at conferences held in London, which were attended by L. L. Summers, member and technical adviser of the War Industries Board, and George Armsby, chief of the tin section, each country participating in the conference will get its needed supply of pig tin. The action amounts to an international monopoly of a beneficent nature.

The plan of distribution worked out allows the United States about 80,000 tons of pig tin, or two-thirds of the world's entire production, annually. With the War Industries Board supervising the allowance to this country, all imports of pig tin, tin ores and concentrates will be consigned to the American Iron and Steel Institute, which will receive, pay for and distribute the metal to the industry through the United States Steel Products Company.

The price will be regulated by the War Industries Board and will be uniform to all consumers of 10 tons of pig tin or over. There will be another uniform price for users of less than 10 tons. These prices will be maintained at a level which will encourage production in the tin-mining countries—Great Britain and the Straits Settlements chiefly—and stop profiteering. Prices, rules and regulations will be announced later. It is probable that users and dealers may be licensed.

The War Industries Board believes there will be insured by these arrangements a steady supply of material at a stable and reasonable price. Since the negotiations for the pooling arrangement began in London six weeks ago, the price of pig tin has fallen steadily. The quotation on Sept. 6 last showed a net decrease of 14c. per lb. as compared with the price on July 15, 1918.

That there may be a sufficient supply of tin in the United States to meet the war needs and to supply essential civilian uses, vigorous plans for conservation of the metal are being made effective through coöperate efforts by the War Industries Board and by the Food and Fuel administrations in the enforced substitution of other than tin for containers, wherever that is possible. Tin-container manufacturers have agreed with the War Industries Board in plans that will curtail their use of tin plate 30%, which means a saving in the next three months of about 150,000 tons of tin plate.

The Food Administration is working out a tin-conservation plan with various industries, including lard and lard-compound packers, wholesale grocers, cracker manufacturers, tea and coffee packers, cocoa and chocolate manufacturers and baking-powder manufacturers. All have been urged to substitute fiber, paper or other containers where possible.

The Fuel Administration has taken up the subject with the oil dealers, and the War Industries Board is working along similar lines with the tobacco manufacturers and all industries in which tin is used in turning out the finished product.

Mr. Baruch said that the Summers commission is planning for the extension of the pooling arrangement to basic materials other than tin. He admitted that it is the desire of the board to extend the pooling arrangement to all minerals of which there is a shortage.

The above is communicated by a Washington cor-

respondent. We may add that the new arrangement will abolish the unrestricted competition for tin among American, British and other Allied interests. Hereafter all purchases of tin in the Straits Settlements will be made by E. Boustead & Co. on their own behalf and on that of the other importing houses, which firm will act under the direction of the tin control in London. In Great Britain, licenses will continue to be issued by the rubber and tin committee to various shipping firms.

Imports and Exports of Metals and Ores

Imports of the more important metals and ores as reported by the Department of Commerce for July, 1918, and those for July, 1917, the latter as finally revised, were as follows:

IMPORTS, JULY, 1917, AND JULY, 1918
(In pounds, unless otherwise stated)

Metal and Ore:	July, 1917	July, 1918
Antimony ore, contents	1,442,929	1,119,077
Antimony matte, regulus or metal	2,856,333	1,400,030
Copper:		
Ore, contents	6,472,934	6,179,353
Concentrates, contents	2,213,200	5,185,245
Matte, regulus, etc., contents	797,982	1,533,838
Imported from (in part):		
Canada	2,951,522	2,104,426
Mexico	2,475,101	3,397,685
Cuba	3,080,526	2,121,720
Chile	751,181	3,417,904
Peru	67,368	350,175
Unrefined black, blister, etc	10,122,230	19,543,854
Refined, in bars, plates, etc	46,865	5,389,000
Old, etc., for remanufacture	2,951,355	111,891
Composition metal, copper chief value	29,187	14,145
Lead:		
Ore, contents	10,151,631	3,597,906
Bullion, contents	6,222,828	2,134,609
Imported from (in part):		
Canada	317,759	2,209,572
Mexico	7,306,624	3,495,546
Chile	.....	26,307
Pigs, bars and old	32,012	24,927
Pyrites, long tons	76,826	46,908
Zinc:		
Ore, contents	10,232,491	1,193,916
Imported from (in part)		
Canada	878,962	829,327
Mexico	6,531,129	364,589
Blocks or pigs, and old	36,823	.....
Manganese ore, long tons	53,438	29,886
Imported from (in part):		
Cuba	360	9,702
Brazil	43,437	15,925
British India	1,200	1,700

Exports of copper, lead and zinc for July, 1918, as reported to the Department of Commerce, with the figures for the corresponding month of 1917, the latter as finally revised, were as follows:

EXPORTS OF COPPER, LEAD AND ZINC
(In pounds)

Copper:	July, 1917	July, 1918
Ore, contents	293,200	326,352
Concentrates, contents	.....	121,000
Unrefined, black, blister, etc	297,980	672,000
Refined in ingots, bars, etc	54,275,337	64,573,910
Exported to (in part):		
France	13,749,296	30,738,418
Italy	7,620,353	11,311,323
United Kingdom	28,778,133	19,595,996
Canada	3,389,136	2,826,126
Composition metal, copper chief value	7	7,690
Old and scrap	2,240	.....
Pipes and tubes	2,782,255	173,557
Plates and sheets	2,302,123	377,148
Wire, except insulated	1,792,223	1,905,418
Lead:		
Pigs, bars, etc., produced from domestic ore	6,270,671	13,711,872
Pigs, bars, etc., produced from foreign ore	179,369	3,046,069
Exported to (in part):		
Denmark	699,235	.....
Canada	1,317,443	5,880,469
United Kingdom	2,688,893	7,430,468
Argentina	740,350	.....
Japan	.....	2,658,855
Zinc:		
Dross	858,221	2,023,402
Spelter:		
Produced from domestic ore	15,271,244	8,589,975
Produced from foreign ore	4,480,007	361,243
Exported to (in part):		
France	7,254,385	6,290,460
Italy	649,156	356,000
United Kingdom	9,489,089	2,186,547
Canada	1,723,643	373,891
Mexico	.....	2,020
In sheets, strips, etc	2,454,625	1,461,441

Half Year's Production of Chromite

In the first six months of 1918, according to the U. S. Geological Survey, 26,000 long tons of all grades of chromite ore was mined in the United States, as compared with 42,700 in 1917. Mining was carried out under unfavorable conditions during the first four months of 1918, and many properties were not opened until April or May. The production of the first six months of 1918 may therefore be about one-third of the production for the year, which would amount to 65,000 to 75,000 long tons of all grades of ore, equivalent to 52,000 to 60,000 long tons of ore containing 50% chromic oxide.

The shipments from Jan. 1 to June 30 amounted to about 18,000 long tons of ore of all grades, equivalent to 14,400 tons containing 50% chromic oxide. Labor conditions in the chromite industry in California and Oregon have been as unfavorable as those in other industries. Transportation has been difficult, particularly haulage from the mines to points for shipment by railroad and water. The roads were put in better condition by the end of June, however, and they will probably be still further improved during the latter half of the year.

Huge Loan Best in the End

We must buy the war as common sense tells us to buy coal and other commodities—in as large quantities as we can. Expensive at best, war comes cheaper when bought in the sensible way. That is the reason the Government has arranged for the floating of the largest war loan the world has ever seen. Smaller loans, which would not meet in full the extraordinary needs of our victoriously fighting armies, would mean only prolongation of the war, at far greater cost to the people of America in the end.

The huge loan means economy in money, in resources, as well as economy in the lives of our soldiers "Over There." The faster the loan is taken, the more abundantly it is oversubscribed, the less the war will cost. By the same token, the greater the success of the huge loan, the more wealth in America will be saved from the maw of war.

The safest investment in the world is a Liberty Bond. For a patriotic American, Liberty Bonds are the best investment in the world. It is not only a wise thing to hold them—it is the patriotic thing to do. The soldier that takes a trench and then voluntarily gives it up is not to be compared with one who takes a trench and holds it against the enemy. An American who buys a Liberty Bond and then sells it is not so good an American as one who buys a bond and holds it. This does not apply, however, to one who sells his bond because of real necessity; there is legitimate trading in Liberty Bonds, which the Treasury recognizes.

Complete and overwhelming success of the great loan will mean the speeding of the day when war prices will end and the cost of living return to the scale of normal times of peace, and when our fighting men will return to productive labors, and the drain upon the property and life of the nation will at last be ended. The bonds must be bought, and by everybody, to achieve this end.

Events and Economics of the War

The most notable achievement of the American forces during the war was made last week when, on Sept. 12, the troops under General Pershing completely wiped out the St. Mihiel salient in 27 hours, taking 15,000 prisoners and 200 guns; continuing their advance on a 33-mile front, they have come within range of the fortress of Metz. Gains toward Laon and Cambrai were also made by the Allies. French and Serbian troops, taking the offensive on Sept. 16 against the Bulgarians between Dorian and the Vardar, pierced the enemy's lines and took 1500 prisoners. Discussion of peace terms proposed by Austria on Sept. 15 was flatly rejected by President Wilson. Not a life was lost when the liner "Persic," transporting 2800 American troops, was torpedoed off the English coast, the ship itself being saved by beaching. A U. S. Army contingent arrived at Archangel, Russia.

In the United States, the War-Minerals Bill, as redrawn by Senator Henderson, passed the Senate on Sept. 11 with minor amendments. Exemption from taxation for a limited amount of the interest on Liberty bonds was asked of both houses by Secretary McAdoo. Eugene V. Debs, former Socialist candidate for President, was sentenced to 10 years in prison for violating the Espionage Act. The Committee on Public Information gave to the press a series of documents revealing the Bolshevik leaders as paid agents of Germany.

Would Make Liberty Bonds Tax-Free

A bill has been reported to the House upon the request of the Secretary of the Treasury, calling for the exemption from taxation of a limited amount of the interest of Liberty Bonds. The measure provides that until two years after the end of the war, the interest on an amount of bonds not over $30,000 in principal, of the Fourth Liberty Loan, owned by an individual, partnership, association or corporation, shall be exempt from graduated additional income taxes, and excess- and war-profits taxes now or hereafter levied.

Former loans are included in the bill as worded at present. The interest received after Jan. 1, 1918, on the amount of bonds of the First Liberty Loan, converted, dated either Nov. 15, 1917, or May 9, 1918; the Second Liberty Loan, converted and unconverted, and the Third Liberty Loan, the principal of which does not exceed $45,000 in the aggregate, owned by any individual, partnership, association or corporation, is to be exempt from such taxes; provided, however, that no owner of such bonds is to be entitled to such exemption in respect to the interest on an aggregate principal amount of such bonds exceeding one and one-half times the principal amount of bonds of the Fourth Liberty Loan originally subscribed for and still owned by him at the date of his tax return. The exemptions sought are to be in addition to all other exemptions provided in the act authorizing the Second Liberty Loan.

Gold Placed Under Control

Complete control over the use of gold for export and domestic manufacture is secured to the Federal authorities through the new order of the Director of the Mint, forbidding the various coinage mints and the U. S. Assay Office at New York to sell gold bars except to those holding priority orders. The order was issued on Sept. 9. The New York Assay Office had announced on Aug. 30 that it had been instructed to stop the sale of gold bars entirely until further notice, but that instruction was revoked the following day. Its issuance, however, evidently caused certain interests to seek to stock up with gold bars, as in the succeeding five business days, it is said, $1,772,000 worth was bought, or twice the normal amount.

The authority as to the quantity of gold to be sold for commercial purposes is vested in the War Industries Board, the Federal Reserve Board, and the Secretary of the Treasury, as stated on the market page of the last issue of the *Journal*. By some the order is looked upon as an effort to stop hoarding; also to reduce the production of less essential articles.

War Board Takes Steel Inventory

A country-wide inventory of stocks of steel on hand is being made by the War Industries Board at the instance of its chairman, Bernard M. Baruch, in coöperation with the census bureau of the Department of Commerce. The ascertainment of the supply of steel is of first importance in view of the deficiency of production of steel for direct and indirect war needs.

The present estimated total production of steel in sight is 17,000,000 tons, and war demands total over 23,000,000 tons, with the demand constantly rising. In a recent interview with the Washington newspaper correspondents, Mr. Baruch announced he could not approve requests for an ounce of steel for domestic uses, because of the imperative need of meeting the war demands.

The census bureau, through its equipped census-taking organization, is sending questionnaires to more than 40,000 manufacturers in this country asking complete reports of stocks of steel on hand down to the smallest holdings. It is sought to reach every manufacturer who uses steel in any way and in any amount in his industry.

Koppel Plant Sold

At the public sale of the Orenstein, Arthur Koppel Co.'s plant at Koppel, Penn., by the Alien Property Custodian on Sept. 12, the Pressed Steel Car Co. was the successful bidder. The price paid was $1,312,000, but the sale remains to be confirmed by the advisory committee for which A. Mitchell Palmer, the custodian, is acting. The public auction of the enemy-owned plant

was originally scheduled for Aug. 15, but was later postponed. There were seven bidders, each of whom deposited a check for $50,000 as a guarantee that he would abide by the terms of the sale. The auction was attended by several hundred representative steel men. The proceeds will be invested in Liberty Bonds.

The firm's history, it is said, furnished an example of the methods which Germany pursued before the war to acquire military information regarding American industry. As one of the many branches throughout the world of the parent concern in Germany, the Koppel company installed light railway equipment in the greater part of American plants making munitions, steel and similar products. It therefore had no difficulty in obtaining valuable data for Berlin.

Mint Receives Platinum

Platinum in the form of jewelry has been sent in such quantity to the office of Ray T. Baker, Director of the Mint, in response to the Government's call for the metal, that Mr. Baker was led to request on Sept. 10 that further shipments be sent thereafter to the U. S. Assay Office. Payment will be made for these consignments, it is said, but those wishing to donate platinum should send it to the Red Cross.

According to Washington dispatches, as announced in last week's issue, Mr. Baker will act as Platinum Administrator. His duty will be to collect the metal, refine it, and deliver it to the War and Navy departments as they require it.

Britain Considers Post-War Priority

The British Minister of Reconstruction appointed a committee last year, says *Iron and Coal Tr. Rev.*, to consider the principles upon which, in the event of a shortage of the necessary supplies for industry after the war, such things should be rationed, and to report upon the machinery requisite for the purpose. The committee has now presented its report, and though advising that control should be discontinued at as early a date as possible, and that in the meantime there should be the least possible interference with private enterprise, it has made recommendations as to the principles and machinery for allocation and priority after the war in cases where it is found to be imperative.

The committee has recommended that special consideration should be given to industries which provided a large measure of employment, and that importance should be attached primarily to industries connected with: (1) The production of food and raw materials; (2) the manufacture of machinery and equipment which are immediately necessary for the industrial and transport requirements of the country; (3) the manufacture of finished goods for export; (4) the production of goods for home requirements of a pressing nature. Detailed recommendations are also made by the committee as to the machinery to direct allocation and relative priority.

The government has decided to take immediate action on the lines of the committee's report and the recommendations of the Minister of Reconstruction. It is the intention of the government that post-war control and allocation of materials shall be applied only in cases where it is absolutely necessary. On the assumption, however, that of certain commodities there will be a shortage which will render some form of control imperative, arrangements must be made for dealing with the matter.

It is proposed that a small Cabinet Committee on Post-War Priority shall be set up, consisting of the President of the Board of Trade, the Minister of Labor, the Minister of Shipping, the Minister of Munitions, and the Minister of Reconstruction, with the same chairman as the War Priorities Committee. This committee will determine large questions of policy and will lay down the general principles upon which any allocation and priority should proceed where necessary. Secondly, this Cabinet committee will be assisted by the standing council composed of members of the departments chiefly concerned, together with persons representative of commerce, industry, and labor. These two bodies will form the central machinery, and will, of course, be in close touch with the existing War-Priorities Committee.

Gasoline Stocks Decreasing

A serious shortage of gasoline exists, according to data furnished the Senate on Sept. 11 by Fuel Administrator Garfield, who intimated that it was this situation that made the "gasless Sunday" necessary in the East. The figures indicate only a 30-day reserve supply. Though the California production of gasoline has decreased equally with that of the Eastern fields, it has been necessary to draw upon it to the extent of 250 cars to make up for the shortage in the East.

The data furnished the Senate as to stocks in the territory east of California show a decline of 3,200,000 bbl. between the high point on Apr. 1, 1918, and Aug. 1. The average total daily consumption in this territory is given as 194,000 bbl., which is 3000 bbl. more than the approximate daily production.

Stocks in California decreased from 1,787,000 bbl. on Mar. 1, 1918, to 848,000 bbl. on Aug. 1, a difference of 939,000 bbl. The average daily deficit for the first half of 1918 is 3000 bbl. The movement of crude petroleum and its products is eastward, both for export and for the war needs of this country. The situation would indicate the need for greater rather than lessened restrictions upon the use of gasoline.

Low Accident Record at Nitro, W. Va.

A remarkably low accident record through concerted effort in modern safety engineering is claimed by the U. S. Employees' Compensation Commission for the work of constructing the Federal explosives plant "C," at Nitro, W. Va., which was begun early in January, 1918. Hundreds of buildings have been erected on the 1600-acre plant site for making smokeless powder.

To date, it is claimed, there has been but two-tenths of 1% of the number of working hours lost by injuries resulting from accidents causing absence of employees. Only six fatalities have occurred during the last eight months. Upward of 19,000 employees have been working overtime and Sundays to complete this gigantic project. Only eight accidents per 10,000 employees per day have occurred entailing loss of one day or more. This accident-prevention work has been done under the direction of C. B. Hayward, safety engineer.

Industrial News from Washington

By Paul Wooton, Special Correspondent

War-Minerals Bill Passes Senate

The Senate passed the War-Minerals Bill on Sept. 11 without a rollcall. Despite the fact that the bill was rewritten by the Senate committee, it is understood that the House conferees will accept it as just passed. Senator Smoot's effort to eliminate chalk, fluorspar, fullers earth, kaolin and mica from the bill was unsuccessful. A number of amendments were proposed and accepted. Their importance, however, was limited to perfecting certain phases of the bill, to which the committee gave its consent.

Senator Henderson, in urging the adoption of the bill, said that it would put the United States in a position to control largely those rare metals and minerals which will be used after the war as well as during the war. Senator King, of Utah, made several long arguments against the measure. His principal fear is that private enterprise will be interfered with and that it will bring few benefits of a substantial character to the men who do the actual mining.

Senator Shafroth, of Colorado, in justifying the action of the committee in departing so widely from the House bill, said that conditions surrounding the mining industry are such as to make it impracticable to attempt to apply the exact provisions of the Lever Act to it. He also explained why the committee had seen fit to reject the maximum and minimum price proposals contained in the House bill.

Senator King declared that "private capital, private ingenuity and private industry will go out and develop the mining districts as they have in the past." Senator Jones, of New Mexico, countered with the statement that the price of some metals has increased up to 2000%, but that a mere increase of price, without a definite length of time for the price to prevail, would not induce the opening of properties requiring time and large expenditures. To this, Senator Smoot suggested that the tariff be tried. Senator Jones answered that any tariff that might be thought of would not serve to protect a miner from the low-cost producers within the United States.

During the course of the debate, Senator Jones revealed the fact that Mr. Baruch has been making contracts which were backed by his private fortune. It was necessary to take this step, he said, to secure certain metals, because there was no authority in law for the Government to undertake it.

Senator Fall was afraid that the bill as originally drawn gave the Government the power to fix the wages of every miner in the United States. He was allowed to attach an amendment to make certain that no such interpretation would be placed upon it. Though he objected to a number of points in the bill, he declared that the "committee worked faithfully and arrived at a compromise such as I can force myself to accept, when I never could have supported anything along the lines of the original House bill." Senator Fall feels that he has added an important safeguard to the bill in annexing a proviso "that no ores or metals the principal money value of which consists in metals and minerals other than those specifically enumerated shall be subject to requisition."

Senator Shafroth amended the bill so as to provide that the headquarters and offices required for the administrative force are to be situated at such a point west of the Missouri River as the President may deem proper. The conferees who will consider the bill are Senators Henderson, Walsh and Poindexter, and Representatives Foster, Taylor and Garland.

Should Claim Deferment for Men

The War Department has provided the necessary machinery for the protection of essential industries like mining from the indiscriminate operation of the draft, and is depending upon the companies and individuals to protect their industries by taking special care to see that skilled labor which cannot be replaced receives the proper industrial deferred classification. Mining organizations producing necessary war minerals should consider it a patriotic duty to attend actively to this matter at once, it is held, and to take up with their local boards the classification in the draft which their key men should receive.

The Army desires to have every man who can be replaced put into a classification where he will be ready to carry a gun as soon as called for, but does not wish to take men who would be more useful for war purposes where they are. Should those engaged in operating essential war mines not carry out this duty promptly, the War Department may naturally hesitate, it is said, to furlough men from the Army in cases where the companies have neglected to ask the proper deferred classification for the men, as provided for under the selective-draft regulations.

Machinery has also been created whereby, in some instances, the key men in essential industries, who have failed for any reason to receive industrial deferred classification, may still be returned to their work by the Adjutant General of the Army after their arrival at camp. Under this arrangement, the different departments and bureaus representing certain industries may designate a certifying officer, who may recommend to the Adjutant General that the soldier in question be granted an indefinite furlough without pay and ordered to report to the industry where his services are needed. For the protection of the metal-mining industry in this regard, the Secretary of the Interior has named Van. H. Manning, Director of the Bureau of Mines, as the certifying officer for the Department of the Interior.

This function has been assumed by the Fuel Administration for the coal mining and oil industry, so that the Bureau of Mines will receive only applications for the mining and metallurgical industries, excluding the steel industry.

Editorials

"Hello! This Is Liberty Speaking"

WITH this issue we publish an attractive insert with the slogan "Hello! This is Liberty speaking. —Billions of dollars are needed, and needed now." This direct message is to you and to every other American. The Fourth Liberty Loan is almost upon us. It is up to you to do your part. Put this insert above your desk as a reminder that when Liberty calls, you will be there.

The "Mines-Control" Bill

THE "mines-control" bill was so rewritten in the Senate's committee that it emerged quite shorn of its guise as a mines-control bill, becoming simply an authorization to the Government to engage in trading in minerals and metals, with the right to take over and operate any idle mines of the substances specified in the act. As drafted by Senator Henderson, this was a great improvement over the House bill, which contained provisions that the Senate would never have passed, as appeared from its debate. The worst feature of Senator Henderson's bill was the 75% clause.

Unfortunately, the Senate let that stand, no one apparently noticing it; anyway, there was no discussion of it. However, some other amendments were made. By one of these the administration is limited exclusively to the substances named, and by another there may be no requisitioning of ores or metals the principal money value of which consists in minerals or metals other than those named in the act.

A rather unfortunate amendment is that which prevents the President from selling anything for less than the purchase price or production cost. With such a stipulation, the Secrétan syndicate in copper of 30 years ago would have been a great many years in liquidation. We can imagine the plight of the Government if it be overbought in ferromanganese, tin, and some other things, being unable to get out, even at a small sacrifice, while the going is good.

Another amendment provides for headquarters and offices for the administrative forces west of the Missouri River. And, finally, one limits salaries to the rates paid for similar or like services rendered in executive departments of the Government.

With these amendments, the bill was passed by the Senate after a rather perfunctory debate, and it now goes into conference. Further comment may well be deferred until the bill takes its final form.

Copper and Cotton

THE promise of a large crop of cotton this year has been blasted by unfavorable weather, and we are new confronted by the certainty of a short crop. Normally this would be followed by a further advance in price, as it was, although the latter was already high. But now the War Industries Board proposes to step in and fix the price for cotton, the immunity of which has heretofore been the subject of pungent comment. Immediately the Southern senators and representatives rose in rage and rushed to the White House to see about this iconoclastic idea of interfering with what has previously been sacrosanct. It may be conceived that the White House was embarrassed by this situation, but the President seems to be meeting it manfully.

However, the immunity of cotton heretofore has been akin to a scandal in our affairs. We compare it with copper, for the latter has been the chief scapegoat. Both copper and cotton are essential elements in ammunition. Copper is used for making the cartridge cases, cotton for making the explosive that is put into them. Copper is produced in the North and West by companies that are largely owned in New York and New England. Cotton is produced in the South, chiefly by individual planters. In the economic policy of both the Administration and of Congress there has been a mighty difference according to geography and a mightier one according to whether a group of, say, 20,000 people combine to do business together, or whether the same number undertake business individually.

The people in the West and North, where copper is produced, cannot escape the feeling that their industry has been arbitrarily handicapped, while that of the South has been left free. Really there is far more reason for fixing the price for cotton now than there ever was for fixing the price for copper. Cotton is a commodity of seasonal production. The planting of this year's crop was determined by the price for last year's, but before the real commodity price of last year's crop could be determined there were many speculative adjustments and maneuvers. In a situation like the present there would naturally be unusual turmoil and great profits by some shrewd and lucky people at the expense of those less shrewd and lucky. Such situations seldom develop in commodities of regular production, like the metals—at least not to the same extent—for they are never stocked up in the same way.

The Federal Trade Commission

THE independent press, ourselves included, has been scathing in criticism of the Federal Trade Commission under the chairmanship of William B. Colver. Some people, not perceiving the national danger in the policy of that body, have been surprised and even have thought the criticism was too harsh. Yet the same has been voiced on the floor of Congress by members who have been alive to the fact that this commission was attacking some interests for political purposes, while it was exonerating or being silent about others. The meat packers have been lately the special target of the

commission. They are limited by agreement with the Food Administration to a profit of 9%. "If the packers made such profits as Henry Ford's motor company" said Senator Sherman, "the Federal Trade Commission would have been speechless with indignation." It has been pointed out that the Federal Trade Commission not only plays favorites but also that it is ignorant and malicious in its representations respecting interests against which it seeks to inflame the people. It has the right to pry into the affairs of all business enterprises, but it is so ignorant that it cannot understand the information that it commands. Last year it studied, among other things, the cost of producing copper, and blundered with the data, which in this case did not do the harm that might have been done, for its recommendations were overruled by the War Industries Board. Not so with its "study" of the cost of producing coal, which led Messrs. Baker and Daniels to repudiate the Lane-Peabody agreement, that did more than anything else to produce the coal crisis of last winter, and for which it is blamed by the Fuel Administration itself.

The indictment of this commission has ceased to be that of the press alone, or the unofficial charges of other bureaus of the Government, but has become that of the recognized and unprejudiced organ of the business of the country. The Chamber of Commerce of the United States sent to President Wilson, under date of Aug. 17, 1918, a communication in which it asserts that the Federal Trade Commission has ceased to perform the duties for which it was created and implies that it has, by reason of the attitude toward business that it has adopted and the activities of some of its members, become a menace to the welfare of the nation.

Lowering Haulage Costs

THE small capacity of cars used in many mines greatly increases the cost of train haulage, including that of loading and dumping. In this issue is described a mine car that has a capacity of 82 cu.ft., and yet can be lowered through a 4 x 5-ft. shaft compartment without difficulty. The Hecla car will doubtless require some modification to adapt it to local conditions. For some drifts it will be too wide, in view of its length, to make sharp turns, although it will go around a 28-ft. curve. But we are certain that, by using this type of design, many companies which at present are shuttling long trains of 1½-ton cars back and forth between the chutes and the skip pockets, in the mad attempt to keep up with the skips, will find that they can develop a car which will cut down their haulage costs considerably.

To use this type of car to best advantage, it is necessary to arrange the haulage track so that the trains run directly over the skip pocket, as the cars can then be dumped easily and rapidly. At many mines this can be accomplished only by rearranging the haulage drifts so that the ore trains will run across the skip pockets at the rear of the shaft stations. When new levels are opened, however, the pockets may be cut as inclined raises starting at a distance below the level sufficient to bring them out on the level far enough from the shaft so that their tops may be flared without weakening the latter. It is folly to blast out a skip pocket directly under the floor of a station, as is typical of present-day practice. The amount of ground thus taken out next to the shaft is greatly increased, and the pockets must be made much smaller than efficient operation demands.

At this time, when there is such a shortage of labor throughout our mining regions, we believe that the Hecla type of underground car is well worthy of serious consideration at most shaft mines in the West. Increasing the capacity of the car used in the trains will not only lower the haulage costs, but will greatly decrease the number of men usd on the haulage levels.

Sir William Ramsay

IN DR. RICHARD B. MOORE'S appreciation of Sir William Ramsay, which appears in the July issue of the *Journal of the Franklin Institute*, we find the following paragraph, which deserves a wider circulation and which we commend to the attention of those of our readers who have not already seen it:

> Ramsay's courage was another great asset. He was never afraid to say or write what he believed to be true, no matter what criticism might be aroused. On one or two occasions he made premature announcements that had to be taken back, but these were few and far between, and need not be remembered in connection with the magnificent series of actual discoveries that he gave to the world. It was this quality of courage more than anything else that made him the great man that he was. He had confidence in his own work; and when his results were contrary to those of others, he was not afraid to stand by them. On the other hand, he was equally willing to acknowledge a mistake when it was made.

Such a pen portrait will be valued even by technologists and engineers whose interest in Ramsay's achievements may be purely academic; the writer of the memoir sensed the principal reason for his success—the unwavering faith in his own work, the courage of his conviction. His persistent belief arose not from any superficial bias, but from an ingrained conviction that comes to all real students and investigators who remain true to their self-imposed task of leaving no stone unturned to add to knowledge, and to whom no fact is too insignificant to escape notice and painstaking classification.

As the exception is said to prove the rule, so the occasional acknowledgment of fallibility throws into bolder relief Ramsay's great contributions to physical and chemical science. Such initiative as his invites criticism, whereas commendation is usually held in reserve as a post-mortem tribute. There is only one way of avoiding adverse criticism, and that is to avoid making mistakes; and we learned recently that individuals in the latter category would be confined to those who are dead and those who attempt nothing.

Ramsay would have done little if he had remained content to echo the opinions of others—if he had tried to evade the responsibility attached to proclaiming his opinions before the proof was overwhelming. We are grateful to Dr. Moore for an appreciation of so eminent a colleague in the brotherhood of scientific endeavor—an appreciation that contains many lessons.

The record of the hearings before the Senate Committee on Mines and Mining on the War-Minerals Bill will be an addition to any mining library. It will be sent to any reader of the *Journal*, without charge, on application to our Washington correspondent—Paul Wooton, 307 Union Trust Building, Washington, D. C.

The article on "Ore Treatment in Colorado" that appeared in our issue of Aug. 31 was prepared by a member of our editorial staff. Inadvertently, acknowledgment was not made at the time of the source from which the various tables in the article were derived. These tables, as well as the table in the article on "Mine Adits in Colorado," were compiled from *The Mineral Industry* and *The American Mining Manual*, and acknowledgment of the use of these two references is made herewith.

BY THE WAY

The following extract from a recent communication is printed as received. We refrain from laying ourselves open to the accusation of having attempted "to gild refined gold." We therefore give it as it came:

My dear sir

I noticed your Add inreguard you were interested in securing corspondences from one in mining centers, who might keep you in tutch with the mining activity of The districts of importance, and it is with pleasher to the best of my ability from long years of experience in the mining fields and not haphazared guessing I will hope to give you such infermation in-which you are interested reguarding mining properties of merit and magnatude disclosing the earmarks of probable developing into dividen paying properties, that could be secured and equipted and, purchessed on right terms,

Mind you I wish to impress you with the fact I cannot make a producing mine out of gaunge material five hundered miles away from any mineral zone, and above all I would be the last man to lead you to error or take up your valuable time in being devoted to a wildcat proposetion, or bring you on any expenctive rain-bow chases,

I have studed this formation from early life in my teens. and their is no reason why I should make any Error's having carefull watched all the great mines of this state develope into the greatest dividen payers in the U S,

In brief, their are a lot of oppertunities here to be taken up and if you are interested. I should indeed be pleased to go into further details with you. I will ashure you that I will not lead you to any expenctive errors, But I would suggest the best plan would be to send your engineer here and go over the different properties with me and select what would suite you.

What Your Liberty Bond Will Do

If you buy a $100 bond of the Fourth Liberty Loan you are lending the United States Government enough money to feed a soldier in France a little more than seven months. Or you have furnished enough money to give him a complete outfit of winter and summer clothing, including shoes and stockings, and slicker and overcoat and blankets, with enough left over to arm him with a good revolver. You have done that much to beat back the Hun.

It takes $35 more to arm him with a rifle with a bayonet on it, and if you buy a second $100 bond you furnish him this rifle and 1000 cartridges for it; and there will still be enough of your money left to purchase a good-sized bomb to throw in a dug-out, or demolish a machine gun, together with the Huns operating it.

The effort to separate Liberty Bond holders who are not familiar with stock and bond values from their Liberty Bonds has taken a new turn. The manipulators, instead of offering to buy the bonds at inadequate prices, offer in exchange for them stocks and bonds of various wildcat corporations, the face value of which is large but whose actual value is little or nothing.

Monthly Copper Production for 1918

This table is compiled from reports received from the respective companies (except in the cases noted as estimated), together with the reports of the U. S. Department of Commerce as to imported material, and in the main represents the crude-copper content of blister copper, in pounds.

The grand total includes, under "Imports in ore and blister copper," the production of such companies as Canada Copper, Granby, Cananea, Braden, Cerro de Pasco and Chile. As a matter of record, however, the individual figures are given after the total. We also report the production of the Boleo, Backus & Johnston and Kantanga companies, whose copper does not come to the United States.

MONTHLY CRUDE COPPER PRODUCTION, 1918

	May	June	July	August
Alaska shipments	6,069,642	3,980,197	3,994,204	4,245,557
Arizona:				
Arizona Copper	4,130,000	3,700,000	4,000,000	4,300,000
Cons. Ariz. Smelting	2,000,000	1,750,000	1,430,000	1,250,000
Inspiration	10,250,000	10,300,000	9,000,000	9,000,000
Magma	1,169,083	947,128	800,000	900,000
Miami	5,100,408	4,692,554	4,793,082	5,374,198
New Cornelia (*a*)	2,880,000	2,822,000	2,300,000	2,838,000
Old Dominion	3,239,000	3,368,000	2,533,000	2,064,500
Ray	8,120,000	7,736,559	7,300,000	6,625,000
Shannon	802,000	672,000	794,225	708,000
Shattuck Arizona	840,999	805,310	672,024	682,861
Other Arizona	27,491,118	25,823,920	24,727,751	26,363,078
California:				
Mammoth	1,328,000	1,196,000	1,330,000	1,320,000
Michigan:				
Calumet & Hecla	12,944,732	11,699,212	11,118,426	10,718,520
Other Lake Superior (*b*)	7,000,000	7,000,000	7,000,000	7,000,000
Montana:				
Anaconda	28,400,000	25,800,000	25,400,000	24,900,000
East Butte	2,208,300	1,999,760	2,076,460	1,714,358
Nevada:				
Mason Valley	1,759,728	1,224,485	1,190,177	1,032,702
Nevada Cons	7,000,000	7,250,000	6,400,000	6,500,000
New Mexico:				
Chino	5,987,340	6,706,474	6,310,396	5,065,818
Utah:				
Utah Copper	18,200,000	18,500,000	16,021,766	19,920,947
Eastern smelters (*b*)	1,750,000	1,750,000	1,750,000	1,750,000
Total reported	158,670,350	149,723,599	140,941,511	.....
Others, estimated	22,400,000	17,000,000	17,350,000	.....
Total United States	181,070,350	166,723,599	158,291,511	.....
Imports, ore and concentrates, etc	10,886,293	11,624,275	12,898,436	.....
Imports in blister, etc	27,892,478	13,801,332	19,543,854	.....
Grand total	219,849,121	192,149,206	190,733,801	.....
British Columbia:				
Granby Cons	3,808,125	3,438,521	2,167,077	2,820,207
Mexico:				
Boleo	1,873,760	1,322,720	1,697,360	.....
Cananea	4,100,000	4,100,000	5,000,000	5,000,000
Other Foreign:				
Braden	6,758,000	8,292,000	7,036,000	6,690,000
Cerro de Pasco	6,166,000	5,874,000	5,238,000	5,786,000
Chile	7,506,000	9,280,000	7,556,000	.....
Katanga	5,180,810	3,505,315	4,894,200	4,894,200
Backus & Johnston	2,053,818	2,096,727	1,324,823	.....

(*a*) Only electrolytic cathodes are entered. New Cornelia also produces some copper from ores sent to Calumet & Arizona smeltery, which is included under "Other Arizona." (*b*) Estimated.

The item "Alaska shipments" gives the official figure of the U. S. Department of Commerce. Kennecott production for May, June, July and August was 3,404,000, 4,044,000, 5,090,000 and 5,280,000 lb., respectively.

The production of the United States by months since the beginning of the year was as follows:

	1918
January	165,431,568
February	160,011,364
March	185,525,168
April	163,207,096
May	181,070,350
June	166,723,599
July	158,291,511

Bonuses Paid to Its Employees engaged in military service by the De Beers Consolidated Mines aggregated $869,226 on June 30, 1917, according to its annual report. The number of its employees in active service as of that date was 354, and the casualty list totaled 182, of which 62 were known to be fatal.

NEW PUBLICATIONS

The Use of Permissible Explosives in the Coal Mines of Illinois. By James R. Fleming and John W. Koster. Pp. 110; illus. Bull. 137, U. S. Bureau of Mines, Washington, D. C.

Abstracts of Current Decisions on Mines and Mining from September to December, 1917. By J. W. Thompson. Pp. 147. Bull. 164, U. S. Bureau of Mines, Washington, D. C.

Siliceous Dust in Relation to Pulmonary Disease Among Miners in the Joplin District, Missouri. By Edwin Higgins, A. J. Lanza, F. B. Laney and George S. Rice. Pp. 116; illus. Bull. 132. U. S. Bureau of Mines, Washington, D. C.

Bibliography of Petroleum and Allied Substances, 1915. By E. H. Burroughs. Pp. 147, U. S. Bureau of Mines, Washington, D. C.

Recovery of Gasoline from Natural Gas by Compression and Refrigeration. By W. P. Dykema. Pp. 123; illus. Bull. 151, U. S. Bureau of Mines, Washington, D. C.

Bibliography of Petroleum and Allied Substances, 1915. By E. H. Burroughs. Pp. 147. Bull. 149, U. S. Bureau of Mines, Washington, D. C.

The Lake Clark-Central Kuskokwim Region, Alaska. By Philip S. Smith. Pp. 162; illus. Bull. 655, U. S. Geological Survey, Washington, D. C.

The Structural and Ornamental Stones of Minnesota. By Oliver Bowles. Pp. 225; illus. Bull. 663, U. S. Geological Survey, Washington, D. C.

Clay-Working Industries and Building Operations in the Larger Cities in 1916. By Jefferson Middleton. Mineral Resources of the United States, 1916. Part II. Pp. 73. U. S. Geological Survey, Washington, D. C.

Southern California Floods of January, 1916. By H. D. McGlashan and F. C. Ebert. Water-Supply Paper 426, U. S. Geological Survey, Washington, D. C.

The Cosna-Nowitna Region, Alaska. By Henry M. Eakin. Pp. 54; illus. Bull. 667, U. S. Geological Survey, Washington, D. C.

The Geology of the Tuapeka District, Central Otaga Division. By P. Marshall. Pp. 72; illus. Bull. 19, New Zealand Department of Mines, Geological Survey Branch, Wellington, New Zealand.

The Quaternary Geology of Southeastern Wisconsin, with a Chapter on the Older Rock Formations. By William C. Alden. Pp. 356; illus. Prof. Paper 106, U. S. Geological Survey, Washington, D. C.

Annual Report of the Mines, 1917. Pp. 79; illus. Department of Public Works and Mines, Halifax, N. S.

The Evolution of National Systems of Vocational Re-education for Disabled Soldiers and Sailors. By Douglas C. McMurtrie. Pp. 319, illus. Bull. 15, Federal Board of Vocational Education, Washington, D. C.

Petroleum, Asphalt and Natural Gas. Pp. 248; 5 x 7½; illus. Bull. 14. Leather. $2. Kansas City Testing Laboratory, Kansas City, Mo.

The American Fertilizer Hand Book; the Standard Reference Book and Directory of the Commercial Fertilizer Industry and Allied Trades. Pp. 456; 7½ x 10½; illus.; $1.50. Ware Bros. Co., Philadelphia, Penn.

Measuring the Temperature of Gases in Boiler Settings. By Henry Kreisinger and J. F. Barkley. Pp. 72, illus. Bull. 145, U. S. Bureau of Mines, Washington, D. C.

A pamphlet written for the purpose of assisting in the efficient use of various fuels. Errors in the ordinary methods of measurement of boiler-gas temperature are pointed out. The necessary instruments are described, including the thermocouple, for which construction and calibration notes are given. The results of a number of tests with various types of boilers are tabulated.

La Pratica del Forno Elettrico. Alfred Tiburzi. 4 x 6, pp. 259, illus. Ulrico Hoepli, Milano, Italy.

A short review of electric furnace practice. Arc and resistance furnaces are described, as well as their operation and control. The book is in Italian, and will therefore be of little practical use to American metallurgists. Those interested in the development of electric furnaces in foreign countries, however, should find the treatise of interest and value.

The Salt Creek Oil Field, Wyoming. By Carroll H. Wegeman. Pp. 52, illus. Bull. 670, U. S. Geological Survey, Washington, D. C.

Descriptive of an oil field producing 10,000 bbl. daily—the largest in Wyoming. The history of the development of the district, drainage, water supply and geology are among the subjects dealt with. The source, distribution and yield of oil, and flow and operation of wells are described. Future production is estimated.

Analysis of Mine and Car Samples of Coal Collected in the Years 1913 to 1916. By Arno C. Fieldner, Howard I. Smith, J. W. Paul and Samuel Sanford. Pp. 478, illus. Bull. 123, U. S. Bureau of Mines, Washington, D. C.

Samples of coal are analyzed by the Bureau of Mines from time to time, and the results applied in connection with investigations into the causes of accidents in mines, geological features, value of the product, and other matters. The bulletin under review gives analyses and descriptions of samples collected from 1913 to 1916 inclusive. Analytical methods employed are described.

Geology and Paleontology of the Raton Mesa and Other Regions in Colorado and New Mexico. Papers by Willis T. Lee and F. H. Knowlton. Pp. 450, illus. Prof. Paper No. 101. U. S. Geological Survey, Washington, D. C.

Any one interested in the coal measures of Colorado and New Mexico will find in this professional paper important reference to this subject.

Mineral Springs of Canada, Part II. The Chemical Character of Some Canadian Mineral Springs. By R. T. Elworthy. Pp. 173, illus. Bull. 20, Canada Department of Mines, Ottawa, Canada.

Details of the composition of a number of samples of Canadian mineral waters, prefaced by much general information on the subject, including definitions, methods of recording analyses, classification system of collection of samples, and analytical systems. A bibliography is appended.

Report of the Clay Resources of Southern Saskatchewan. By N. B. Davis. Pp. 93, illus. Canada Department of Mines, Mines Branch, Ottawa, Canada.

An account of field investigations and laboratory tests on a large number of clays collected in southern Saskatchewan. The geology of the district is described and general data of interest are included. The information on the characteristics of various classes of clay, their preparation and manufacture, will be of value to technologists and merchants An excellent map of the district is appended.

Annual Report of the Mineral Production of Canada During the Year 1916. By John McLeish. Pp. 343. Canada Department of Mines, Mines Branch, Ottawa, Canada.

A detailed collection of statistics of the production, exports and imports of minerals during 1916, the fiscal year terminating on Mar. 31. Comparative tables are given and also production by province. The various metals are considered under separate sections, and complete data of non-metallic and clay products and structural materials are included.

Report on Mining Operations in the Province of Quebec During the Year 1917. Pp. 147, illus. Department of Colonization, Mines and Fisheries, Quebec, Canada.

Quebec's mineral production for 1917 shows a 22% increase in value over the previous year's output. Even gold and silver production was raised, but this is accounted for by the fact that both metals come from zinc-lead and copper ores, and are recovered as byproducts. Asbestos and graphite output has increased considerably. Details

of the individual operations of the various mines during the year are given, together with notes on economic geology and other pertinent information. A list of the principal operators and owners of the mines and quarries in the province will be found useful for reference purposes.

Mineral Resources of Alaska. Report on Progress of Investigations in 1916. By Alfred H. Brooks and others. Pp. 469, illus. Bull. 662, U. S. Geological Survey, Washington, D. C.

This publication deals at considerable length with the progress made in Alaska during 1916, and contains complete statistics. An informative article on the mining industry follows a preface and administrative report, all three being contributed by Alfred H. Brooks, who has handled the subject in an able manner, basing his information largely on an intimate personal knowledge of the country. Special articles on placer deposits on the Porcupine, Tolovana, Anvik-Andreafski and other districts, and on the Seward Peninsula are presented. Other monographs deal with lode deposits containing either gold or copper. A detailed account of water-power investigations in southeastern Alaska is also given.

The Arbouin Copper Mines at Cardross, on the Chillagoe Mineral Field, North Queensland. By Lionel C. Ball. Pp. 70, illus. Publication No. 261, Department of Mines, Queensland Geological Survey, Brisbane, Australia.

This bulletin deals with a copper district situated about 150 miles from Cairns, North Queensland, which was discovered in 1872, but was neglected until 1897. A company was organized in 1909 to work the principal deposits, and a blast furnace blown in, early in 1912, which operated intermittently until the outbreak of the war. Statistics show that it has cost more than twice the value of the product to obtain an output. Freight from the coast absorbed $50 per ton of material hauled. Sinking a three-compartment shaft probably cost $125 per foot; driving, about $50. Concentration of ore is advisable, but smelting operations have shown that success is attainable. A carefully arranged synopsis of the geology of the ore deposits and the mineralogy of the district gives complete information in this connection, from which a reliable estimate of the future worth of this isolated mineral field may be made.

Concrete Engineer's Handbook: Data for the design and construction of plain and reinforced concrete structures. By George A. Hool, Nathan C. Johnson and others. 6 x 9, pp. 885, illus. $5. McGraw-Hill Book Co., New York.

A distinctive feature of the book is that the authors have supplemented their own work on the subject by chapters and contributions by other specialists dealing with less known phases of concrete and reinforced-concrete construction. The section on material is informative, well arranged and comprehensive. General methods of construction, plant requirements, and properties of mortars and concrete are clearly described and illustrated. Details of buildings, bridges, arches, walls and chimneys form an important proportion of the book, and are considered both with reference to theory and design, and to construction. A special section on dams merits attention; and the information on siphonic spillways is new and from an authoritative source. The general arrangement of the book —the division into sections and subsequent paragraphing— is excellent. Although primarily intended for concrete engineers, the volume will prove of considerable value as a reference book when concrete or reinforced-concrete work is under consideration.

A Handbook of Briquetting, Vol. II. Briquetting of Ores, Metallurgical Products, Metal Swarf and Similar Materials, Including Agglomeration. By G. Franke. Translated by Fred. C. A. H. Lantsberry. 6 x 9, pp. 214, illus. J. B. Lippincott Co., Philadelphia, Penn.

A companion volume to a previous publication (Vol. I) that dealt mainly with the briquetting of mineral fuels. The book, however, is complete in itself and covers in detail the characteristics of crude ores and prepared materials suitable or unsuitable for briquetting; the object of the process, and the particular requirements to be observed to insure successful results. Byproducts from metallurgical reduction works, and swarf (filings and like materials) from workshops are classified. Complete data of briquetting practice, with or without the use of binding materials, for a large number of products, are given in tabulated form; and approved practice is subsequently elaborated in greater detail. Binding materials are discussed: and drying and moistening machines described.

The mechanical aspect of the question is covered by descriptions of various briquetting machines. The book concludes with accounts of typical plants, which mostly reflect German and Norwegian practice, together with details of calcining in channel ovens. Tubular sintering furnaces are also considered.

The volume will be of value as a reference book to those who are concerned with briquetting operations, or who are interested in the possible application of the practice to their products, as exemplified by European methods.

The Twenty-eighth Annual Report of the Transvaal Chamber of Mines for the Year 1917. 7 x 9½, pp. 506. Transvaal Chamber of Mines, Johannesburg, South Africa.

The report contains data of monthly and annual (1917) output from the mines of the Rand and other parts of the Transvaal, with complete information as to the mill equipment in operation at each property. Sources of the gold are shown, according to the treatment method employed, and this is followed by a systematized statement of working costs and profits. A complete list of liquidations and companies registered in the country is given. Tables of labor distribution, salary and wages earned, casualties, and death rate, with average and proportionate (white and native) number of workmen employed, are presented in convenient form. Complete statements are appended of dividends paid, and past and present production of the mines.

The activities of the Chamber in dealing with economic problems are shown in accounts of progress made in the treatment and prevention of miners' silicosis, and in connection with experimental work in dust allaying. Social welfare work has been carried out in unusual directions, and ordinances have been passed improving the former regulations with regard to holiday leave on pay for all employees.

The book contains a mass of statistical information published in a manner that might well be adopted in many other mining districts. It will be acceptable to those who seek information on mining operations in the Transvaal.

Mortality from Respiratory Diseases in Dusty Trades (Inorganic Dusts). By Frederick L. Hoffman. Pp. 458. Bull. 231, Industrial Accidents and Hygiene, Series No. 17, Bureau of Labor Statistics, U. S. Department of Labor, Washington, D. C.

Chapter IV of this complete authoritative review deals with the mineral industries (mines, quarries, ore reduction and smelting). Frederick L. Hoffman, in discussing the limitations of occupational statistics, says:

> Much has been written in general terms on the health of miners and other mine employees, which, for reasons stated requires to be accepted with extreme caution. No very satisfactory progress has been made in the perfection of vital statistics to the extent that the relative health and mortality of specific employments under and above ground can be ascertained, especially with regard to the relative incidence of pulmonary tuberculosis and non-tuberculous respiratory diseases. As previously pointed out, the health-injurious conditions are frequently limited to a comparatively small group of underground employees, as best emphasized in the case of the rock drillers of the gold mines of the Transvaal. All general conclusions concerning the relation of the industry in its entirety or its principal branches must be considered inadequate for medical and public health purposes, or as a basic consideration for protective legislation.

A complete review of such statistical matter and reports as have been collected, together with a discussion of preventative measures, is given. The dust hazards of different kinds of mining are separately considered. To mine managers and employers of underground labor there is much of value in this part of the bulletin.

Personal

Have You Contributed to the Association of the 27th Engineers?

H. A. Wheeler is investigating the manganese resources of Missouri.

George A. Packard has left Boston for Ontario for a few weeks' examination work.

Arthur Thacher, of St. Louis, Mo., attended the Institute meeting in Colorado.

Philip N. Moore has returned to St. Louis, Mo., from a two months' trip to Alaska.

F. G. Stevens, of Toronto, Ont., has been examining coal properties in Kentucky and West Virginia.

Karl Ellers, of the American Smelting and Refining Co., has been in Salt Lake City, in connection with business for his company.

G. C. Bateman, general manager of the La Rose Mines, Ltd., Cobalt, Ont., has been examining properties in Alberta and British Columbia.

D. C. Jackling and **C. M. MacNeill,** of the Utah Copper Co., were in Salt Lake City recently for the purpose of inspecting the company's property.

C. Carleton Semple was in New York recently, having arrived in Seattle, Wash., last month after a trip through southwestern and southeastern Alaska.

J. C. Houston, formerly assistant manager of the Dome Mines, Ltd., at Porcupine, Ont., has been appointed manager of the Kirkland-Porphyry gold mine.

R. H. Selp, safety engineer for the New Jersey Zinc Co. at Franklin Furnace, N. J., attended the meeting of the National Safety Council at St. Louis last week.

Frank W. Sansom, mining engineer, of Joplin, Mo., has been made lieutenant colonel of the Second Regiment, Missouri State Guard. He served in the Spanish-American War.

Clemence W. Hippard and **Han Ho Huang** have been appointed research graduate assistants in mining engineering at the engineering experiment station of the University of Illinois.

Frederick E. Burbidge, manager of the Federal Mining and Smelting Co., of Wallace, Idaho, has returned from Quantico, Va., where he visited his son, who is a lieutenant of marines.

R. M. Jones, mining engineer of Goldfield, Nev., has been commissioned a captain of engineers and at present is with Company 3, Engineer Officers' Training School, Camp Humphreys, Virginia.

Earnest Bamberger has returned to Salt Lake City from Washington, where he has been engaged in war work, to take charge of his interests in this section, including the Ontario mine, at Park City.

O. F. Brinton, of Baxter Springs, Kan., has resigned as manager of the Admiralty Zinc Co., with properties in the Oklahoma section of the Joplin district, and will, it is understood, join the U. S. Army.

N. H. Getchell has returned to his mines in the Senator district, Arizona, after a long stay in a Chicago hospital, that kept him from his seat in the Arizona Senate during the recent extra legislative session.

Roy H. Allen, mining engineer and manager for the Tennessee Mining Co., at Joplin, Mo., has been notified of his acceptance in the Quartermaster Department of the Aviation Service, to hold the rank of captain.

George W. Moore, for the last seven years connected with the American Metal Co. as buyer in the Joplin district, has resigned to become head of the buying department of the Eagle-Picher Lead Co., with offices in Joplin.

Harrison E. Clement has recently been appointed general manager of the American Mining and Exploration Co., operating the Imlay and Rye Patch mines, in the Humboldt district, with headquarters at Imlay, Nevada.

William H. Kemp, of South Boston, Mass., and **William C. Lapham,** of Quincy, Mass., have returned East from a visit to Los Angeles, Calif., and Jerome, Ariz., made in connection with the recently compromised Hull Copper Co. litigation.

Sidney L. Shonts, mining engineer, of Wallace, Idaho, has been commissioned by the Government to investigate chromite deposits in Idaho and eastern Oregon. He is now in Oregon in response to requests to examine several discoveries of promise.

A. D. Hughes, manager of the dredging operations of the Yukon Gold Co. on Prichard Creek, Idaho, has enlisted in the Engineer Corps of the Army and will report for duty at Camp Humphreys, Va. His successor is **D. H. Perry** of San Francisco.

W. M. Tappan, formerly superintendent of the Hull-Rust mine at Hibbing, Minn., and for several years assistant superintendent of the Hibbing district, has been promoted to be general superintendent of the district for the Oliver Iron Mining Co.

Oscar Lachmund has resigned as general manager of the Canada Copper Corporation and will be succeeded by **Hugh R. Van Wagenen,** of Denver, Colo. Mr. Van Wagenen, has been in British Columbia looking over the situation and is to return to take up his new duties in a few weeks.

Harold C. E. Spence recently returned to his headquarters at the Ritz Carlton Hotel, Montreal, after spending several months in Labrador, Newfoundland, and Nova Scotia on work in connection with the oil-shale deposits in those places. He is now at the Mount Royal mines, at Duncan, Arizona.

Carlos W. Van Law has resigned as a vice president of the United States Smelting, Refining and Mining Co., and announces that he will engage in a general consulting practice, with especial attention to organization and management of mining and metallurgical enterprises. Mr. Van Law has been spending most of his time for the last two years in reviving the Crimora manganese mines in Virginia, which used to be famous as the largest domestic producer of this ore. Mr. Van Law has also been doing some work for Governmental departments in Washington.

Obituary

R. A. Kelso, a pioneer of Ontario and discoverer of the Alexo nickel mine, died in Vancouver, B. C., early in the summer. The townsite of Kelso, Porcupine, was named after him.

E. A. Ubrey, formerly active in mining affairs in Utah, died suddenly in Salt Lake City, on Sept. 1, at the age of 71. He was one of the organizers of the Alta Tunnel and Construction Co., of Utah.

Societies

American Association of Engineers has issued a directory of engineers, giving a brief synopsis of the experience and training of all members of the association, for the good of the members and as an aid to the employer of engineers. Cloth; 6 x 9 in.; pp. 192; $2.

Institute of Metals (British) held its autumn meeting on Sept. 10-11 in London. The following papers were presented: "The Effect of Progressive Cold-work upon the Tensile Properties of Pure Copper," by W. E. Alkins; "The Resistance of Metals to Penetration Under Impact," including a note on "The Hardness of Solid Elements as a Periodic Function of Their Atomic Weights," by Prof. C. A. Edwards; "Grain Growth in Metals," by Z. Jeffries; "Rapid Recrystallization in Deformed Non-Ferrous Metals," by D. Hanson; "The Influence of Impurities on the Mechanical Properties of Admiralty Gun Metal," by F. Johnson; "Rapid Method of Estimating Phosphorus in Bronzes," by T. E. Rooney; "A Peculiar Case of Disintegration of a Copper-Aluminum Alloy," by R. Seligman and P. Williams; "Annealing Cold Rolled Aluminum Sheet by Abbreviated Exposures at Various Temperatures," by R. J. Anderson; "Alloys of Copper and Zinc: an Investigation of Some of Their Mechanical Properties," by F. Johnson; and "Use of Liquid Fuel in the Foundry," by Capt. A. E. Plant.

Technical Schools

New York University is about to embark on a movement for enlarging its engineering school to coöperate more fully with the Government in war service and in reconstruction service after the war. Chancellor Elmer E. Brown states that plans for the extension of the school of applied science of the university include the erection of a new engineering building on the campus at 181st St., New York, on a tract recently given to the university by Mrs. Russell Sage. The movement is regarded as a war emergency measure. The council of the university and the faculty of the engineering school agree as to the need of keeping engineering students in training during the war, and of introducing added facilities for technical instruction. Dean Charles H. Snow of the school of applied science states that the attendance in engineering schools has fallen off about 35%. During the last summer New York University has trained 1800 National Army men, 600 at a time, as gas-engine workers, automobile repairers, truck chauffeurs, blacksmiths, carpenters, machinists, concrete workers, radio operators, and in other crafts. These men, on completion of their training, were assigned to different army units.

Industrial News

Metals Disintegrating Co., Inc., has removed from 3 South William St. to 62 Broadway, New York.

Vulcan Steel Products Co., 120 Broadway, New York, will discontinue the publication of "Vulcan" with the August issue for the period of the war. Governmental restrictions concerning house organs and the need for conserving labor and material render this step advisable.

Manufacturers' Catalogs and supplementary literature are needed at U. S. A. General Hospital No. 9 at Lakewood, N. J., for re-educational work among disabled soldiers. The courses studied are those given in any polytechnic school and cover 40 or more subjects. The catalogs should be addressed to the Chief of Educational Service at the hospital.

Industrial Electric Furnace Co., Chicago, makers of the Snyder electric furnace, are installing a five-ton furnace in the plant of the Zimmerman Steel Co., Bettendorf, Iowa. It is a three-phase furnace designed for acid operation and will be used for general work. C. H. Atherton, manager of the latter company, ordered the installation to replace the converter which they had been using.

Jeffrey Manufacturing Co., Columbus, Ohio, has reopened its branch office in Cleveland, Ohio, at 437 Leader-News Bldg., which will be in charge of P. C. Dierdorff and C. B. Reed. Messrs. Reed and Dierdorff have both had years of successful sales and engineering experience in the manufacture and application of Jeffrey products and are especially qualified to render advisory service to customers in solving elevating, conveying, crushing and mining-machinery problems.

New Patents

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

Aluminum, Process of Making Nitride of. Mark Shoeld, Chicago, Ill., assignor to Armour Fertilizer Works, Chicago, Ill. (U. S. 1,274,797; Aug. 6, 1918.)

Ball Mill. Donald H. Fairchild, Denver, Colo. (U. S. No. 1,275,184; Aug. 6, 1918.)

Concentration—Jig. Henry W. Faust, Seattle, Wash., assignor to Sybil B. Faust. (U. S. No. 1,275,235; Aug. 13, 1918.)

Copper, Method of Producing Commercially Pure. Charles S. Bradley, New York, N. Y. (U. S. No. 1,275,374; Aug. 13, 1918.)

Furnace. Electrical Induction. Oluf Christian Böckman. Notodden, Norway. (U. S. No. 1,275,206; Aug. 3, 1918.)

Metals, Production of Finely Divided. Thomas A. Edison, Llewellyn Park, West Orange, N. J., assignor to Edison Storage Battery Co., West Orange, N. J. (U. S. No. 1,275,232; Aug. 13, 1918.)

Mine Ventilation, Means of. Stanley Nettleton, Johannesburg, Transvaal, South Africa. (U. S. No. 1,274,438; Aug. 6, 1918.)

Phosphorus, Manufacture of. Harry Orlando Hickman Wenman, Bishop's Castle, England. (U. S. No. 1,274,479; Aug. 6, 1918.)

Platinumizing Metal Surfaces, Process of. Benjamin B. Crombie, Port Chester, N. Y. (U. S. No. 1,274,995; Aug. 6, 1918.)

Zinc. Process for Utilizing the Residues Obtained in the Distillation of. Rudolf Köhler and Otto Baltin, Lipine, Germany. (U. S. No. 1,275,045; Aug. 6, 1918.)

Editorial Correspondence

SAN FRANCISCO—Sept. 10

Petroleum Production in California in June totaled 8,486,932 bbl. During the month, 42 new wells were completed, having a total initial daily production of 5492 bbl. The total number of wells producing in the month was 8292, having a total daily production of 282,896 bbl., an increase over May of 7763 bbl. There was a total of 56 new rigs installed and 382 wells were being drilled. Six wells were abandoned. Field and pipe-line stocks, including crude and residium, at July 1, totaled 24,233,520 bbl., an increase from June 1 of 256,602 bbl. of crude and a decrease of 22,790 bbl. of residium, or a total increase of 233,812. These figures are taken from the summary issued by the Pacific Coast Petroleum War Service. The report of the state oil and gas supervisor, R. P. McLaughlin, issued Aug. 31, shows 17 new wells ready to drill during August, making a total of 514 since Jan. 1, compared to 724 for the same period in 1917, a decrease of 29%. At the end of 1917 every oil-producing county in the state registered an increase in average daily production for the year. But the figures for June, 1918, although showing an increase over May in average daily production, show an appreciable decrease in some of the important fields as compared to June, 1917. The increase in June, 1918, over May, is due to large increase in other fields and development in the new coast fields.

Temporary Labor Shortage in the mines of Nevada County has been overcome by the return of a large number of mine laborers from the shipbuilding plants, whither they had gone beguiled by higher wages. Many of them soon learned that the cost of living and the various attractions for the entertainment of workingmen drew so heavily upon their earnings that they were unable to save as much per month as they had at the mines. No doubt hundreds of the men were enticed from the mining camps by the fear of curtailment in gold mining on account of the high cost of operation. Recently this fear has given way to the hope that the Government will do something to relieve the gold-mine operator, and many of the miners have come to realize that they themselves have been largely responsible for the reduction in gold production, for shortage of labor has been one of the effective factors in reducing output of the mines. In addition to these causes for the return of the miners to the mining camps, the fact that their jobs in the mines are of a permanent character, and the more profitable in the long run, has created an influence difficult to escape by workmen who have the future welfare of their families at heart. The manufacturing centers have their attractions, which are costly; the mining camps their home influences and interests, which are economic. But the men had become restless and impatient, and not a few of them persuaded themselves that shipbuilding was a more patriotic employment than mining.

DENVER—Sept. 11

Tungsten Mining in Colorado appears to be on a stable basis, although it is not as active as during the boom days of 1917. At the present time the demand is strong, and the price ranges from $18 to $22 a unit. All of the developed properties are running at full capacity, and the mills of the Wolf Tongue, at Nederland; the Long Chance, on the Beaver; the Primos, at Lakewood; the Rare Metals, at Rollinsville; the Vasco, at Tungsten; the Red Sign, at Ferberite, and the Lucky Two; at Boulder, are running steadily. At Boulder, the Tungsten Production Co. is working to capacity, manufacturing ferrotungsten, for which there is a good market, and the Black Metals Co. is turning out large quantities of tungstic acid.

Fluorspar Mining in Colorado is greatly stimulated by the demand for this mineral on account of its use in making war munitions. The mineral is mined near Jamestown, in Boulder County; at the Barstow mine, in San Juan County; and elsewhere in the state. The Wano mill, at Jamestown, has been overhauled and changed so as to concentrate fluorspar, and the output of this ore will be increased to 125 tons daily as soon as the plant is operating at full capacity. The present output is from 50 to 60 tons daily. Lack of transportation facilities has prevented greater production of this ore, which must be hauled to Boulder in auto trucks over a poor wagon road. At present a movement is on foot to build a new and better road. The concentrate is shipped to Chicago, Pittsburgh, and other Eastern points.

The New Draft Bill is of vital interest to Colorado mine operators, especially as it refers to classification of labor. Representative mining men have interviewed General Crowder and Chairman Neave of the man power committee of the U. S. Employment Service, in whose hands is placed jurisdiction over problems involved in the new draft. The Provost Marshall is determined to place all physically able men from 18 to 36 into military service at once except those shown to be absolutely necessary to production in the industries. Mine operators are asked to make suggestions promptly to assist in placing valuable men in deferred classes. The United States Employment Service plans a campaign backed by a declaration of President Wilson, to urge all men engaged in necessary work in mines, oil fields and industries producing raw or manufactured materials, to ask for deferred classification. All decisions as to classification will be made by district boards and not by local boards. The State Advisory Board of the U. S. Employment Service in Colorado will nominate three advisors to sit with the District Board, one to pass on agricultural questions, one on industries, and one on commercial and professional pursuits. The advice of these men will probably count heavily in decisions of district boards; hence the selection of the industrial advisor is important. As these appointments will be made at an early date, operators should take prompt measures to see that suitable appointments are made. It is desired that representative men be appointed to fill these positions. Mine operators and metal producers are urged to at once check up on all employees in order to place in the hands of the district board individual personal information regarding each man essential to each mine or oil field.

SALT LAKE CITY—Sept. 13

Mining, Development and Operating Costs to Utah metal producers have risen considerably during the last six months, and show an increase of at least 33 to 50 and in some cases up to 65% between Jan. 1 and July of the present year. During that period the rise in the price of some of the principal supplies has been approximately as follows: Powder, from $20.88 to $24.75; fuse, $28.50 to $53.75 per 1000 ft.; caps, $18 to $24 per 1000; steel, 11c. to 23c. per lb.; timber, $28.50 to $34.75 per 1000 ft. Also, wages have increased 75c. a shift within this time, the present scale being: Machine men, $5.25; machine helper, $5; hand miner, $5; mucker, $4.75; timberman, $5.25; trammer, $4.75; laborer, $4. In addition, there has been an increase of 25% in freight rates, and an increase of 55% in the freight rate on bullion to Eastern refineries, all of which must be paid by the producer. The result has been a decrease in production, especially of low-grade ores, and some companies have discontinued the mining of copper. The Utah Chapter of the American Mining Congress, acting for Utah metal producers, has requested that the Railroad Administration restore the old rates on ores of an actual value of $20 or less. The matter is now under consideration, and favorable action is hoped for. If the rates on low-grade ores are restored, the resultant increased production of ores of this character will add to the output of higher-grade ores also, as more high-grade ores developed in connection with low-grade bodies will be shipped.

RENO, NEV.—Sept. 7

Secondary Mining Education for men employed in metal mines and mills was first introduced by Nevada and is now conducted as an extension department of the University of Nevada. The system consists of five district schools. Four of these are permanently situated at Virginia City, Tonopah, Goldfield and Ely, and the fifth is a moving school which is at present in session at Yerington, but is free to go to any camp in Nevada where the demand is sufficient. The object of Nevada's secondary mining schools is to enable working miners and millmen to fit themselves for higher positions without stopping work. The only requirement for entrance into these schools is the ability to talk and read English, and the instruction is elementary and practical in character. Thirty-seven courses are offered, and suggestions are made for the grouping of these courses to train for different positions. Courses and groupings may be obtained by writing to the Director of the Mackay School of Mines at Reno, Nevada.

PHOENIX, ARIZ.—Sept. 10

Handbills Calling for a General Strike in the Globe-Miami and the Jerome districts have been circulated. They announced the purpose of the proposed strike to be the forcing of the release of Thomas J. Mooney, William D. Haywood and others now in custody, including members of the I. W. W. recently convicted in Chicago for violation of the Espionage Act.

The State Corporation Commission has been petitioned by 3000 men working in the copper mines and smelteries of the Miami district to investigate water and electric-light service rates. Complaint is made against five water companies and also against the city of Miami. The commission has asked the water companies to supply data as to costs and earnings and will soon arrange for a hearing.

WALLACE, IDAHO—Sept. 7

Scientific Ventilation of deep workings is receiving the attention of Coeur d'Alene operators. The Federal Mining and Smelting Co. has taken the lead in this matter at the Morning mine, and is now delivering fresh air at the rate of 200 cu. ft. per min. per man employed. Robert N. Bell, state mine inspector, recently made an exhaustive investigation of the system adopted by the Anaconda company at Butte, and finds the system well adapted to meet conditions in this district. Its essential features, as described by Mr. Bell, are smooth-lined main conduits, plenty of blower capacity, and a sufficient number of air doors to direct its equal distribution underground and exhaustion back to the surface. According to Mr. Bell, there are no natural rock temperatures in Coeur d'Alene mines above 80 degrees.

Official Authority has been given the Oregon-Washington R. R. & Navigation Co. to construct a nine-mile branch up Pine Creek. The construction of this line was started last autumn, but during the winter high water carried out the completed track. By the time conditions were favorable to resume construction, the Government had taken over all railroads and suspended extension of new lines. Three months ago, through representations made by mining companies on Pine Creek, Director-General McAdoo authorized the expenditure of the original estimate, $300,000, for the completion of the branch. Following his action, the railroad company made a new survey, changing the grade to avoid damage by high water, which, with the increased cost of labor and material, brought the estimated cost up to about double the original figure. Confronted with this additional expense, the railroad company was unwilling to proceed without further authorization. This was recently received from Judge R. S. Lovett, Administrator of Railroads for the Government, and the enterprise will be taken up without further delay. Among the shipping mines that will be served are the Douglas, Constitution, Nabob and Highland-Surprise.

BUTTE, MONT.—Sept. 13

Efforts to Increase Copper Production are handicapped on account of the lack of skilled miners. There is not a property in the district that could not give employment to more men. With the new registration, several thousand miners will be subject to draft, and unless some concentrated effort is made to have them exempted, the pro-

duction before the close of the year will be considerably lower than at present. Many of the miners are married men with families, and they will not be called upon for the present, but the majority of the men employed in all the mines are single, and they are surely to be placed in Class 1. Both the Anaconda and the Butte & Superior companies fell behind in tons of ore hoisted during August, and there will probably be a further decline during the present month. Next month there may be some additions to the mine force, owing to men returning from prospecting in the hills during the summer and from ranch work, but the number will not even up the loss by the draft.

ST. LOUIS, MO.—Sept. 10

Lead Mining in Franklin County is receiving considerable attention at present. The Tamm interests have opened up a lead-and-zinc property near Anaconda that is producing considerable zinc carbonate. The Franklin Mines Co. is reopening tin-lead properties on Hoosier Creek near St. Clair. The old Northumberland mine, at St. Clair, is being reopened and a shaft has been sunk to 118 ft. on a fissure vein. St. Louis interests are opening up a fissure-vein deposit south of the Meremac River, near the old Cyclone mine.

JOPLIN, MO.—Sept. 9

The First of a Number of contemplated warehouses for ore storage in this district is under construction at Picher, Okla., and the promoters of the Oklahoma Ore Storage Association, which is associated with the Oklahoma Mining Exchange, expect to build several others immediately. Though the plan appears to be gaining headway, older producers are still credulous in respect to the enterprise. During the last week George E. Nicholson, head of the Kusa Spelter Co., Kusa, Okla., wrote to the promoters of the project and gave it his unqualified endorsement, stating that he would dispense with his ore buyers in this field as soon as the warehouse association begins business. Promoters of the idea have announced in Miami papers that they expect to build one or more warehouses at Joplin or Webb City, but the matter has not as yet been brought to the attention of the producers or business men in these cities. It is hoped, it is said, to have the first warehouse at Picher, Okla., completed by October 1.

CLEVELAND, OHIO—Sept. 10

The Labor Shortage in the Lake Superior iron districts is becoming more evident, according to "Iron Age." This is particularly true on the Gogebic and Cuyuna ranges, and on the latter has necessitated some curtailment in the production of manganiferous ores, which have been so much in demand this year. Stock piles at the underground mines on the various ranges have been well cut down, and it is expected that these piles will be about cleaned up when navigation closes. More ore carriers are being diverted to the Lake Michigan grain trade, and as soon as the grain movement has started from ports at the head of Lake Superior, considerable additional vessel tonnage must be withdrawn from the ore trade.

GRAND RAPIDS, MINN.—Sept. 8

Itasca County Shipments amounted to 6,716,000 tons of iron ore for the year ended June 30, 1918, according to the report of W. J. Trescott, mine inspector for the county. The Canisteo mine, at Coleraine, shipped 1,621,387 tons of ore and removed 1,707,732 yd. of overburden during the period mentioned. From the standpoint of shipments, the Bennet mine, in the Keewatin district, ranks second, with a shipment of 920,495 tons, and the Holman mine third, with 841,537 tons. At the Hill Annex mine, at Calumet, 1,218,131 yd. of dirt was removed, and at the Arcturus mine, at Marble, 1,136,708 yd. During the year there were within the county 11 fatal accidents. Considerable exploration was done, a total of 300 men being employed in this work. The average wage for all mining labor was $4.34 per day, and varied from $3.88 for common labor to as high as $9.30 for steam shovel engineers. During the period, 9,149,000 yd. of overburden was stripped at different mining properties and three washing plants were started, which makes a total of nine now in operation. Shipping and development operations employed 4273 men, which is the largest number in the history of the county, as 3300 were employed in the previous year and only 2200 in 1900, when great development and construction work was under way.

TORONTO—Sept. 13

Development of Oil Resources of western Canada has recently been strongly urged upon the government as a war measure by the Saskatoon Board of Trade and other representative bodies. The government has referred the question to the Reconstruction Committee of the Cabinet, of which the Hon. A. K. MacLean is chairman. There is little data available as to the commercial possibilities of the western oil deposits, as the reports deal almost entirely with the geological and scientific conditions. D. B. Dowling, of the Geological Survey, is now engaged in an investigation of these oil fields and the action of the committee will probably be influenced by the result of his researches.

Acquittal of the Defendant was the decision given by Police Magistrate Armstrong, of Cobalt, in the case M. P. MacDonald, mining engineer, charged with violating the Ontario Land Surveyors' Act by doing underground surveying. The case is regarded as one of importance to the profession as establishing the right of mining engineers to do underground surveying, within properly recorded boundaries, as has hitherto been the general practice in Cobalt. An adverse decision might have entailed the re-survey of most of the underground workings of the camp. The exclusive right of the surveyors to make surveys for recording purposes is not disputed.

VICTORIA, B. C.—Sept. 12

Value of Gold Bullion deposited at the Dominion of Canada assay office, Vancouver, B. C., during the month of August, 1918, was $608,838.43, which is an increase of $253,845.43, over the same month of 1917. Most of this gold came from the Yukon.

Consolidated Mining and Smelting Co. of Canada has announced a scholarship of $500 per annum which it will give to the man standing first, among the families of its employees, in his matriculation examination for an applied science course in the British Columbia University or any Canadian university.

The Installation of a Reduction Plant for the purpose of developing the production of mercury required in Canada for munition purposes has been recommended by Charles Camsell, in charge of the work of the Geological Survey in British Columbia, following his examinations of mercury deposits at the western end of Kamloops Lake. The deposits occur in irregular veins, consisting chiefly of calcite and quartz, with some dolomite, containing pockets of cinnabar in a zone of decomposed tertiary volcanic rocks. A small quantity of mercury was produced from these deposits in the period extending from 1895 to 1897, in all 138 flasks of 76½ lb. each, valued at $4607. There has not been any production of mercury in Canada since. Its occurrence has been reported in ores of the Cobalt district, Ontario; in the neighborhood of Field, B. C., and near Sechart, west coast of Vancouver Island.

The Establishment of a Steel Industry on the Pacific Coast which would lead to the utilization of the magnetic iron ores of British Columbia, as well as to the material advancement of its commercial interests, is earnestly desired by the provincial government. William Sloan, Minister of Mines, declares that he has decided to diamond drill a number of the most promising properties to gain a definite idea of the tonnage available and also to give those interested a practical demonstration of the possibilities of the iron and steel industry. His engineers have been carrying out investigations with this work in mind, and properties have been selected. He therefore has announced that tenders would be called for at an early date for the diamond drilling of iron properties and that the work thereon would be proceeded with as expeditiously as possible, in order that the desired information might without loss of time be put before those who might be interested in the iron-ore deposits of the province.

The Boundary District of British Columbia has suffered a blow in the recent closing down of the Phoenix mines of the Granby Consolidated Mining and Smelting Co., with the consequent discontinuance of operation of the Grand Forks, B. C., smeltery. The absence of this industry, apart from the general indirect effect, means a serious loss to the West Kootenay Power and Light Co., which for years has supplied power for this plant, and to the small mine operators accustomed to make shipments of ore to the smeltery for treatment, besides throwing many employees out of work. The explanation given by the company is that it is no longer profitable to handle the low-grade ore of the Phoenix mines, because of increased costs, among those things instanced being the increase in the cost of hydro-electric power, increased price of coke and increased railway freight rates. The mines have been operated for some time on a narrow margin, it taking 22½c. per lb. to produce a pound of copper from their ores, because of high costs. With the government price of 23½c. per lb., there was a margin of profit of 1c. The subsequent increase to 26c. per lb. did not make the difference that might have been looked for, owing to the simultaneous rise in freight and other charges.

The Mining News

ARIZONA

Cochise County

SHATTUCK ARIZONA (Bisbee)—August production was: Copper, 682,861 lb.; lead, 199,528 lb.; silver 14,189 oz., and gold, 112.91 oz. Production for eight months of 1918 was: Copper, 6,561,059 lb.; lead, 644,465 lb.; silver, 100,460 oz., and gold, 819.51 ounces.

CALUMET & ARIZONA (Warren)—Smeltery production during August amounted to 5,568,000 lb. of copper, of which 4,376,000 lb. was available for Calumet & Arizona.

Greenlee County

ASH PEAK EXTENSION (Duncan)—Sinking from 200 to 300 level and will crosscut vein. John Horrigan is superintendent.

ASH PEAK (Duncan)—Development by Goldfields-Consolidated progressing with satisfactory results. Charles Starr is superintendent.

PHILLIPS & YOUNG (Duncan)—To start development on manganese property next week.

RIVAL (Twin Peaks)—Drifting on 200 level.

Mohave County

HAMME CLAIMS (Cedar Valley)—Deep tunnel to be driven to cut several veins 1000 ft. below outcroppings. Mill to be moved to a point below mouth of tunnel, which is expected to develop an ample water supply.

CHLORIDE QUEEN (Chloride)—New machinery has been installed. Shaft is down 230 feet.

EMERSON (Chloride)—Has erected mill.

GOLDEN CROSS (Chloride)—Developing Jack Pot claim and has installed complete plant.

TENNESSEE (Chloride) — Operations temporarily suspended.

RICO (Kingman)—Shaft nearing 200 level.

UNITED EASTERN (Oatman)—Mill making 97% extraction of quartz ore carrying gold.

SILVER LEGION (Stockton Hills)—Leased by A. J. and W. O. Davidson and G. W. Brady, who will ship. Ore carries gold, silver, copper and zinc.

Pima County

NEW CORNELIA (Ajo)—August production was 3,928,000 lb. of copper.

GUNSIGHT (Gunsight)—To use trucks to transport ore to the railroad.

MONTEZUMA (Gunsight)—Five-stamp mill started on property seven miles east of old Gunsight and 24 miles east of Ajo.

COBRIZA (Tucson)—Being developed under lease by Wiley B. Akers. First car of copper and silver ore shipped. Mine situated 65 miles west of Tucson, in Como Babi Mountains.

Pinal County

RAY HERCULES (Ray)—Two sections of mill in full operation and the third to begin soon.

Santa Cruz County

CONSOLIDATED ARIZONA COPPER (Mowry)—Has received hoist and engine. Other machinery ordered. Shaft has been sunk 100 feet.

MORNING GLORY (Patagonia) — Increasing working force. Leased by E. R. Shaw and associates.

MOWRY (Patagonia)—Plant to be installed to concentrate manganese ores.

THREE R (Patagonia)—Operating 100-ton concentrating mill.

Yavapai County

GADSDEN (Jerome)—Sump below 1200 level has been sunk and station is being cut.

GRAND ISLAND (Jerome) — Sinking three-compartment shaft at rate of 100 ft. a month, and now down about 270 feet.

GREEN MONSTER (Jerome)—Dorothy May shaft down 849 ft. and bottom is diorite.

SQUAW PEAK (Jerome)—Tunnel in over 200 ft. and has cut ore.

VERDE COMBINATION (Jerome)—Four headings being worked on the 1080 level. Three show mineralization in quartz and schist.

VERDE SQUAW (Jerome)—Plant has been installed and will operate soon.

ARKANSAS

Marion County

DIXIE GIRL (Buffalo)—Late rains have furnished supply of water for milling purposes. Hauling ore for shipment. Building new tram from deposit of carbonate to the mill.

HAWKEYE (Rush)—Mill completed and in operation. Ore being hauled to Yellville for shipment.

MATTIE MAY (Rush)—Opening up second body of carbonate ore, 75 ft. below upper body productive for some time. Mill to be built on property soon.

MORNING STAR (Rush)—Opened 20-ft. face of manganese-bearing clay above zinc-bearing strata. Ore is disseminated through the clay in varying sizes.

WILD BILL (Yellville)—Under operation by H. M. Berdeen, who has opened up good lead prospect.

CALIFORNIA

Shasta County

MAMMOTH (Kennett)—Smeltery production during August is estimated at 1,320,000 lb. of copper.

COLORADO.

Boulder County

MALMO (Brainerd Camp)—Tunnel operations resumed Sept. 1. A shoot of gray copper ore has been opened. C. E. Bredenberg is manager.

CARIBOU (Caribou)—Leadville lessees producing considerable ore. Transportation of ore delayed by car shortage of Denver, Boulder & Western R.R. About ten carloads of high-grade silver ore awaiting shipment.

San Miguel County

MORNING STAR (Mount Wilson)—Being developed under lease by Nick Zurich, of Telluride. Compressor and air drills have been installed. Small vein of silver-lead ore has been opened.

CARBONERO (Ophir)—Active development to be continued. Three carloads of crude ore shipped last month.

SHIPMENTS OF ORE AND CONCENTRATE from Telluride during August were: Smuggler and Black Bear, 42 cars of concentrate to Pueblo and 18 cars to Durango; Tomboy, 2 cars concentrate to Pueblo and 34 cars to Durango; Cimarron, 2 cars concentrates to Pueblo; Lewis, 3 cars concentrate; Boomerang mine, one car crude ore; total 102 cars. During same month last year 123 carloads were shipped.

TOMBOY (Telluride)—Wage scale paid by company since May 15, 1918, has been raised 50c. per day.

IDAHO

Shoshone County

SHERMAN (Burke)—Raise being driven from No. 5 tunnel to connect with level 500 ft. above.

COPPER KING (Mullan)—Mine has closed down pending arrangements to build 100-ton mill.

NATIONAL (Mullan)—Installation of new hoist and electric pump almost completed. Mill running one shift only while changes are being made. Winze to be sunk 200 ft. from 1500 level.

TUSCUMBIA (Wallace)—Lessees operating mine and Idora mill have started shipping concentrates. Idora mill is on Beaver Creek, one mile from railroad.

NEVADA

Eureka County

OIL SHALE has been discovered 13 miles north of Eureka, and locations are being made.

Humboldt County

O'LEARY AND CLOUGH (Golconda)—Have sold manganese mine, 16 miles south, to National Resources Corporation, of Indianapolis. Development work to start soon. Buildings under construction. Plan to use caterpillar tractor for ore haulage to railroad.

Lander County

COPPER CANYON (Battle Mountain)—Shipping 30 tons of copper ore per day. High freight rates, smelting charges and wages have seriously cut down profits on this ore, as is true of all small copper producers in Nevada, higher price of copper notwithstanding.

Nye County

THANKSGIVING (Manhattan)—To resume operations under direction of C. T. Stanley. To sink shaft 100 ft. deeper and crosscut to ore.

WHITE CAPS (Manhattan)—Shaft sinking has started.

TONOPAH DISTRICT ore production for the week ended Sept. 7 totalled 9335 tons, of an estimated gross milling value of $158,695. Producers were: Tonopah Belmont, 1895 tons; Tonopah Mining, 3900; Tonopah Extension, 2184; Jim Butler, 217; West End, 777; Rescue, 66; MacNamara, 315; Montant, 162; Halifax, 112 and miscellaneous 22 tons.

NORTH STAR (Tonopah) — Drifting north on 980 level has cut smelting-grade ore for full width of drift and for length of 25 ft. Drifting still in progress.

WEST END CONSOLIDATED (Tonopah)—New office building being built.

Storey County

UNION (Virginia City) — Two men seriously injured on 2600 level by accidental explosion of charge in drill hole while it was being loaded.

White Pine County

CONSOLIDATED COPPER MINES (Kimberly)—July production of copper was 1,059,389 lb. Transmission line and transformer station were completed early in July. Kimberly concentrator, Morris-Brooks compressor plant, mine pumps and haulage, pumping plant for concentrator and all shops and small equipment are to be placed on electric drive.

NEW MEXICO

Grant County

BOSTON-HECLA (Lordsburg)—Surveying site for new shaft and buildings and constructing wagon road. R. E. Vandruff is general manager.

EL DORADO (Lordsburg)—Option has been taken by G. Neil, of Wilcox, Ariz., who will start work soon.

GREEN KING (Lordsburg)—New shaft down 35 ft. and showing copper sulphides. Daniel Brial is owner.

UTAH

Beaver County

MILFORD COPPER (Milford)—Making shipments of iron ore and small amount of copper. Alfred Frank is manager.

Juab County

TINTIC SHIPMENTS for the week ended Sept. 7 amounted to 155 cars.

APEX STANDARD (Eureka)—Sinking shaft. Mine has extensive holdings in western end of district.

EUREKA MINES (Eureka)—Two machine drills started on 700 level. Considerable low-grade ore available, as well as ore of better grade.

IMPERIAL LEAD (Tintic Junction)—Has contracted for hauling of ore to railroad. W. Mont Ferry is president.

LIBERTY MANGANESE (Tintic Junction)—Owns 11 claims in west Tintic section. Promising showing of manganese ore developed by 100-ft. tunnel and crosscut. T. L. McCarthy, of Salt Lake, is president.

Salt Lake County

MONTANA-BINGHAM (Bingham)—Two cars of copper ore shipped recently.

Summit County

PARK CITY SHIPMENTS for the week ended Sept. 6 amounted to 3,578,394 lb. ore and concentrates.

SILVER KING CONSOLIDATED (Park City)Drain and operating tunnel in 7700 feet. Mill machinery being installed at No. 2 shaft, where 250-level workings are being cleaned out and retimbered to produce mill ore for mill. Old workings recently cleaned out and closed down.

Tooele County

SEMINOLE COPPER (Gold Hill)—Ore being stocked on dump. Mill to be built.

WESTERN UTAH COPPER (Gold Hill)—Gold Hill shaft down 325 ft. Level to be cut at 400 ft., and development undertaken. Copper ore cut in Yellowhammer shaft, down over 90 ft. Property producing about 100 tons of ore daily.

Utah County

ACTIVE PROPERTIES in American Fork Canyon are the Globe Consolidated, Bog Iron, Mineral Flat, Earl Eagle, Bay State, Healey, Etta May and Smuggler.

BELEROPHON (American Fork)—Shipped first car of concentrates from new mill. Under lease to C. B. Ferlin.

WASHINGTON

Ferry County

LONE PINE-SURPRISE (Republic) — Shipped 1500 tons during August. Ore has been followed 342 ft. on 500 level. Little development work in progress.

Stevens County

UNITED COPPER (Chewelah)—Property has been leased to A. W. Kemp, who is making small shipments.

CANADA

British Columbia

LANARK (Illecillewaet)—Rich vein uncovered for 350 ft. shows lead, copper and silver ore. New machinery is being installed.

LADYSMITH SMELTING (Ladysmith)—Has ceased operations again, the smeltery having been run for a short time, during which period an accumulation of ore was disposed of.

EUREKA (Nelson)—Mine has been sold to Inland Mining Co., of Walla Walla, Wash. J. J. Malone is manager.

TIDEWATER COPPER (Sidney Inlet)—Opening up old workings. Driving tunnel through mountain and constructing small railroad to connect with wharf to facilitate shipments.

CONSOLIDATED MINING AND SMELTING (Trail)—Rock Candy group of fluorspar claims, situated on north fork of the Kettle River, being rapidly developed and will make regular shipments soon.

MEXICO

Sonora

GREENE CANANEA (Cananea)—Production in August was: Copper 5,000,000 lb.; silver 155,940 oz. and gold, 1250 ounces.

PERU

Junin

CERRO DE PASCO (Cerro de Pasco)—Planning new smeltery, to be built at the junction of company's main railroad and the Central Ry. of Peru. Project is expected to cost about $5,000,000 and will have a capacity of 10,000,000 lb. of blister copper per month.

AFRICA

Belgian Congo

UNION MINIERE DU HAUT KATANGA. (Elizabethville)—Produced in August 4,894,210 lb. copper.

The Market Report

SILVER AND STERLING EXCHANGE

Sept.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Sept.	Sterling Exchange	Silver New York, Cents	Silver London, Pence
12	4.7550	101⅛	49⅛	16	4.7550	101⅛	49⅛
13	4.7550	101⅛	49⅛	17	4.7550	101⅛	49⅛
14	4.7550	101⅛	49⅛	18	4.7550	101⅛	49⅛

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Sept.	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
12	*26	†	8.05	7.75	@9⅛
13	*26	†	8.05	7.75	@9⅛
14	*26	†	8.05	7.75	@9⅛
16	*26	†	8.05	7.75	@9⅛
17	*26	†	8.05	7.75	9.25 @9.35
18	*26	†	8.05	7.75	9.10 @9.20

* Price fixed by agreement between American copper producers and the U. S. Government, according to official statement for publication on Friday, September 21, 1917, and July 2, 1918.

† No market.

The above quotations (except as to copper, the price for which has been fixed by agreement between American copper producers and the U. S. Government, wherein there is no free market) are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quszations for electroly tic copper are for cakes ingots and wirebars.

We quote electrolytic cathodes at 0.05 to 0.10c below the price of wirebars, cakes and ingots.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

LONDON

Sept.	Copper Standard Spot	Copper Standard 3 M.	Copper Electrolytic	Tin Spot	Tin 3 M.	Lead Spot	Lead 3 M.	Zinc Spot
12	122	122	137	343½	343½	29½	28½	54
13	122	122	137	343½	343½	29½	28½	54
14	...	...	...	...	...	...	...	...
16	122	122	137	343½	343½	29½	28½	54
17	122	122	137	343½	343½	29½	28½	54
18	122	122	137	343½	343½	29½	28½	54

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at $4.7515: £29½ = 6.2576c.; £54 = 11.4545c.; £110 = 23.3333c.; £125 = 26.5151c.; £260 = 55.1513c.; £280 = 59.3937c.; £300 = 63.6362c. Variations, £1 = 0.2121205c.

Metal Markets

NEW YORK—Sept. 18, 1918

There is scarcely anything to be said of the markets except to report events, zinc and antimony being the only important metals in which free markets remain.

Copper—There were no special features. Mine production shows a rather distinct tendency to diminish. Refiners have pretty much adjusted their contracts with mining companies on the new terms which the advance in price to 26c. permitted.

Copper Sheets—The base price of copper sheets is 35½c. per lb. Copper wire is quoted at 29 and 30c. per lb. f.o.b. mill, carload lots, subject to any change in the price of copper. Unchanged.

Tin—The great event of the week was the announcement of the international tin control, whereby all purchases in the Straits are to be made through E. Boustead & Co., and allocations for consumption are to be made through the tin control, sitting in London, the distribution in the United States to be through the American Iron and Steel Institute. Moreover, it is generally understood that the financial obligations will be assumed by the U. S. Steel Corporation. This arrangement will put tin merchants completely out of business. Nobody yet knows just how the tin business is going to be done or when the new plans will be inaugurated. Nobody knows just how the buying of tin in Hong Kong and Batavia is to be managed, how the Bolivian and miscellaneous business will be conducted, what will be the position of merchants who have supplies afloat, or what will be the position of producers who have contracted their production for some time ahead.

Singapore quoted £337½, c.i.f., London, on the 12th and the 13th. Since the 13th no quotations have been communicated, and it is assumed that the new order of things has gone into effect, with a consequence of no further trading in that market. In this market Banka tin and metal of 99% grade is quoted at 78@80c., and there is a good demand for it. Straits tin for shipment is quoted at 72c. The London quotation for Straits is £343½, which would be equivalent to 73c. here. It is expected that a price of something like the current quotation will be fixed in London, and something in the neighborhood of 73 or 75c. here. The question will then be whether the Chinese, Dutch, Bolivians and others will be willing to produce and sell for what the international control is willing to give.

Lead—The business is entirely in the hands of the Lead Committee. This is endeavoring to make seven or eight tons suffice where ten tons are needed. Orders for consumption are being carefully scrutinized, and all uses that are deemed nonessential are being excluded.

An error was made in our London prices last week. The price of London lead, 3 months, should have been 28½ on each of the respective dates, Aug. 29, Aug. 30, Sept. 2, Sept. 3 and Sept. 4.

Zinc—A rather large business was done in both common spelter and brass special. Europe wants to buy a lot of manufactured brass, but we seem to be unable to furnish all that is wanted, owing to insufficient brass-mill capacity, or, rather, not insufficient mill capacity, but insufficient labor. The spelter market did not respond to some large purchases in the manner expected, and as the week wore on it became easier. Spot and prompt metal fetched distinctly higher prices than what producers were willing to accept for fourth-quarter contracts. High-grade spelter is easy, and a fairly large sale of intermediate was made at a surprisingly low figure.

Average monthly price of New York spelter—Our July and August monthly New York spelter prices are in error, and we make correction as follows: July, 8.688; August, 8.985.

Zinc Sheets—Unchanged at $15 per 100 lb., less usual trade discounts and extras as per list of Feb. 4.

Other Metals

Aluminum—Unchanged at 33c. per lb.

Antimony—The market was firm at 14@14½c. for spot. There were some large inquiries in the market, and it is doubtful if much metal can be obtained at the price quoted this week. There is still some unsold stock, but the quantity is steadily diminishing, and there is understood to be some large prospective business. Futures are held at prices relatively higher than spot. We quote 14½@14¾c., duty paid. The Chinese and Japanese houses are not at all keen about selling.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.50 per lb. for wholesale lots—500 lb. and over.

Cadmium—This metal is quoted at $1.50 @1.75 per pound.

Nickel—Market quotation: Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—Unchanged at $125@130. Demand is fair and stocks are light. San Francisco reports by telegraph, $118, firm.

Gold, Silver and Platinum

The general stock of money in the United States on Sept. 1 totaled $7,092,955,371; of this, $3,079,300,229 was in gold coin and bullion, $460,253,959 in standard silver dollars and $231,874,845 in subsidiary silver. The money in circulation on Sept. 1 was $5,621,311,201, or $52.95 per capita. On Sept. 1, 1917, the per-capita circulation was $45.96.

Silver—Shipments to London for the week ended Sept. 14 were 700,000 ozs. Business with the Far East is being done on a large scale from San Francisco. China exchanges are now ruling very high, owing to the lack of bullion importation.

Mexican dollars at New York: Sept. 12, 78; Sept. 13, 78; Sept. 14, 78; Sept. 16, 78; Sept. 17, 78; Sept. 18, 78.

Platinum, Palladium and Iridium—Prices fixed at $105, $135 and $175, respectively.

Zinc and Lead Ore Markets

Joplin, Mo., Sept. 14—Blende, per ton, high, $77.70; basis 60% zinc, premium, $75; Class B, $65@60; Prime Western, $52.50@50; calamine, basis 40% zinc, $38@33. Average selling prices: blende, $52.79; calamine, $38.03; all zinc ores, $52.23.

Lead ore, high, $106; basis 80% lead, $104@100; average selling price, all grades of lead, $103.21 per ton.

Shipments the week: Blende, 14,593; calamine, 457; lead, 1519 tons. Value, all ores the week, $788,670.

The development of a stronger demand advanced the market $2.50 per ton, and it is reported one buyer was short of filling orders and could not get the ore without further advances. Sellers early learned of the larger demand and withheld their ore.

Platteville, Wis., Sept. 14—Blende, basis, 60% zinc, highest price reported, $70.60 per ton. Base price for premium grade, $75; base price for high-lead blende, $49 to $50 per ton. Lead ore, basis 80% lead, $97 per ton. Shipments reported for the week were 2578 tons blende, 353 tons galena, and 715 tons sulphur ore. For the year to date the totals are 92,089 tons blende, 5381 tons galena, and 34,561 tons sulphur ore. During the week there was shipped to separating plants 2485 tons blende.

Other Ores

Chrome Ore—There is reported to be more ore offered than the market is able to absorb, and quotations are easier.

Manganese Ore—Unchanged.

Molybdenum Ore—In better demand. We quote $1.10.

Tungsten—The demand for high-grade ores still continues strong, although high-grade scheelite is practically off the market. High-grade wolframite ranged in price from $24.50 to $25 per unit. Low-grade ores have shown no real improvement in price; sold without guarantee they range from $18 to $19 per unit. Charles Hardy makes the following interesting comment: "Unfortunately, the supply of high-grade ore, low in manganese and practically free from tin and copper, is becoming scarcer almost every day. On the other hand, the specifications for the manufactured product are so strict that most buyers insist upon the most rigid adherence to their specification for the ore. Nevertheless, such works as can use off-grade ores have also entered the market

on a large scale, and, besides spot lots, two contracts were closed to absorb future shipments, especially of eastern ore. These contracts should eliminate from the market a considerable quantity of the now so freely offered Chinese wolframite. Besides, Italy is in the market for a large tonnage of tungsten ore. The War Board, however, has ruled that no shipment can be allowed from this country at present, and thus negotiations for the Italian requirements will be carried on direct with the country of origin, and, if the contract is completed, this large tonnage will also eliminate from the open market material which would otherwise be freely offered for sale."

Other Minerals

Pyrites—Spanish lump is quotable to those who possess a license from the Government at 17c. per unit on the basis of 9s. ocean freight, buyer to pay war risk, less 2% and excess freight; but no sulphur imports are being received. Domestic pyrites is selling at a price of 25c. per unit, f.o.b. mine, according to delivery basis. Some mines in the South are reporting prices as 34c. per unit for lump and 32c. per unit for fines f.o.b. mines. Unchanged.

Iron Trade Review

PITTSBURGH—Sept. 17

The quarterly meeting between the price-fixing committee of the War Industries Board and the special committee of the American Iron and Steel Institute will be held in Washington tomorrow, to discuss the matter of prices to rule for the fourth quarter of the year.

Production of steel ingots in August was less than expected, being at the rate of only 40,300,000 gross tons a year, against rates of 42,250,000 tons in July and 43,500,000 tons in June. Thus far this month there have been heavy gains, by reason of the weather being more favorable. Based on the ingot reports, an estimate may be made that about 6,000,000 net tons of finished rolled steel was produced in July and August, and with the increase over this rate that may be expected, the half year's output may be 19,000,000 tons, which compares with the War Industries Board's recent statement that 23,000,000 tons is needed for the period, whereas the prospective output was only 17,000,000 tons. The result of the discrepancy is a further tightening of supplies of raw steel for certain finishing departments. Thus recently the current allotment of sheet bars for the tin-plate mills, equal to approximately 100%, is cut by 30% for the fourth quarter. Merchant mills and wire mills are likely to be restricted further, and a meeting is to be held next week to consider whether standard steel pipe can stand a further restriction.

Pig Iron—There is no open pig-iron market, supplies being obtainable only on allocations, and then with difficulty. The market remains quotable at the set limits, covering deliveries through Sept. 30: Bessemer, $35.20; basic, $32; No. 2 foundry, $33; malleable, $33.50; forge, $32, f.o.b furnace, freight from the Valleys to Pittsburgh being $1.40 and from six detached furnaces somewhat less.

Steel—There is no regular soft steel in billet or other unfinished form available, and only occasional odd lots of shell-discard steel. Surplus production at various plants was allocated long ago, and from time to time these allocations are modified or extended for additional periods of time. We quote: Billets, $47.50; sheet bars and small billets, $51; slabs, $50; rods, $57.

Ferroalloys

Ferroalloys—Consumers are showing no particular confidence in the future of the market, there being cases of consumers covering for first quarter but not for second quarter, although the recommendation some time ago was that consumers cover for the half year. There is practically no demand for prompt lots. We quote ferromanganese at $250, delivered, for 70%, with $4 a unit extra for higher manganese content, and 16% spiegeleisen at $75, furnace.

Coke

Coke—Production of byproduct coke continues to make a new high record nearly every week, the last report showing 557,000 tons, which, with 616,00 tons of beehive coke, made a total of 1,173,000 tons, the largest weekly total this year with two exceptions. Connellsville beehive production is holding its own, and Connellsville coal shipments to byproduct plants have shown a slight tendency to increase. The Fuel Administration has ordered the cessation of screening old dumps at beehive plants, on the ground that the work absorbs labor needed at ovens. The screenings were being sold for household use at as high as $6.75 per net ton at plant, so that the contractors were in position to pay fancy prices for labor.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1916	1917	1918	1916	1917	1918
Jan.	56.775	75.630	88.702	26.960	36.682	44.356
Feb.	56.755	77.585	85.716	26.975	37.742	42.792
Mar.	57.935	73.861	88.082	27.597	36.410	43.620
April	64.415	73.875	95.346	30.662	36.963	47.215
May	74.269	74.745	99.505	35.477	37.940	48.980
June	65.024	76.971	99.500	31.060	39.065	48.875
July	62.940	79.010	99.625	30.000	40.110	48.813
Aug.	66.083	85.407	100.292	31.498	43.418	49.077
Sept.	68.515	100.740	.....	32.584	50.920	.....
Oct.	67.855	87.332	.....	32.361	44.324	.....
Nov.	71.604	85.891	.....	34.192	43.584	.....
Dec.	75.765	85.960	.....	36.410	43.052	.....
Year	65.661	81.417	.....	31.315	40.851	.....

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

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1917	1918	1917	1918	1917	1918
Jan.	28.673	23.500	131.921	110.000	142.895	125.000
Feb.	31.750	23.500	137.895	110.000	148.100	125.000
Mar.	31.481	23.500	136.750	110.000	151.000	125.000
April	27.935	23.500	133.842	110.000	147.158	125.000
May	28.788	23.500	130.000	110.000	142.000	125.000
June	29.962	23.500	130.000	110.000	142.000	125.000
July	26.620	25.904	128.409	119.913	140.409	134.913
Aug.	25.380	26.000	122.391	122.000	137.000	137.000
Sept.	25.073	.....	117.500	.....	135.250	.....
Oct.	23.500	.....	110.000	.....	125.000	.....
Nov.	23.500	.....	110.000	.....	125.000	.....
Dec.	23.500	.....	110.000	.....	125.000	.....
Year	27.180	.....	124.892	.....	138.401	.....

Tin	New York		London	
	1917	1918	1917	1918
January	44.175	85.500	185.813	293.227
February	51.420	92.000	198.974	311.525
March	54.388	(a)	207.443	318.875
April	55.910	(a)	220.171	329.005
May	63.173	(a)	245.114	364.217
June	62.053	(a)	242.083	331.925
July	62.570	(a)	242.181	360.347
August	62.681	(a)	243.978	380.900
September	61.542	.....	244.038	.....
October	61.851	.....	247.467	.....
November	74.740	.....	274.943	.....
December	87.120	.....	298.556	.....
Av. year	61.802	.....	237.563	.....

(a) No average computed.

Lead	New York		St. Louis		London	
	1917	1918	1917	1918	1917	1918
January	7.626	6.782	7.530	6.684	30.500	29.50
February	8.636	6.973	8.595	6.899	30.500	29.50
March	9.199	7.201	9.120	7.091	30.500	29.50
April	9.288	6.772	9.158	6.701	30.500	29.50
May	10.207	6.818	10.202	6.704	30.500	29.50
June	11.171	7.611	11.123	7.511	30.500	29.50
July	10.710	8.033	10.644	7.750	30.500	29.50
August	10.594	8.050	10.518	7.750	30.500	29.50
September	8.680	.....	8.611	.....	30.500	.....
October	6.710	.....	6.650	.....	30.500	.....
November	6.249	.....	6.187	.....	30.500	.....
December	6.375	.....	6.312	.....	30.500	.....
Year	8.787	.....	8.721	.....	30.500	.....

Spelter	New York		St. Louis		London	
	1917	1918	1917	1918	1917	1918
January	9.619	7.836	9.449	7.661	48.329	54.000
February	10.045	7.814	9.875	7.639	47.000	54.000
March	10.300	7.461	10.130	7.286	47.000	54.000
April	9.459	6.890	9.289	6.715	54.632	54.000
May	9.362	7.314	9.192	7.114	54.000	54.000
June	9.371	8.021	9.201	7.791	54.000	54.000
July	8.643	8.688	8.473	8.338	54.000	54.000
August	8.390	8.985	8.190	8.635	54.000	54.000
September	8.136	.....	7.966	.....	54.000	.....
October	7.983	.....	7.813	.....	54.000	.....
November	7.847	.....	7.672	.....	54.000	.....
December	7.685	.....	7.510	.....	54.000	.....
Year	8.901	.....	8.813	.....	52.413	.....

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

Pig Iron, Pgh.	Bessemer‡		Basic‡		No. 2 Foundry	
	1917	1918	1917	1918	1917	1918
January	$35.95	$37.25	$30.95	$33.95	$30.95	$33.95
February	36.37	37.25	30.95	33.95	30.95	33.95
March	37.37	37.25	33.49	33.95	35.91	33.95
April	42.23	36.15	38.90	32.95	40.06	33.95
May	46.94	36.20	42.84	33.00	43.60	34.00
June	54.22	36.36	50.05	33.16	50.14	34.16
July	57.45	36.60	53.80	33.40	53.95	34.40
August	54.17	36.60	50.37	33.40	53.95	34.40
September	46.40	.....	42.24	.....	48.58	.....
October	37.25	.....	33.95	.....	33.95	.....
November	37.25	.....	33.95	.....	33.95	.....
December	37.25	.....	33.95	.....	33.95	.....
Year	$43.57	.....	$39.62	.....	$40.83	.....

‡ As reported by W. P. Snyder & Co.

STOCK QUOTATIONS

N. Y. EXCH.† Sept. 17	
Alaska Gold M.	2⅛
Alaska Juneau	1⅛
Am. Sm. & Ref., com.	76⅛
Am. Sm. & Ref., pf.	103¼
Am. Sm. Sec., pf., A	90
Am. Zinc	15
Am. Zinc, pf.	46⅛
Anaconda	67⅛
Batopilas Min	1
Bethlehem Steel	80⅛
Butte & Superior	25⅛
Butte Cop. & Zinc	10⅛
Cerro de Pasco	33
Chile Cop.	15⅛
Chino	39⅛
Colo. Fuel & Iron	45⅛
Crucible Steel	64⅛
Crucible Steel, pf.	88⅛
Dome Mines	9⅛
Federal M. & S.	11⅛
Federal M. & S., pf.	39⅛
Great Nor., ore ctf.	30⅛
Greene Cananea	44⅛
Gulf States Steel	78
Homestake	74
Inspiration Con.	53⅛
International Nickel	29⅛
Kennecott	32⅛
Lackawanna Steel	81
Mexican Petrol	104
Miami Copper	27⅛
Nat'l Lead, com.	57⅛
National Lead, pf.	101⅛
Nev. Consol.	20⅛
Ontario Min	8⅛
Ray Con	24
Republic I. & S., com.	90
Republic I. & S., pf.	102⅛
Sloss-Sheffield	60
Tennessee C. & C.	18
U. S. Steel, com.	109⅛
U. S. Steel, pf.	110⅛
Utah Copper	83⅛
Va. Iron C. & C.	71

BOSTON CURB* Sept. 17	
Alaska Mines Corp.	‡.12
Boston Ely	.60
Boston & Mont.	.43
Butte & Lon'n Dev.	.15
Calaveras	1
Chief Con.	3⅛
Contact	‡.15
Corbin	‡10
Cortes	.14
Crown Reserve	.15
Crystal Cop.	‡.41
Eagle & Blue Bell	‡2⅛
First Nat. Cop.	‡1⅛
Houghton Copper	.50
Intermountain	‡.05
Iron Cap	.19
Mexican Metals	.35
Mines of America	‡1
Mojave Tungsten	.11
Nat. Zinc & Lead	.15
Nevada-Douglas	.45
New Baltic	.40
New Cornelia	17
Oneco	.20
Pacific Mines	‡.35
Rex Cons	‡.06
Yukon Gold	.85

SAN FRAN.* Sept. 17	
Alta	.02
Andes	.02
Best & Belcher	.02
Caledonia	.03
Challenge Con	.03
Confidence	.04
Con. Virginia	.18
Gould & Curry	‡.01
Hale & Norcross	.04
Jacket-Cr. Pt.	.06
Mexican	.17
Occidental	.40
Ophir	.02
Overman	.01
Savage	.02
Sierra Nevada	.11
Union Con.	.26
Utah Con.	.01
Belmont	2.00
Jim Butler	.47
MacNamara	.31
Midway	.06
Mont.-Tonopah	.10
North Star	.04
Rescue Eula	.08
West End Con.	.96
Atlanta	.02
Booth	.03
Comb. Frac.	‡.02
Florence	.10
Jumbo Extension	.09
Kewanas	.01
Nevada Hills	.01
Nevada Packard	.25
Round Mountain	.17
Silver Pick	.03
White Caps	.13
Big Jim	‡.75
United Eastern	3.60

COLO. SPRINGS* Sept. 17	
Cresson Con.	4.81½
Doctor Jack Pot	.03½
Elkton Con.	.04½
El Paso	.10
Gold Sovereign	‡.02
Golden Cycle	1.66
Granite	.17
Isabella	.03½
Mary McKinney	.07
Portland	.82
United Gold M.	.12
Vindicator	.30

BOSTON EXCH.* Sept. 17	
Adventure	.80
Ahmeek	75½
Algomah	‡.15
Allouez	49½
Ariz. Com., ctfs.	15½
Arnold	‡.20
Bingham Mines	9⅛
Bonanza	‡.16
Butte-Balaklava	‡.25
Calumet & Ariz.	67½
Calumet & Hecla	460
Centennial	12
Copper Range	46½
Daly West	2⅛
Davis-Daly	5⅛
East Butte	10⅛
Franklin	‡4⅛
Granby	83⅛
Hancock	‡6
Hedley	‡12
Helvetia	‡.15
Indiana	‡.60
Isle Royale	‡25⅛
Keweenaw	1⅛
Lake	5
La Salle	2
Mason Valley	‡3⅛
Mass	3⅛
Mayflower	‡2⅛
Michigan	2⅛
Mohawk	55
New Arcadian	1⅞
New Idria	14⅛
North Butte	13⅛
North Lake	.60
Ojibway	‡.65
Old Dominion	39
Osceola	51⅛
Quincy	66
St. Mary's M. L.	‡49
Santa Fe	‡.60
Seneca	11⅛
Shannon	3⅛
Shattuck-Ariz.	‡15⅛
So. Lake	1
So. Utah	‡.16
Superior	4⅛
Superior & Bost.	3⅛
Trinity	3
Tuolumne	‡1
U. S. Smelting	43
U. S. Smelt'g, pf.	43
Utah Apex	1⅞
Utah Con.	9⅛
Utah Metal	2
Victoria	‡2
Winona	1
Wolverine	23
Wyandot	‡.50

N. Y. CURB† Sept. 17	
Big Ledge	.75
Butte & N. Y.	‡.75
Butte Detroit	‡.05
Caledonia	.45
Calumet & Jerome	⅛
Can. Cop. Corpn.	1⅛
Carlisle	‡2
Cashboy	.04
Con. Aris. Sm.	1⅛
Con. Coppermines	5
Emma Con.	‡.10
Goldfield Con.	‡.20
Goldfield Merger	.02⅛
Greenmonster	‡⅛
Hecla Min.	4⅛
Howe Sound	4
Jerome Verde	‡.50
Louisiana	‡⅛
Magma	‡28
Majestic	‡.15
Marsh	.03
McKinley-Dar-Sa.	‡.44
Milford	‡.75
Mother Lode	34
Nixon Nevada	‡.36
Ohio Cop.	⅛
Rawley	‡2⅛
Ray Hercules	4⅛
Richmond	‡.56
Rochester Mines	.32
St. Joseph Lead	14
Standard S. L.	⅛
Stewart	.14⅛
Success	.12⅛
Tonopah	2⅛
Tonopah Ex.	1⅛
Tribullion	.12⅛
Troy Arizona	.10
United Cop.	⅛
United Verde Ext.	‡37⅛
United Zinc	1⅛
Utica Mines	‡.08

TORONTO* Sept. 17	
Adanac	.06
Bailey	.02
Beaver Con.	.27
Chambers Ferland	‡.10
Coniagas	2.00
Hargraves	.02
Kerr Lake	5.75
La Rose	.37½
Min. Corp. of Can.	‡2.00
Nipissing	8.75
Peterson Lake	.08
Temiskaming	.28
Wettlaufer-Lor.	.01
Davidson	‡.30
Dome Exten.	.14
Dome Lake	.10
Hollinger	4.50
McIntyre	1.37½
Newray	.15
Porcu. Crown	.10
Teck-Hughes	.20
Vipond	.10
West Dome	.06

* Bid prices. † Closing prices. ‡ Last Quotations.