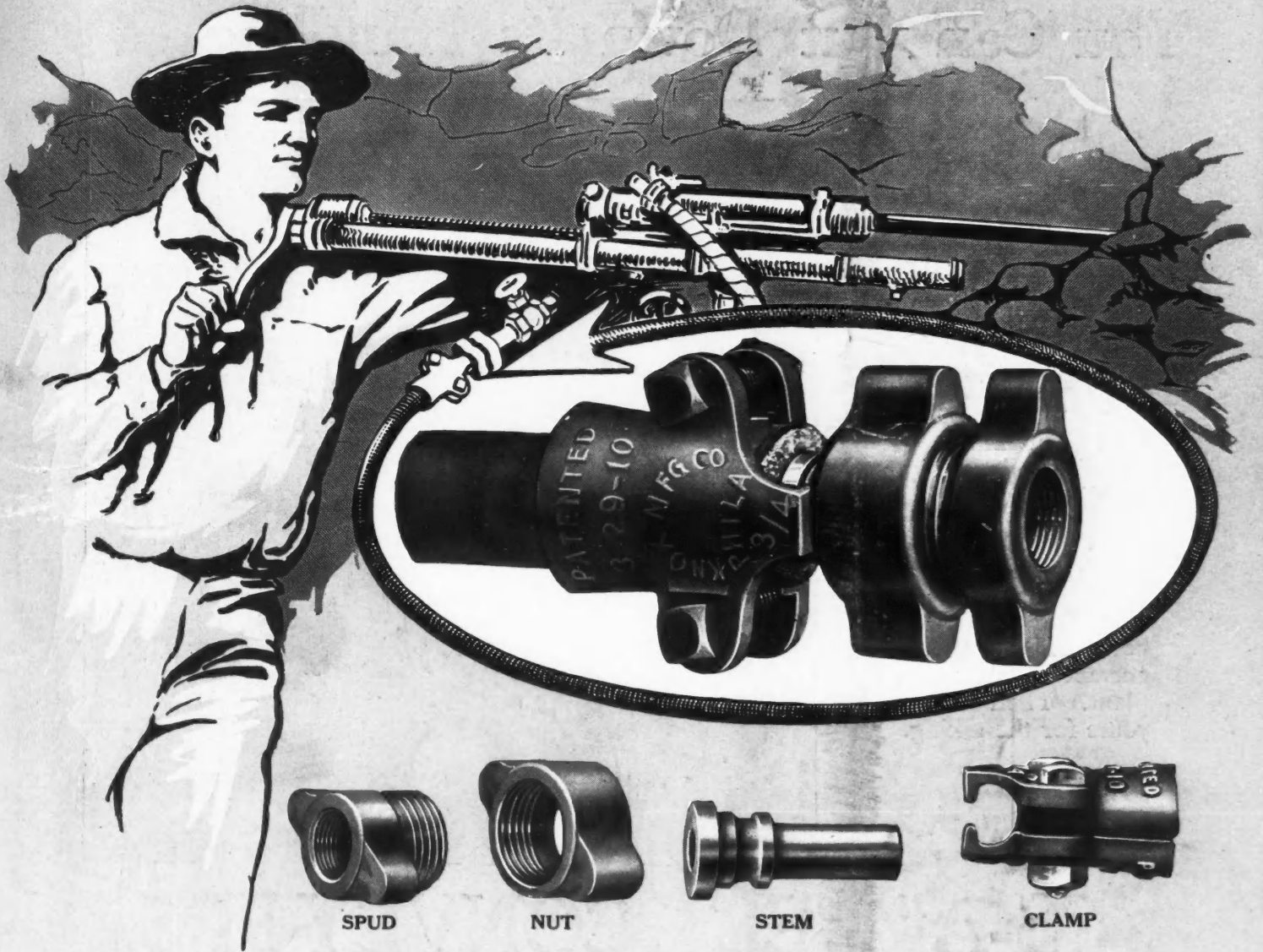


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McGraw-Hill Co., Inc.

New York, June 29, 1918



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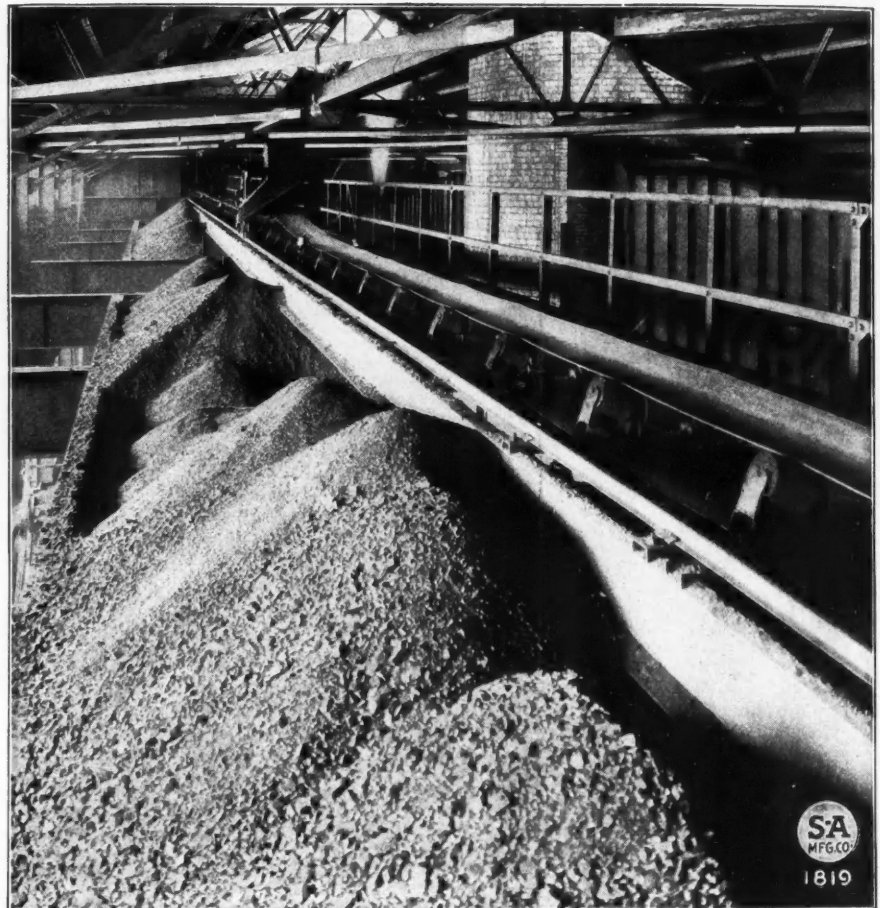
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ST. JOSEPH LEAD CO.'S SHAFT NO. 3 AND RIVERMINES POWER PLANT, IN THE FLAT RIVER AREA OF THE SOUTHEAST MISSOURI DISSEMINATED LEAD DISTRICT

The Mining Districts of Joplin and Southeast Missouri—V*

By H. W. KITSON

Southeast Missouri produces 35% of the lead in the United States, and has increased its yield 54% since 1913. Of the output, the Flat River and Fredericktown sections produce 90 and 10%, respectively, from low-grade disseminated lead deposits, which occur as metasomatic replacements interstratified with the nearly horizontal lower beds of an unmetamorphosed

Cambrian dolomite. The orebodies at Bonne Terre have been worked continuously through joint, fissure and bedded deposits from the surface to a depth of 375 ft.; those at Flat River and vicinity are mostly at depths of 400 to 500 ft. The open-stope and columnar-pillar method of mining prevails throughout the district and affords a good extraction at a low cost per ton.

THE magnitude of mining operations in the Southeast Missouri district is best conceived by a comparison of its mineral production with that of Joplin and other districts in the United States and foreign countries. In 1917, Southeast Missouri produced 204,869 tons of lead, or 35% of the total domestic

output of the United States, and, including foreign imports, the relative proportion was 32 per cent.

In point of base metallic tonnage, the production from Southeast Missouri compares favorably with that from the Joplin district, which in 1917 yielded 40,575 tons of lead, or 7% of the domestic output, and 290,945 tons of spelter—a total metallic output of 331,520 tons. Both districts produce a practically pure base metal, the silver content in the ores being commercially negligible,

*Continued from Part I, Dec. 22, 1917; Part II, Feb. 23, 1918; Part III, Mar. 2; Part IV, "Milling Practice and Operating Costs in the Joplin District," Apr. 20.

and average prices in 1917 for lead and zinc differed only by 8.721c. and 8.813c. per lb., respectively.

In 1913, the world production of lead amounted to 1,120,000 metric tons.¹ Of this total the United States contributed 395,000 tons, of which 133,000 tons was produced from Southeast Missouri. In the same year, Spain produced 203,000 tons; Germany, 181,000 tons, and Australia, 116,000 tons. In 1917 the rate of production of lead from Southeast Missouri had increased by 54% over the 1913 output, thereby excelling the normal output of Germany before the war.

FLAT RIVER AREA PRODUCTIVE OF 90% OF LEAD FROM SOUTHEAST MISSOURI

The productive area in Southeast Missouri, as shown in Fig. 1, is mainly in the vicinity of Flat River, St. Francois County, and is locally known as the "Lead Belt." It is situated 60 miles south of St. Louis and 225 miles in a northeasterly direction from Joplin. This section accounts for about 90% of the total production from the district, the remainder coming mostly from the vicinity of Fredericktown,² Madison County, 25 miles further to the southeast, with relatively smaller amounts from Washington and Ste. Genevieve counties.

The Southeast Missouri district lies on the eastern side of the Ozark uplift, about 40 miles west of the Missouri River, toward which the drainage system of the area is directed. Elevations in the Flat River section vary from 700 to 800 ft. above sea level. At Big River the valley has been eroded to an elevation of only 610 ft., but in the southern part of the district the St. Francois Mountains attain elevations of 1800 ft. Over most of the productive area the surface is gently rolling, affording but few good gravity millsites. The rainfall amounts to about 40 in. a year, and water from underground sources is plentiful for milling purposes. Normally, the winters are mild, but the summers are invariably hot and humid.

The stratigraphic features of the 'district' are simple and consist of Cambrian sedimentaries deposited near shore in an ancient shallow sea unconformably upon an eroded pre-Cambrian granite, of which much of the material constitutes the later formations. The granite basement and its overburden of sedimentaries slope downward radically from the St. Francois Mountains, at which point they have been relatively elevated over a comparatively small area by faulting, and stand exposed at the surface by erosion.

The La Motte sandstone directly overlies the granite, with a thickness ranging from 200 to 300 ft. This formation is conglomeratic at its base and dolomitic near its upper contact, and decreases gradually in thickness as the central granite core or ancient shore line is approached.

Overlying the La Motte with conformity, the next formation above is the Bonne Terre, which is economically the most important in the district. Buckley³ gives the following description:

The Bonne Terre formation consists chiefly of dolomite with thin laminæ or beds of shale and beds of chloritic, occa-

sionally arenaceous, dolomite. The upper and lower parts of this formation are quite uniformly interstratified with shale, while the middle portion contains only occasional thin leaves of shale between the beds. There is generally an absence of stratification planes, but the bedding planes are well defined and reasonably persistent. The position of most of the bedding planes has been determined by thin films of shale and of abrupt changes in the texture of the dolomite.

The bedding planes are frequently smooth and level, but more often they are rough and wavy. A pivot or pinnacle-like surface is not uncommon. There has evidently been more or less solution and deposition along the bedding, as a result of which some of the adjacent beds are attached and others are free. The coalescing of two bedding planes through the feathering out of an intervening bed occurs frequently in the lower part of the formation. Occasional examples of cross-bedding have been observed in the mines.

Overlying the Bonne Terre conformably in order of deposition are the Davis shale, with a maximum thickness of 160 ft., the Derby and Doe Run dolomites, with a thickness of 100 ft., and the Potosi cherty dolomites, having a thickness of 300 ft.

Within the productive area, faulting of the Block Mountain type has relatively elevated the lower formations, and erosion has either entirely denuded the Bonne Terre near its former upper contact or has left it with but a relatively thin cover of Davis shale. All formations have a slight dip to the southwest, modified locally by faulting and gentle anticlinal and syncline folding. This folding varies often at different horizons of the Bonne Terre within the same areas, and appears to be the result of deposition upon the uneven granite floor and to solution, rather than lateral dynamic stress.

JOINT PLANES AND FAULT ZONES HAVE IMPORTANT INFLUENCE IN ORE DEPOSITION

The Bonne Terre dolomite is characterized by extensive jointing, and several definite systems have been recognized, of which some are marked by their persistence and broad openings. Fracture and solution channels have been formed which at some points extend continuously from the surface to the sandstone below, and such undoubtedly had an important influence on deep ore deposition. Joints and fracture planes are found both open and filled with clay, and underground circulating waters have developed caves and sink holes. The surface clays are the alteration product of the eroded Davis shale, and in places these have been productive of galena in the early days of mining. Jointing appears to occur in zones, and evidence has been found in the mines which indicates a series originating at the base of the formation.

Faulting is more in evidence in the Flat River district than at any other mining area of the Ozark region. The faults are of the normal or gravity type, and contiguous blocks, as shown in Fig. 2, have been displaced so as to form a step-like series bounded by the fault plane zones. The major system of faulting antedates the genesis of the ore deposits, which orebodies, however, have been subsequently faulted by a minor series.

The main fault of the immediate district has a displacement of 120 ft. and strikes northeast and southwest, passing through Big River north of Bonne Terre, as indicated in Fig. 2; and a subsequent series to the south has a strike northwest and southeast. Minor faults occur with north-south and east-west strikes. As shown in Fig. 2, this Big River fault has lowered the Davis and overlying formations on the downthrow side to the level of the outcropping Bonne Terre dolomite.

Faulting has had an important effect in guiding underground circulation, and in the Flat River district has created a basin-like condition by which seepage from the surface has formed a reservoir of mineral-bearing solution over the previous La Motte sandstone, favor-

¹"The Mineral Industry," Vol. XXIII.

²"Eng. and Min. Journ.," Vol. 105, No. 2, p. 65.

³"Geology and Mineral Deposits of the Ozark Region." By H. A. Buehler, Bull. 130, A. I. M. E.

⁴Missouri Bureau of Geology and Mines, Vol. IX, Part I. By E. R. Buckley.

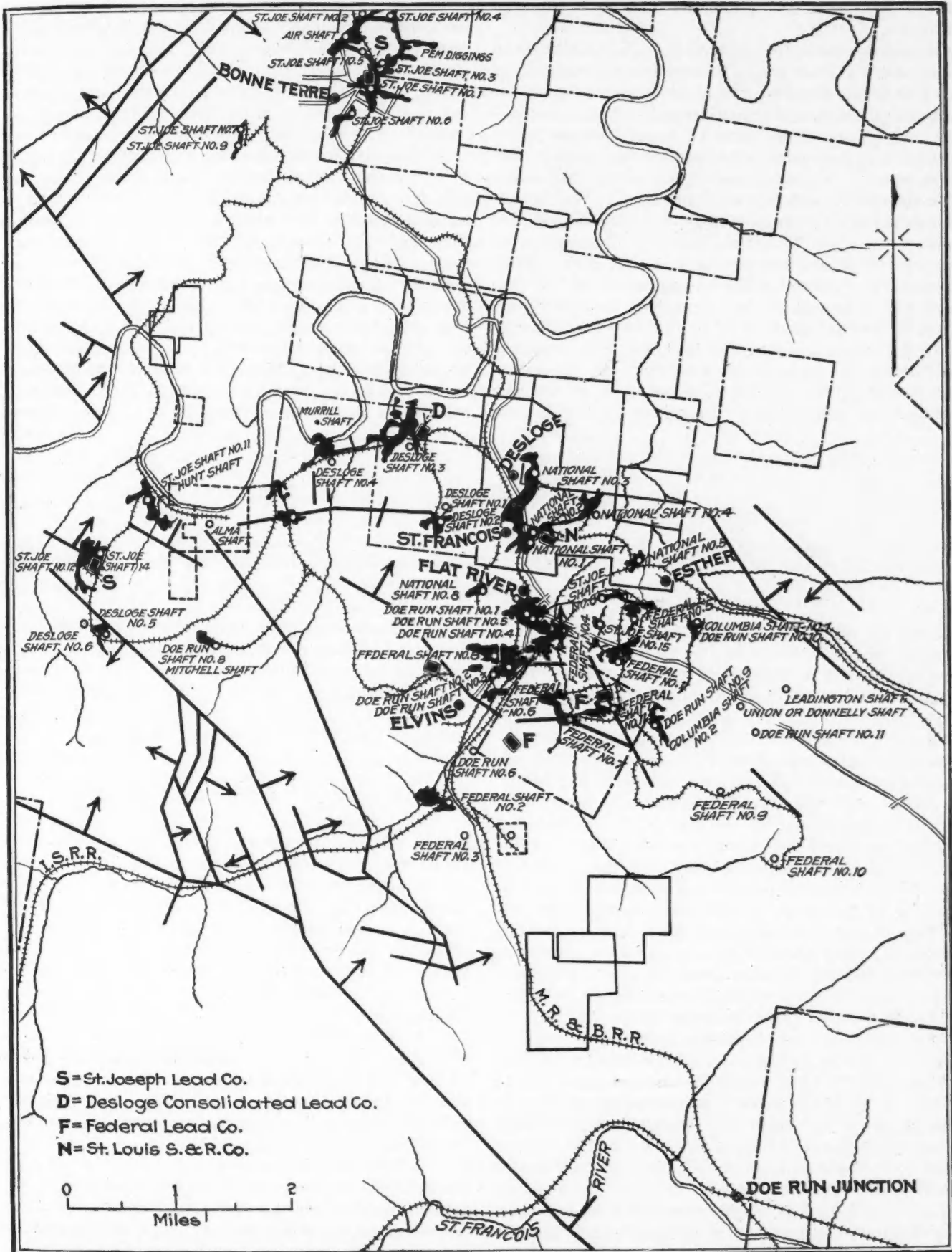


FIG. 1. COMPOSITE MAP OF THE SOUTHEAST MISSOURI DISTRICT, SHOWING GEOGRAPHIC DISTRIBUTION OF MINING CAMPS, AREAS MINED, TRANSPORTATION SYSTEMS AND LINES OF MAJOR FAULTING

able to deposition in the dolomite channels by slow infiltration.

Geologists favor the theory of ore deposition from solutions of surface origin, as explaining the genesis of all ores in the Ozark region, with the exception of the hematite deposits and argentiferous lead veins in granite. The Davis shale forms an impervious barrier to ascending or descending solutions, and the disseminated-lead deposits have been found only where the Bonne Terre formation outcrops at or lies close to the surface, the shale having been completely or largely eroded over such areas. The marked absence of metamorphism of the sedimentaries, the presence of numerous underground water courses and subterranean caves, and deposits of galena in surface clays have generally been accepted as irrefutable proof of this origin of the ore.

In Southeast Missouri the lead has been deposited by metasomatic replacement of the dolomite. There appears to have been little or no secondary enrichment or formation of oxidized ores. Deposition appears to have

The most important deposits of the district are the low-grade disseminated lenses or sheets in which galena replaced dolomite along certain horizons parallel to stratification planes in the lower beds of the Bonne Terre. The main zone of ore deposition appears to occur at short distances above the sandstone contact, as shown in Fig. 3. Some of these orebodies have widths of 800 ft. and frequently extend irregularly for a half mile or more. The orebodies vary in thickness from a few feet up to over a hundred feet, but the average range is probably from eight to twenty feet. Laterally, these orebodies spread out irregularly, and their positions, owing to local variations in grade, as shown by the outline of areas stoped in Fig. 3, indicate the favorable channels of original ore deposition. The trend of the long axis of the Bonne Terre orebody lies with a northeast strike somewhat parallel to the Big River fault. In the southern part of the district the orebodies appear to lie parallel to each other, with a southeast trend parallel to the faulting zones in that area. Minor

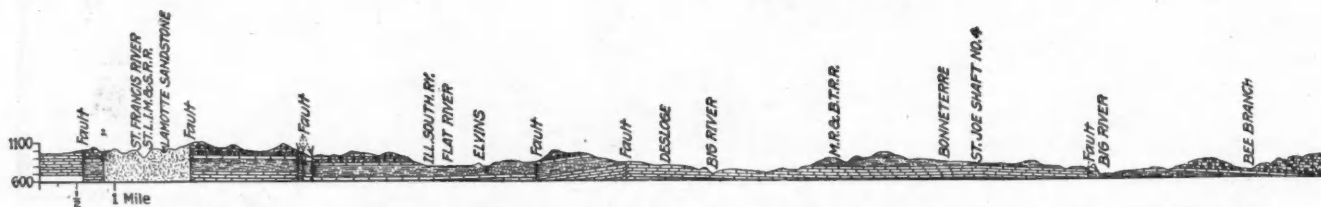


FIG. 2. GEOLOGICAL NORTH-SOUTH SECTION THROUGH FLAT RIVER, SOUTHEAST MISSOURI DISTRICT

avored the darker carbonaceous beds, and little ore is found in the lighter-colored part of the formation. In general, the ore is found in the lower horizons of the Bonne Terre disseminated through the dolomite and shaly portions, and there is little if any marked brecciation, as commonly exists in the Joplin district. Where oxidation has occurred, it has been slight and the rocks have in general retained their dark color. Leaching, when there is any, appears to have been complete, and perfect casts of the original galena are sometimes to be seen. In general, the lateral limits of the orebodies are not sharply defined, but fade gradually into the wall rock, decreasing in grade from the richest portions at the center, except where bounded by joint or fault planes. In many cases, there is a vertical displacement in ore horizons on each side of a joint plane where no movement has occurred. Such a condition is undoubtedly due to preferential replacement in certain favorable portions of the dolomite beds.

The lead deposits of Southeast Missouri are confined mainly to the Bonne Terre dolomite and to independent areas that have been productive in the upper portion of the La Motte sandstone near the contact of the two formations. The lead ores originally mined were found in masses and pockets in the residual surface clays overlying the Bonne Terre and close to the eroded Davis shale. These deposits, though rich, were not extensive, and, although highly productive at one time, are relatively unimportant at present. Such deposits often extended downward into the dolomite, following fissures and joint planes and extending along the bedding planes, but seldom attaining a depth of greater than 50 or 60 ft. At Bonne Terre, however, in the northern part of the district, the lead deposits have been followed from the surface to the La Motte sandstone.

series of orebodies often overlie or underlie the first series at distances varying from 10 to 80 ft., as shown in Fig. 4, and constitute in such mines second and third levels. A small proportion of the lead ore mined—probably not 1%—comes from deposits in the La Motte sandstone and carbonaceous shaly dolomite along the contact.

DAILY PRODUCTION OF FLAT RIVER MINES 20,000 TONS OF ORE

In 1917 the Flat River district mined and milled about 20,000 tons of ore per day. The principal companies, in the order of their productive capacities, are the St. Joseph Lead Co., with a 2400-ton mill at Bonne Terre, a 2000-ton mill at Leadwood, and a 4200-ton mill at Rivermines; the Federal Lead Co., which has a 5000-ton concentrator at Flat River and a 3000-ton plant at Elvins; the St. Louis Smelting and Refining Co. (The National Lead Co.) with a 2500-ton mill at St. Francois, and the Desloge Consolidated Lead Co., which has a 1500-ton mill at Desloge. The Baker Lead Co. has a 500-ton mill at Leadwood, and the Boston-Elvins Lead Co. mined about 10,000 tons in 1917, which was concentrated at the mill of the St. Louis Smelting and Refining Co.

The mines at Fredericktown are among the oldest in the country, and the famous old Mine La Motte has been a producer for many years. The limestone cap overlying the La Motte orebody is being stripped by steam shovels preparatory to mining the low-grade disseminated-lead deposit by opencut methods. This work is being done by the Missouri Metals Corporation, which is erecting a 1500-ton mill to concentrate this ore. The Federal Lead Co. operates the Catherine mine under option, and a 600-ton mill treats this ore at La Motte. This property was producing in 1917 from disseminated-

lead deposits similar to those at Flat River, but late in the year operations were discontinued pending more favorable economic conditions. The Missouri Cobalt Co. has a 300-ton mill at Fredericktown; and the Einstein mine, 12 miles west, has a 25-ton mill treating tungsten and argentiferous lead ore. In 1917 the Fredericktown mines produced from 2000 to 3000 tons of lead ore per day. Concentrators have been constructed and are nearing completion for the treatment of copper-cobalt-nickel ores that have been opened up. Such deposits have been found both in the sandstone and shaly dolomite.

The Flat River district is served by the Mississippi River & Bonne Terre Railroad, the tracks of which extend from Doe Run through to Elvins, Rivermines, Flat River, St. Francois, Desloge, Bonne Terre, Big River, and Herculaneum and terminate at Riverside. This road is owned by the St. Joseph Lead Co., which has a smeltery at Herculaneum, but all the traffic for the district, consisting of freight, ore, and concentrates, is transported over this line. The St. Louis, Iron Mountain & Southern Railway, which has been absorbed by the Missouri Pacific Railway, connects Riverside with St. Louis and Potosi. The Missouri Pacific also connects the district by two lines to southern points, and the Illinois Southern Railway connects St. Francois with the Mississippi River and Illinois coal fields. Perryville and other eastern Missouri points are connected with Farmington, the St. Francois County seat, by the Cape Girardeau Northern Railway. The Federal Lead Co. ships concentrates to its smeltery at Alton, and the St. Louis Smelting and Refining Co. has a smelting plant at Collinsville, Illinois.

SIMILARITY OF MINING METHODS PREVAILS IN DISTRICT

Mining conditions and methods throughout the district are similar in essential features and differ but little in detail. Orebodies are found and explored by diamond drilling, and subsequently are developed by vertical shafts sunk through the main ore level, which ranges at depths in various parts of the district from 350 to 500 ft. The orebodies in the main lie from 40 to 50 ft. above the La Motte sandstone, and shafts are sunk at a point in the area most convenient for drainage and tramming grades, as indicated by diamond drill holes. Skip pockets and sumps are cut below the track level, and orebodies that exist either above or below this level are connected by raises or winzes. The ground, whether in ore or country rock, is prevailingly hard and of good standing quality, and little or no timbering is necessary except for chute sets, manways and in the shafts. Timber in the latter is used only for stulls between compartments to support guides and ladderway equipment. Stopes are worked laterally, following the ore for the full height of the breast, leaving columnar pillars for support of the roof at intervals, depending upon the local strength of the back, grade of ore, and convenience in laying track. The method of drilling and advancing a breast varies with the height of the heading. Where the height is higher than that of a drill column, an advance heading is carried close to the roof, and the ore below the drift is taken out in a series of stepped benches descending to the main track level. The broken ore is shoveled into cars and trammed by hand or mule to the main haul-

ageway, where it is picked up in trains by a motor and drawn to the shaft.

The St. Joseph Lead smeltery, at Herculaneum, has a total capacity of 100,000 tons a year, and reduces the concentrates from the company's mills at Bonne Terre, Rivermines and Leadwood. The company produced in 1917 from its 20 shafts a larger tonnage than the rest of the district combined. Power is furnished from the new Rivermines turbine plant, which has a capacity of 6000 k.w. and supplies 6600 volts to all the company's mines and mills. A low-cost slack coal fuel is used, and electric power is transmitted over a triangular circuit connecting with the auxiliary power plants in reserve at each of the three mills. This system provides a possible concentration of power at any point from any source along the line.

At Bonne Terre, Shaft No. 1 is located at the 2400-ton mill. The bulk of the tonnage is hoisted through this shaft, though a small tonnage is received on railroad cars from Shaft No. 2. Shaft No. 1 has a depth of 180 ft., has two compartments and is equipped with two 2.4-ton skips, which dump directly into the mill bin.

The main haulage level at Shaft No. 1 is at a depth of 180 ft. The skips are loaded from chute pockets 38 ft. below this level, and these chutes are equipped with air gates of the vertical cut-off type, which operate through a slot in the chute lip below the ore stream. All the ore from this mine is hoisted to the surface from the 180 ft. main haulage level. Trains of 20 one-ton cars, coupled with link chains, are drawn to the shaft by Porter compressed-air locomotives. These locomotives are charged with air at 850 lb. pressure, and one charge will haul 20 tons one-half mile.

SOLID-BOX TYPE CARS HAVE ADVANTAGEOUS FEATURES

Cars are of the solid-box type mounted rigidly on trucks. The bodies are 2 ft. deep and have a square bottom with an area of 11 sq. ft. The wheels are equipped with Whitney Wonder roller bearings, for a 24-in. gage track of 30 lb. rails. The coupling chains are attached to the ends of a drawbar, which is a solid casting with a hook at each end, and is fastened rigidly to the bottom of each car.

The shaft station has a three-track arrangement. The cars are dumped into the skip loading pocket by means of two tipples or dumping cradles, described in the *Engineering and Mining Journal* of Dec. 1, 1917. Trains back in on either of two outside tracks, which at the station have a down grade toward the pocket. The station tenders unhitch the cars, and after unloading one by one at the tipples, return them to the central track, which has a slight down grade away from the pocket. This system is capable of rapid unloading where a small-size car is used. The gateless feature eliminates all trouble and delay incident to jamming of levers and catches, spilling or overturning. The cars and their auxiliary equipment can be made at the company's machine shops and foundry at a reasonable cost, and few repairs have been found to be necessary.

The mine at Bonne Terre is opened up by stopes and workings from the surface to a depth of 375 ft. At 80-ft. intervals sub-haulage levels, connected to the main motor-haulage level by raises or winzes, are equipped with the same type of car drawn by mules. At each sub-level above the motor level, dumping cradles similar

to those used at the shaft pocket are installed. These raises in general have a zig-zag course from sub-level to sub-level. Such inclines minimize the tramming distances on each level according to the various relative horizontal projections of the orebodies on the various sub-levels and help to break the fall of the ore.

The mine workings below the 180 ft. level are connected by low inclined winzes equipped with single-drum hoists which raise and lower the cars. A 30° incline from a point near Shaft No. 1 connects to workings 90 ft. vertically below the 180 ft. level. Ore was mined from around this incline, but these workings are now abandoned and act as a sump. One inclined winze has a length of over 200 ft. and an inclination of 30°. A

old workings, taking out pillars, stripping above and below old stopes and extending laterally into the low-grade walls. The ore now mined yields an average of 2% lead, but the grade as broken varies from 1 to 3%. The ore occurs in horizontal layers in the dolomite, with disseminated galena between layers. There are, besides, large bodies of purely disseminated ore. The ore breaks from the solid rather fine. Individual lumps are hard and tough and consist mostly of magnesian limestone. There is some chalcopyrite in the ore, the iron content amounting to about 5%. Concentrates from the Bonne Terre ores contain from two to three ounces of silver per ton, 0.4% copper and 9% iron.

The orebodies are often stepped up or down varying

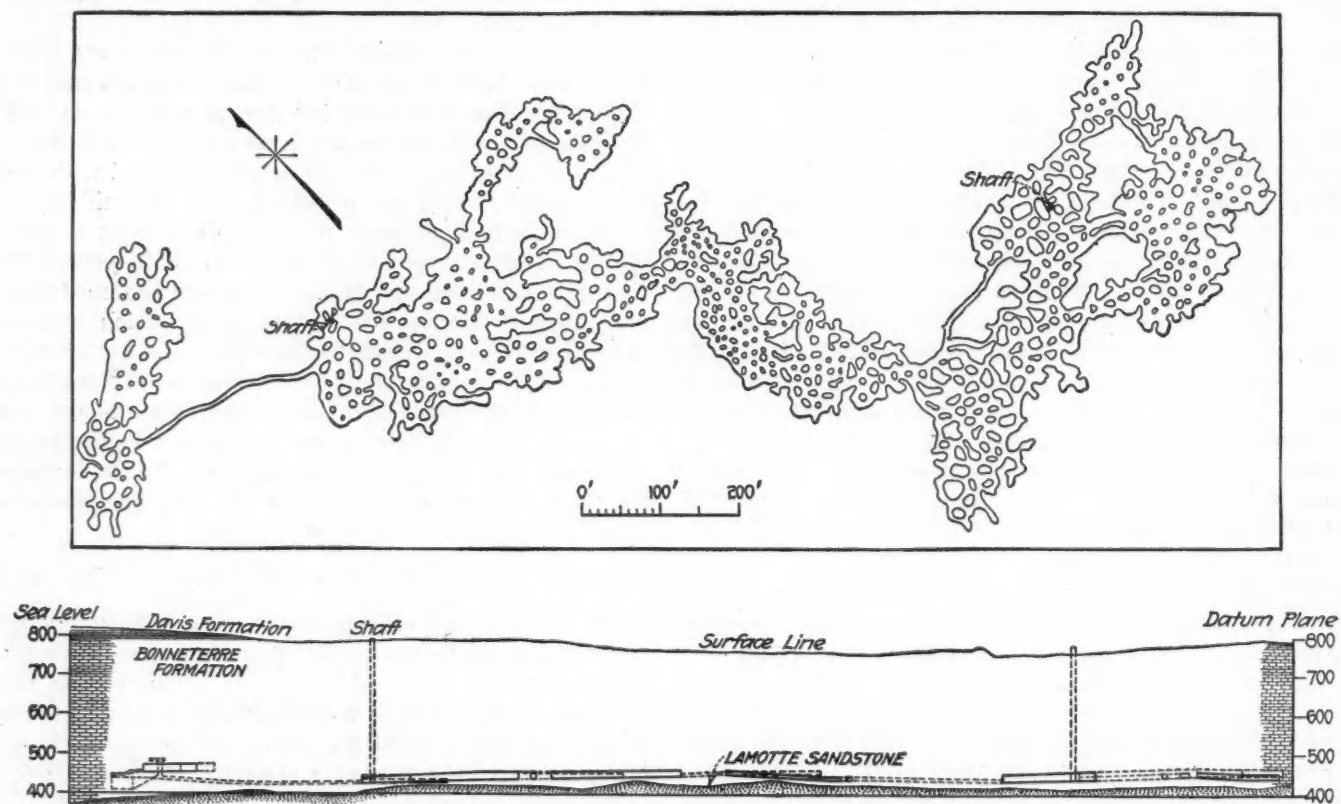


FIG. 3. PLAN AND SECTION OF TYPICAL MINE, FLAT RIVER DISTRICT OF SOUTHEAST MISSOURI

drift from the bottom connects over half a mile distant to another 200 ft. incline at 45° which connects to the 375 ft. level near Shaft No. 2, about one mile north of Shaft No. 1. The output from Shaft No. 2 is about 140 tons per day of one shift. The ore mined at present is mostly of the chloritic type, occurring close to the La Motte sandstone, and operations are confined mainly to old workings. This ore has a thickness of from 9 to 12 ft., and levels have been opened at 400 ft., 450 ft. and 500 feet.

The mule barns at Shaft No. 1 are all on the 180 ft. level, and at the end of each shift the mules from the various sub-levels descend through the old stopes and connecting workings over well-trodden trails resembling those on steep mountain sides. The orebodies at Bonne Terre extended without regularity from the surface to the 375-ft. level or to the contact with the La Motte sandstone. In the early days the ore mined ran as high as 40% lead, and only the highest grade ore was extracted. The St. Joseph Company at present is mining over 75% of the tonnage from Bonne Terre from

distances, as followed in mining, owing to local faulting. Some stopes are 136 ft. in height from floor to back and some only 25 to 50 ft. wide. Orebodies parallel to the bedding planes generally have considerable latitude, but vary in height from 8 to 25 ft. Individually and collectively the orebodies are irregular, and as the mineralization is erratic, the ore grade is subject to considerable local variation.

In virgin ground, heading and underhand stoping methods have been adopted and are similar in principle to methods to be described in more detail presently. Exceedingly deep orebodies are mined by underhand methods in horizontal slices from top to bottom. Besides many minor faults occurring throughout the orebody, open water courses are frequently tapped. Old pillars are robbed and in many cases are reclaimed altogether by stoping out a horizontal slice at the top and subsequently shooting down the whole pillar and block-holing large fragments.

Ingersoll-Rand and Sullivan plugger type drills have been adopted throughout the district. These drills are

used unmounted or mounted with a 24-in. screw feed, and either wet or dry. When mounted in high stopes, extensible 2½-in. columns are used. Extensions are made by means of threaded sleeve joints. The rose bit is used altogether at Bonne Terre, and holes are drilled 10 to 16 ft. deep. Du Pont Red Cross powder of 40% strength is used for blasting. The ground cannot be sprung as at Joplin, and therefore holes are not chambered. Air pressure is supplied at 80 lb. gage at the mains. Brow or back holes are drilled in mining strips of ore left in the backs of old stopes. Such holes are drilled with pluggers mounted on extensible columns, and they are pointed at an angle to the back and are generally 16 ft. deep. Steel is sharpened at a shop on the 180-ft. level.

GOOD VENTILATION MAINTAINED

Ventilation all through the mine is good, although there are no strong air currents. A dozen or more openings to the surface through old shafts create a sufficient natural draft, and no fans are necessary. The men enter the mine through a stairway in a vertical shaft used solely for this purpose, but are hoisted on a cage at a third shaft which handles only men and supplies.

A 500-gal. motor-driven centrifugal pump is stationed at the sump near Shaft No. 1, and a 400-gal. pump at Shaft No. 2. A third pump of 400 gal. capacity is stationed near old Shaft No. 7, and the total water handled at present is only about 1300 gal. per minute.

The mine is worked two 8-hour shifts per day, but hoisting continues for three shifts at Shaft No. 1, which has a capacity of 2750 tons per 24 hours. Owing to the nature of operations about 48 tons of ore is broken per machine shift, which is somewhat higher than at mines working in virgin ground. About one ton of ore is broken per stick of powder.

FLAT RIVER DEPOSITS IN STRUCTURAL BASIN

In the Flat River area the mineralization appears to be confined to the sandstone basin, the limits of which have been rather well defined by contour data obtained from diamond drilling. Within the area of this basin the orebodies appear to have a northwest-southeast trend parallel to each other. The explanation of this condition is to be found in the more or less well-defined fault zones shown in Fig. 1. The shale is not always in the lower part of the basin, and the ore is not always deposited in connection with the shale; and no generally accepted theory as to ore occurrence has been formulated with sufficient exactitude to serve as a guide to exploration. Within the orebodies, the successive precipitation of lead, zinc, copper and iron is often found to occur in the reverse order or without any apparent order of succession. Rich ore is sometimes found at synclines and sometimes at anticlines. In general, the dip is to the west, but local faulting and gentle folding cause variations. Orebodies usually occur near the older faults and are themselves faulted, with displacements that range from 7 to 20 ft. Folding is often strong enough to carry the ore above or below the main level to such an extent as to necessitate working from sub-levels by raises or inclined winzes.

Six shafts are tributary to the St. Joseph Lead Co.'s Rivermines 4200-ton mill. St. Joseph company's Shaft No. 3 is equipped with cages. Some shafts in the dis-

trict are equipped with skips and over-head cages and one shaft has an auto-motor hoisting equipment. All the hoisting is from one level. At the Federal Lead Co.'s Shaft No. 12, a pocket of 300-ton capacity has been cut for a depth of 38 ft. below the main level, together with a sump and pump station. This sump receives the drainage from auxiliary pumps installed in the lower stopes, where some ore occurs close to the sandstone. Cars are nearly all of the same type as those used at Bonne Terre. On the cage, these cars rest upon a false track bottom which has a rectangular area equal to the gage and wheel base of the cars. This section is cut out of the center of the main deck. When the cage rests on the station chairs, the false bottom is raised level with the track of the main deck and station, but when the cage is lifted from the chairs, the false bottom drops relatively with the car two or three inches below the main deck, thereby preventing movement of the car along its track during hoisting by effectively blocking the wheels fore and aft. This is another advantageous feature, in connection with this type of car, conducive to rapid hoisting. The cars are hoisted to the top of the loading bins at the surface, where there is a pair of dumping cradles, operated by two tenders. From the bins railroad cars are loaded and the ore is transported by locomotives to the mill at Rivermines.

MAIN HAULAGE LEVEL AT 475 FT. DEPTH

The haulage level from St. Joseph Shaft No. 3 is 475 ft. below the surface, the horizon of the main orebody; and conditions are altogether fairly well representative for the district as a whole.

The station at this shaft is equipped with three 24-in. tracks which handle the cars as received in trains drawn by gas-motor haulage locomotives. At some of the mines, electric haulage equipment has been installed. The central track has a slight down grade toward the shaft, and from it the loaded cars are trammed by station tenders to the cages. The empties are returned on either of the side tracks, which are sunk below the main track level to give the proper down grade away from the shaft.

HAULAGE LEVELS ESTABLISHED FROM DIAMOND-DRILL DATA

From the shaft station a haulage drift has been driven 7 ft. high and 8 ft. wide. The elevation of this level was established from diamond-drill data, and the station track elevation thus predetermined by making proper allowances for an upgrade drift away from the shaft. This elevation was selected as nearly as possible according to the average of the lowest points in the main orebody. The slight effect of anticlines and synclines in the orebody is disregarded for the sake of an efficient haulage system, and any ore that occurs below the track level is stoped subsequent to the completion of its upper portion.

The main haulage drift after reaching the orebody follows its general trend through the longitudinal center. Drifting and stoping operations may be conducted simultaneously, stopes being opened up laterally from the main drift by leaving wall pillars between and a sufficient lag in stoping operations behind the heading in the haulage drift to avoid conflict of operations.

With the exception of a few drifts that are driven

through the dolomite, connecting the shaft with the main and outlying orebodies, and raises or winzes connecting upper and lower orebodies at other horizons, there is comparatively little development through barren country rock. Most of the ore is developed in the course of stoping, the general limits of deposits only having been roughly predetermined by diamond drilling. Diamond drills, however, do not give dependable outlines, and the cuttings from rock drills are watched closely as the faces of stopes are advanced.

In drifting, rounds are invariably drilled by pluggers mounted on columns. The wide drift section and the flat stratification of the dolomite have developed an advantageous side-cut system of drilling rounds. Most of this work is done on contract, one shift drilling and the next shoveling. Each round is alternately drilled from a set-up near one corner of the heading, all holes being drilled radially from the column 4-ft. deep. Twenty holes are generally drilled per round and pull about $3\frac{1}{2}$ feet of ground.

HEAVY WATER FLOWS CAUSED BY DRIFTING THROUGH SANDSTONE

There is little or no ore in the sandstone in this section of the district, though there is sometimes an occurrence of ore in the dolomite close to the contact. In drifting, the unevenness of the sandstone floor often

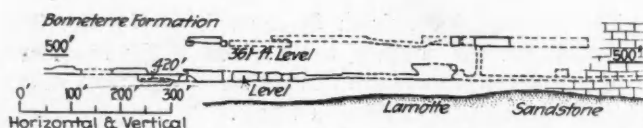


FIG. 4. SECTION OF TYPICAL FLAT RIVER MINE, SHOWING RELATION OF MAIN AND UPPER ORE LEVELS TO THE LA MOTTE SANDSTONE

necessitates driving through this formation. While driving, such headings are invariably wet, and a veritable shower follows the heading, lasting for several weeks or until the formation in the vicinity is drained. This causes a considerable flow of water along the drifts, which cannot be handled by a ditch, as the amount of loose sand would soon fill it up and render it useless. Such headings are avoided where possible on this account. In drilling, water reservoirs are frequently tapped, and for a time there is often a considerable flow. Such reservoirs eventually become drained, but until such time work is often necessarily suspended.

Where the main heading is driving through ore, lateral crosscuts are driven at intervals and throw switches are put in the main track. The motors draw the cars to and from the stope headings where convenient, but in most cases mules also have to be used supplementary to the main level haulage, as well as on sub-levels above, where such exist.

The height of a stope breast is 7 to 8 ft. The breast and underhand bench method of advancing faces is used throughout where the face of ore is greater than 8 ft. high. Breast holes are drilled from 8 to 10 ft. deep, depending upon the height of breast. In all cases where the ore is high, the breast heading is driven at the top of the orebody. Stope holes are invariably drilled down, although lifters are sometimes drilled under the bench when the stope is mucked clean, which is seldom the case at the time drilling starts. High

stopes are advanced in steps, the breast of each bench lying on a general incline of about 60 degrees.

Each round in a stope breast pulls about $3\frac{1}{2}$ ft. of ground horizontally and is drilled with three holes at an angle to the face. To gain greater breaking efficiency in plan, stope headings are advanced with a serrated outline. Three holes are used and the central hole is drilled a few inches closer to the face than either the upper or lower. In blasting, the center hole is set off first, which relieves the burden from the other two, thereby securing greater breakage than is otherwise possible. Stope holes are drilled down, and the face is advanced in 8 to 10-ft. benches. These benches are drilled and blasted in order from top to bottom as the face advances.

Plugger-type drills with a pneumatic feed, and rose, Carr and bull bits are in general use. Where hollow steel is used, the holes at the bits are sometimes placed in the side instead of in the center. Extension columns are used up to 25 ft. in length, and 60 to 80-lb. air pressures are maintained.

As a rule, the bulk of the ore is shoveled only once, the shots being so placed at the various benches that the ore is thrown to the track floor of the stope. The long-handled round-point shovel is preferred, the ore being shoveled from a rough bottom. One of the companies in the district is using five Meyers-Whaley shoveling machines with success. A power shovel of another make had been tried out a few years ago by one of the large companies without much satisfaction, but the conditions of the trial were not conducive to the best results. Power shovels at present are solving or will solve to a great extent the labor problem, and stoping conditions are especially favorable to their use.

As at Bonne Terre, the upper ore horizon is connected to the main level by raises equipped with dumping cradles at the top and chutes at the bottom, and lower orebodies by winzes equipped with hoists and single track inclines over which cars are raised and lowered.

The ore occurs in layers parallel with the stratification. Some layers are cut by small faults, but the edges of the orebody in general taper out in grade from the center. Large bodies of waste are found to occur within the limits of the orebody. Ore is often found disseminated between the stratified layers, and often there is nothing but waste between such layers. Bands of shale frequently occur in the dolomite and make bad roofs. When careless machinemen drill their holes too high and break into such bands, the roof is thereby greatly weakened. Such loosened strata or shells in the back have to be either barred down or shot out.

WHERE POSSIBLE, PILLARS ARE LEFT IN LOW-GRADE ORE

The ore varies from 7 to 50 or 60 ft. high in different parts of the mines. A stope in one mine was over 90 ft. high, consisting of superimposed layers of ore about 300 ft. in diameter. This stope appeared to lie along one of the older fault fissures and yielded an average of 4% lead.

Pillars are left where possible in the low-grade ground, but in ore in moderately high stopes they are from 16 to 18 ft. in diameter and from 20 to 30 ft. apart in the clear. In high ground, pillars are often 20 to 30 ft. in diameter and are spaced from 10 to 12 ft.

apart. In high ground it is better to have small pillars close together than large ones far apart, as a better extraction is obtained when robbing later. Big pillars when robbed leave too wide a roof unsupported between. The pillars at some of the mines are left with a triangular spacing in the clear of 22 ft. and are from 20 to 25 ft. in diameter.

Pillars are usually mined from top to bottom from scaffolds set up on ladders until a bench has been cut around the top high enough to set up a drill column.

lower ore horizon, the latter is mined first and pillars are left with some degree of regularity. In subsequently stoping in the upper horizon, the pillars are spotted by the engineer, so as to be left superimposed with respect to those below.

If less than 10 ft. of barren ground lies between the orebodies, the whole is taken out.

The percentage of ore left in pillars varies with the height of the ground, but averages in the district from 15 to 20%. One of the greatest difficulties to overcome

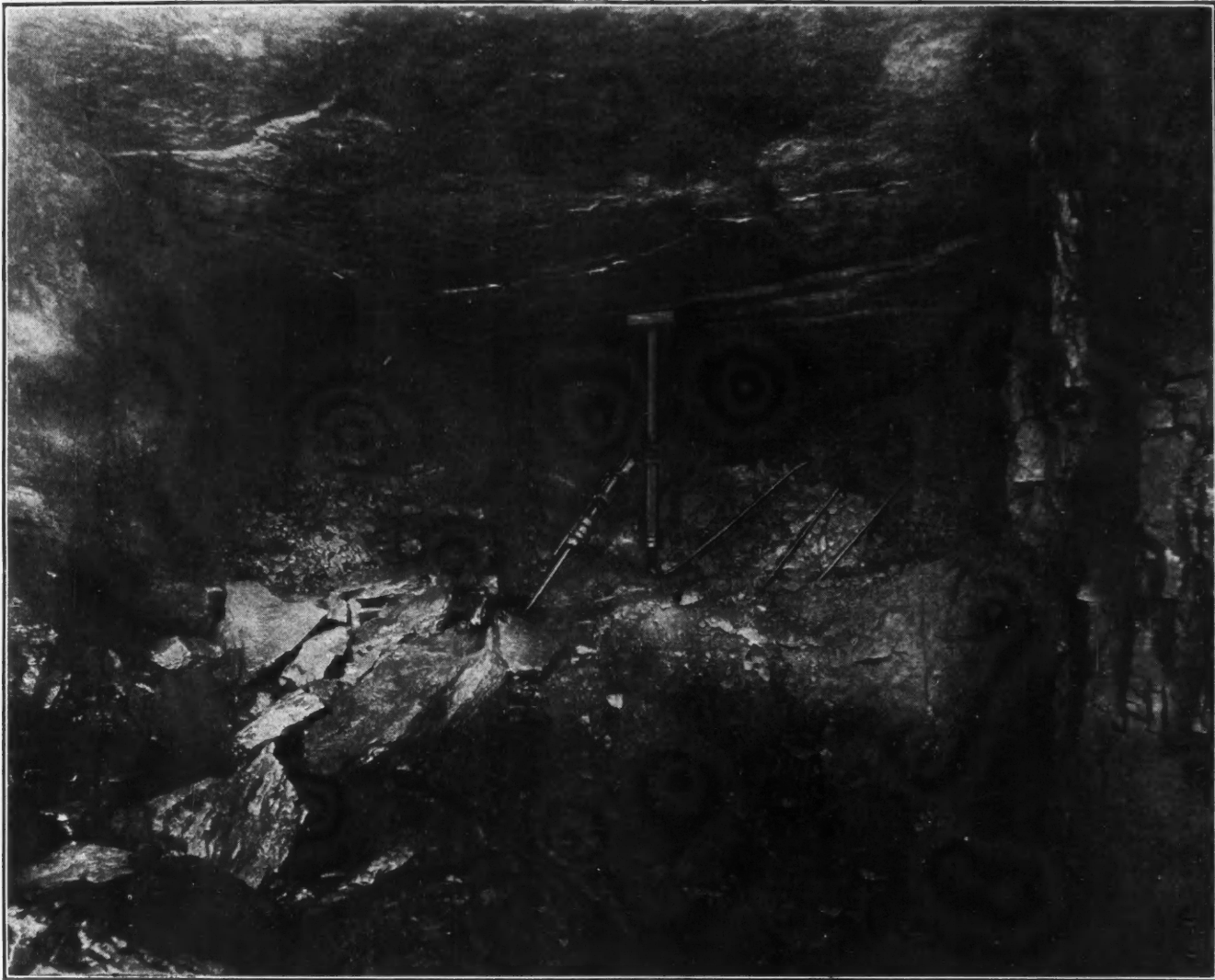


FIG. 5. STOPE HEADINGS ARE ADVANCED DRILL COLUMN HIGH CLOSE TO THE BACK, AND ORE BELOW THE HEADING, IF ANY, IS UNDERSTOPED IN BENCHES PROGRESSIVELY, LEAVING COLUMNAR PILLARS IN THE OREBODY, SPACED AND PROPORTIONED ACCORDING TO HEIGHT AND STRENGTH OF THE ROOF OR GRADE OF THE ORE

From this bench, holes are drilled down around the pillars, and a big tonnage is thus broken.

Work is guided largely by local conditions, and barren limestone often has to be taken to give a stoping height of 7 ft. Ore is mined as low as 2% lead, and the average for this type of stope must be estimated accordingly. Low-grade ground is often mined to develop higher-grade places not discovered by diamond drilling and in order to supply a constant workable tonnage to the mill.

Upper ore horizons are frequently 50 or 60 ft. above the main level stopes, floor to floor, and have from 35 to 40 ft. of barren ground left between. In mining such upper orebodies, where they are directly over a

among the miners is the tendency to leave large pillars. Pillars are later robbed, however, as at Joplin, but the total extraction is probably higher in Southeast Missouri mines on account of different surface conditions, pillars being robbed to the extent of about 50 per cent.

Incline raises to upper levels are usually flat and consist of two compartments. The manway compartment is lined off from the ore chute and is frequently equipped with steps. Ore chutes are equipped in general with arc gates, and the aprons are lined with track rails. Two-compartment inclines are sometimes made with the manway over the chuteway, instead of alongside, the object being to save the timbering in the lining from wear. In the fall of 1917 wages in the dis-

trict were, according to the sliding scale in use, 75% above the base wage, which for machinemen is \$2.75 per day and for shovelers \$2.40 per day. Thus machinemen receive \$4.80 and shovelers \$4.40 per day.

In general, throughout the district, the average broken per man underground varies from seven to eight tons. The average amount of ore broken, except at Bonne Terre, is about 40 tons per machine shift. Shoveling varies in different parts of the district, largely according to the method of tally, and about 17 cars, or 20 to 21 tons, is shoveled per man shift at present although formerly 23 tons was common.

OPERATING COSTS IN SOUTHEAST MISSOURI

A comparison of present mining costs in the Southeast Missouri district, although necessarily of economic importance locally, can have under the abnormal conditions that now prevail throughout the country but little significant value elsewhere. For this and other reasons best known to the various companies operating in the district, no cost data could be obtained. H. A. Guess, however, in a paper⁷ presented at the New York meeting of the American Institute of Mining Engineers, February, 1914, gives the following costs, which may be taken for an average in the district at that time.

TABLE I. UNDERGROUND COSTS PER TON OF ORE IN FLAT RIVER MINES IN 1914

Breaking, labor	\$0.14
power .....	.05
explosives .....	.08
Shoveling .....	.13
Motor haulage .....	.05
Drainage .....	.08
Total	\$0.53

In 1915, Skinner & Plate published⁸ the data in Table II given by Mr. Guess for mining costs of the Federal Lead Company.

TABLE II. MINING AND MILLING COSTS PER TON IN SOUTHEAST MISSOURI

Prospecting	\$0.12
Development .....	.04
Ore breaking .....	.46
Mine to mine bins.....	.23
Mine bins to mill.....	.04
Milling .....	.22
General expense .....	.14
Total	\$1.25

The St. Joseph Lead Co. costs from the annual report also are given, as in Table III, for the year ended Apr. 30, 1914:

TABLE III. COSTS PER TON OF ORE MINED AT THE ST. JOSEPH LEAD CO.

	Bonne Terre District	Leadwood District
Mining	\$0.87	\$0.78
Milling .....	.35	.30
Railroad and freight.....	.06	.04
Total	\$1.28	\$1.12

Interesting cost data were published⁹ by J. R. Finlay in 1909. Mr. Finlay made a thorough study and analysis of local costs, and estimated the following ranges as an average for the district, as shown in Table IV.

⁸"Mining and Mining Methods in the Southeast Missouri Disseminated Lead District."

⁹"Mining Costs of the World."

⁷"Cost of Mining."

Mining methods as a whole in the Joplin and Southeast Missouri districts are similar, except in details of auxiliary operations, and appear to be well adapted to the class of deposits mined. The flat nature of these bedded deposits, the relative low height of ore, compared to lateral extent, combined with the depth, hardness of ground and necessity for preserving surface rights, present certain conditions for roof support that

TABLE IV. TOTAL COSTS PER TON FOR MINING, MILLING AND SMELTING IN THE SOUTHEAST MISSOURI DISTRICT

Mining and hoisting	\$1.00	to	\$1.50
Transfer to mills .....	.05	to	.10
Milling .....	.30	to	.50
General expense .....	.10	to	.20
Freight to St. Louis.....	.097		.097
Smelting .....	.378		.378
Total operating	\$1.925	to	\$2.775
Adding depreciation .....	.312		.312
Dividend costs	\$2.237	to	\$3.087
Adding amortization.....	.576		.576
Total net	\$2.813	to	\$3.663

preclude caving, and the low grade of the ore not only prohibits the use of timber but makes it far more economical to sacrifice a small percentage of the ore in the form of pillars. The wholesale manner in which the ore is stoped and milled does not, from a cost standpoint, permit the practice of underground waste sorting, and even where the grade hoisted might be materially improved thereby the economy of so doing is questionable, as the gain would undoubtedly be more than offset by the added cost per ton.

Mining in Turkey

According to reports from Constantinople, unusual activity is now to be observed in developing the mineral resources of both European and Asiatic Turkey, states a recent issue of *Iron and Coal Trades Review*. No less than 90 applications for concessions have recently been put in to open up deposits of ore of one kind or another in the Vilayet of Aidin alone. In particular, chromite-ore deposits are being keenly sought for, and it is said that the Krupp firm, of Essen, has acquired the rights in two mines and is negotiating for the purchase of two more. So far, over 60 chromite-ore mining concessions in Asiatic Turkey have been granted by the government.

Concessions have also been obtained recently by Turkish subjects to develop manganese ore deposits at Kütshük, in the Sandjak of Menteché, and iron-ore deposits at Burgas, Vilayet of Hudavendighiar; by a German subject to work a manganese ore mine at Inludja, in the Sandjak of Menteché; and by an Austrian to open up a manganese ore mine near Kapakli-Kapus-Dere, also in the Sandjak of Menteché. Reports of discoveries of important deposits of iron ore, chromite ore, and coal in the Vilayet of Brussa, and of nickel ore near Akkais, in the Vilayet of Kastamuni, have also been received. The Heraclea coal mines, which formerly belonged to a French company, are now reported to have been acquired by Turkey, to be worked as a state undertaking.

Venezuelan Mineral Production in 1917 was as follows, according to "Commerce Reports": Gold, 958,304 grams; copper ore, 42,271 tons; petroleum, 54,072 tons; and coal, 20,165 tons.

Valuation of Manganese Ores

A PAPER, "Notes on the Valuation of Ores and Minerals and on Metallurgical Calculations," was presented some years ago at the 21st session of the Institution of Mining and Metallurgy by George T. Holloway. The author confined his discussion largely to manganese and tin, and so much of the article pertaining to the former metal is of interest and value today, that various portions of it, as well as of the attendant discussion, are deemed worthy of reprint and are reproduced in the following paragraphs:

Manganese ores are employed by the chemist in the manufacture of chlorine and for many other purposes, and the metallurgist employs them in the manufacture of steel, etc. For the production of chlorine, which accounts for the bulk of the ore used for other than metallurgical purposes, the presence of lime is objectionable, while phosphorus is harmless. The peroxide (MnO₂), which contains the maximum percentage of oxygen, is practically the only manganese mineral useful for the purposes of the chemist, who buys his manganese ore because it contains oxygen in a cheap, permanent, portable, solid form, and would often prefer it without the manganese. The metallurgist wants manganese, and prefers ores, such as braunite and manganite, containing the minimum of oxygen, whose presence in excess necessitates the use of more fuel and lowers the manganese contents of the ore. He prefers manganite to braunite, as the latter invariably contains silica, which may for all practical purposes be considered as a part of its chemical composition, although not shown in the formula given to it by the mineralogist.

Certain brands of both manganite and pyrolusite are almost absolutely free from silica and are highly prized for the manufacture of ferromanganese. The objection to the peroxide already mentioned may, in fact, be more than neutralized by this freedom from silica, as is the case with certain Brazilian ore. The metallurgist does not object to the presence of lime and is often prepared to pay for it, but he fixes a maximum for phosphorus and silica. In other words, an ore which is worthless to the chemist is the "very thing" for the metallurgist, and the importance of this point in connection with manganese ores may be gaged from the fact that, whereas the consumption of manganese ore in chemical manufactures is measured only in tens of thousands of tons, although, 40 or 50 years ago, it consumed the bulk of the production, the consumption for steel-making amounts to nearly 3,000,000 tons of true manganese ores annually, in addition to enormous quantities of iron ore rich in manganese.

MANGANESE A BYPRODUCT OF NEW JERSEY ZINC ORES

In the roasting of the zinc ores of New Jersey (franklinite, zinkite and willemite) for the production of zinc oxide, a residuum or byproduct consisting essentially of the oxides of iron and manganese, and totalling about 140,000 tons annually in the New Jersey district alone, is produced. This is smelted for the production of spiegeleisen and ferromanganese, and the zinc (which is then the byproduct) is recovered as oxide in chambers at the top of the blast furnace, and is sold to the paint makers or zinc smelters. So great is the production of zinc from such sources and from other manganese ores containing zinc, that a spelter furnace might well be regarded as an ordinary adjunct to a large modern spiegeleisen or ferromanganese plant. Manganese ores are sold at so much per unit of manganese or of manganese peroxide (MnO₂), according to the use to which they are to be applied or the source of the supply, a unit meaning 1 per cent.

In the case of Russian (Caucasian), Indian and Brazilian ore, the price is based on the contents of metallic manganese; the prices of Japanese, Spanish and German ores are commonly calculated from the contents of manganese peroxide. A common basis is 50% of metallic manganese for metallurgical, or 60, 70 or 80% of the peroxide for chemical purposes. The latter figure is almost invariably taken as a

basis in England. The exact conditions depend upon the requirements of the purchasers, and vary in different countries and even in different localities in the same country.

PROPERTIES OF AN ORE DECIDE ITS USEFULNESS

The following details indicate how a careful consideration of the composition and physical properties of an ore, and the market conditions, will decide its use or destination and the prospects of successfully working it. The Carnegie Steel Co. purchased its ore under the following rules in 1911:

Schedule of prices paid per ton of 2240 lb. for domestic manganese ore delivered at Pittsburgh or Bessemer, Penn., and South Chicago.

Prices are based on ores containing not more than 8% silica or 0.20% phosphorus, and are subject to deduction as follows:

For each 1% in excess of 8% silica there shall be deduction of 15c. per ton; fractions in proportion.

For each 0.02%, or fraction thereof, in excess of 0.20% phosphorus, there shall be deduction of 2c. per unit of manganese per ton.

PRICES PAID FOR MANGANESE ORE IN 1911 BY CARNEGIE STEEL CO.

Percentage of Metallic Manganese in Ore.	Price per Unit in Manganese.	Cents. Iron.
Over 49	26	5
46 to 49	25	5
43 to 46	24	5
40 to 43	23	5

Ores containing less than 40% manganese or more than 12% silica, or 0.225% phosphorus are subject to acceptance or refusal at the buyer's option. Settlements are based on analysis of sample dried at 212° F., the percentage of moisture in the sample as taken being deducted from the weight.

In England, the requirements as to richness in manganese and low iron contents are more stringent now than was the case even a few years ago. Ferromanganese containing 80% of manganese is now commonly produced by those who, 10 years ago, aimed only at 70%, but cannot be made from manganese ores containing much iron, as both the iron and manganese are reduced together. The requirements of the steel trade, aided by the extraordinary quantity, uniformity and quality of the Indian, Brazilian and Russian ore, have resulted in a demand for ores of extreme richness and purity, and, though ore containing under 50% or even under 45% is salable, the largest contracts and the best prices are obtained for ore carrying 50% or more of manganese.

PRICE SCALE ABROAD PROVIDED BONUSES AND PENALTIES

In England and Germany, a basis of 50% (or 50 "units" manganese at so much per unit (say 8d. or 9d. at the present moment), with a small bonus or penalization for each unit above or below 50%, is common, a maximum of 8 or 9% silica and a maximum of 0.20 or 0.15% phosphorus being agreed, a deduction of, say, one halfpenny being made for each unit of silica above the maximum, and an agreed deduction for each 0.01 or 0.02% of phosphorus above maximum.

The above basis is common for Caucasian, Indian and Brazilian and other high-class ores which are commonly sold in lots of thousands of tons, averaging from 50 to 55% of manganese and of remarkable uniformity. In the case of Turkish, Japanese and other ores, which are somewhat more variable, a basis of 45% manganese is common. For the former, a basis of 0.03% phosphorus and 10% silica is common, and for the Japanese "brown-stone" ore (pyrolusite or MnO₂) special rates rule. This brown-stone ore is specially suited for chemical purposes, and fetches a higher price than others per unit of manganese. It varies from about 43 to 56% manganese, from 7 to 10% silica, and carries about 0.5% phosphorus, and is commonly sold for its value in "available" peroxide, the schedule being agreed at so much per ton if from 85 to 90% MnO₂, or so much from 75 to 85%, 70 to 75%, or 65 to 70 per cent.

(The schedule of prices of the Carnegie Steel Co. refers to domestic ores and is only approximate. When originally published they were much above the prices then obtainable,

but were established in order to encourage exploration for manganese ores in the United States. The price of manganese ore is usually a matter for negotiation, as it is largely dependent on supply and demand, the cost of ocean freights, and other circumstances. As a general rule, it may be said that the cost of placing manganese ores on the United States market is several shillings per ton more than that for European ports, but this is to a great extent neutralized by the higher manganese assay returns in America. This is believed to be due to the method of sampling in general use there taking in a smaller proportion of small ore.

(The price scale given in the third paragraph following applies mostly to the Caucasian mineral, where penalties are necessary owing to the large number of small firms engaged in the trade. With Indian and Brazilian ores the British contract usually calls for "mineral of usual quality." In Germany there is usually a penalty for manganese below 50%, but the bonus for the richer mineral is not general.)

(The silica penalty in the paper is not quite clear. The halfpenny (presumably per unit of manganese) for each unit of silica, above the maximum would work out, for a 48% ore, at 2s. per ton. This is not so, however, as the usual penalty for Caucasian mineral is 3d. per unit of silica per ton).

It is worth noting that Japanese brown-stone containing 87% (about the best obtainable) fetches about twice as much as 70% ore, though certain Continental pyrolusites, containing about 50% available MnO_2 , and stated to be marketable in the United States, fetch only about one-fifth as much as the 87% Japanese ore. The variations in prices are, of course, only to a small extent dependent on the manganese contents. They depend, for instance, in the case of ores employed for chemical purposes (the manufacture of chlorine, permanganates, etc.), glass-making and dry battery manufacture, etc.; on the ease with which they can be decomposed, that is, on their physical properties, as well as on the absence of excess of lime, iron, etc., which either reduce the value of the product, or entail the use of excess of acid, in decomposing them. The "available" manganese, that is that which can act as peroxide, does not necessarily correspond with the actual manganese contents. Any reducing agent, such as a ferrous compound, acts reversely to the manganese peroxide, and if present in excess may practically wipe it out for many purposes. Lime in the form of carbonate is objectionable to the chemist, and is penalized. For ready sale to him there should not be more than about 2%, and some chemists insist upon its total absence, although the metallurgist views its presence in quantity with indifference, or even welcomes and pays for it.

CAUCASIAN LUMP ORE IDEAL FOR CHEMIST

Even during the last 20 years Continental pyrolusite was salable in England on a guarantee of 60% MnO_2 , and occasionally even as low as 50%, but the main consumption for chemical purposes is confined to 80% ore free from lime and containing a minimum of iron. Special brands, such as certain Spanish pyrolusites, are sold under special schedules, but the ideal ore for the chemist and glass-maker is the Caucasian lump ore, which is free from carbonate of lime, low in iron, rich in peroxide, and sufficiently porous to allow acid to percolate into it, but dense enough not to fall to pieces in the stills. Such ore is confined to certain portions of the Caucasian deposits, and the annual output is probably not over 20,000 tons.

As already stated, there are many manganese ores which contain no "available" oxygen, or are not of the nature of peroxide, or contain constituents which neutralize their oxidizing action. The methods of assay adopted for valuing manganese ores therefore vary according to the purpose to which they are to be applied. For the metallurgist, the ordinary "complete analysis" is required, together with notes as to the hardness and other physical properties bearing upon its probable behavior in the furnace, but for the chemist the manganese is often not determined at all. For his purpose the amount of oxygen which it yields when heated, or the quantity of chlorine which it produces when treated with hydrochloric acid, is usually what he desires to know, together with a test for, or determination of, certain impurities and notes as to its porosity, etc., and the ease with which it is decomposed by heat or acid treatment.

The principal manganese alloys made on the large scale, and their approximate contents, are as follows:

Ferromanganese	75 to 80 or (rarely) 85% Mn.				
Spiegeleisen	15 to 25% Mn.				
Silicomanganese	<table border="0" style="display: inline-table; vertical-align: middle;"> <tr> <td rowspan="3" style="font-size: 2em; vertical-align: middle;">{</td> <td>70 to 80% Mn; 20 to 25% Si.</td> </tr> <tr> <td>50 to 55% Mn; 20 to 25% Si.</td> </tr> <tr> <td>35 to 40% Mn; 20 to 22% Si.</td> </tr> </table>	{	70 to 80% Mn; 20 to 25% Si.	50 to 55% Mn; 20 to 25% Si.	35 to 40% Mn; 20 to 22% Si.
{	70 to 80% Mn; 20 to 25% Si.				
	50 to 55% Mn; 20 to 25% Si.				
	35 to 40% Mn; 20 to 22% Si.				

Silicospiegel

15 to 20% Mn; 10 to 15% Si.

The difference in the above per cents. and 100 is mainly iron in each case, although the amount of carbon may be as high as 5% in the first two.

EIGHT MINERALS IMPORTED AS MANGANESE ORES

The principal minerals which are worked directly or indirectly on the large scale as manganese ore are pyrolusite (MnO_2); psilomelane ($MnO_2 + MnO + BaO + x H_2O$); wad (earthy and variable but containing hydrated peroxide and resembling psilomelane except as regards hardness); manganite ($Mn_2O_3 \cdot H_2O$); braunite ($Mn_2O_3 + x SiO_2$); hausmannite (Mn_3O_4); diallogite or rhodochrosite ($MnCO_3$); and franklinite ($FeZnMn$) $x O$.

In the case of franklinite, wad, and other minerals of variable composition, there is no rule as to manganese contents, and, in many cases, that metal is of less importance than other constituents, and merely adds to the value of the ore because it can be extracted with or after such other constituents. Franklinite ore is obtained in New Jersey, and consists mainly of franklinite, willemite, zinkite, and various silicates containing manganese. The dressing of the ore produces (1) a concentrate composed mainly of franklinite; (2) a concentrate consisting of franklinite with various manganiferous silicates; and (3) a mixture of willemite and zinkite. The two former are employed for the production of zinc oxide, and the last for direct spelter manufacture. The semi-fused residue from the furnaces treating the two franklinite concentrates is smelted in the blast furnace for the manufacture of spiegel, but the residue from the retorts in which the third concentrate is distilled is too siliceous for that purpose, although rich in both iron and manganese, and therefore possessing some slight value as a flux.

In the case of wad, a mineral which has been produced by direct and rapid deposition from solution, the value depends on many circumstances. Some varieties are employed as the pigment known as umber; certain others owe their value to the presence of cobalt, copper, or silver, and comparatively little can be regarded as a true "manganese ore," although, when the mineral is employed as flux, the manganese possesses a distinct value.

MANGANIFEROUS IRON ORES MINED IN LARGE QUANTITIES

Manganiferous iron and silver ores are mined in enormous quantities, the former being mainly smelted in the blast furnace for the production of spiegel or of pig iron high in manganese. In the latter case, the selling price for the manganese content is low and depends on its amount. The manganese may, in fact, be merely paid for at the same price per unit as the iron.

Manganiferous silver ores usually occur as a capping or gossan on various sulphide ores, and commonly consist of the oxide of manganese and iron (the latter usually predominating) with silver sulphide and lead carbonate. They may be divided into three classes—one too poor in silver or lead to be worked for either, but sufficiently rich in manganese to rank with the above-mentioned manganiferous iron ores; a second, rich enough to be worked for silver and lead and containing enough manganese to render it valuable as a flux and enhance its price accordingly; and a third too low to be directly valuable for any one constituent. This last is sold for smelting with argentiferous ores, so that its manganese and iron are utilized as fluxes, and its silver and lead are recovered.

In the discussion which followed, R. O. Ahlers said:

An intimate association with manganese ore enables me fully to appreciate the section dealing with this mineral, and justifies the addition of a few remarks. The author has very concisely given us just what is required to fulfil the object of these notes. Allusion is rightly made to the importance of the physical properties of manganese ore, but as this is of economic importance some qualification should

be given to complete the notes. Speaking of ore for smelting purposes only, what is wanted is ore in lumps, which when fed into the furnace will assist in keeping the burden open, leaving interstices for the passage of the gases, so that they may play equally throughout the whole mass. What the furnace man objects to is fine ore and dust, which impede the gases and get carried off into the flues, necessitating frequent blowing out.

Between the mine and the destination manganese ore has to stand a great amount of hard usage, causing disintegration unless the ore is of a hard and tough nature. In judging a shipment of ore at the port of delivery, the percentage of lump, rubble and fine has always to be taken into consideration, and greatly affects the result. In this connection, I do not think Indian, Brazilian and Caucasian ores should be bracketed together; the two former are good shipping ores, whereas Caucasian may run to as much as 80% of fines.

TRANSPORTATION CHARGES A VITAL MATTER

Another point of importance is the geographical position of the mineral deposit. This may be considered to be outside the province of the paper, but the significance is realized from the fact that though it probably costs only 3s. to mine a ton of ore, that ton may cost 30s. by the time it reaches its destination. A mine yielding only 45% ore, with good transport facilities, may be much more valuable than one giving 54% ore, if badly situated for freights.

Irrespective of mining technicalities, three factors control the value of manganese ore, viz., chemical composition, physical nature and geographical position. The best standard from which to judge a manganese ore is its applicability to the manufacture of 80% ferromanganese. A large amount of ore which falls short of this standard is made to answer by blending with other ores, otherwise it is used for the lower percentaged "ferros," with spiegeleisen at the bottom of the list. It must be remembered that though practically all the iron contained in the ore goes into the alloy, there is always a loss of manganese through volatilization; the more refractory the slag the greater this loss. Further manganese is carried off in the slag, this loss being increased by the impurities in the ore.

There are two statements in the paper to which exception might be taken. It is stated that the lime contained in manganese ore used for metallurgical purposes may be paid for, and the impression might be gained that it is customary to do so. Lime is, of course, an essential in smelting this ore, and, though granting that it may, as an exceptional case, have been paid for, it must be borne in mind that this is far from usual. Again, we read, in reference to manganeseiferous iron ore, "The manganese may in fact be merely paid for at the same price per unit as the iron." In ore of this class I have always found manganese paid for at a higher price per unit than iron.

It is difficult to give definite prices for Europe, where parcels of ore are bought by private contract, and no schedule exists, such as that of the Carnegie Steel Co., quoted by the author. Particularly in the case of the poorer ores, the sale is purely a matter of negotiation.

Standardization of Mine Accident Reports and Statistics

The department of the Interior, Bureau of Mines, has recently compiled, under the direction of Albert H. Fay, the report of a Committee on the Standardization of Mining Statistics.

This report, which is listed as Technical Paper 194, represents the work of a special committee appointed after the convention of state mine inspectors and representatives of industrial compensation commissions held at the invitation of the Secretary of the Interior, in Washington, Feb. 24 and 25, 1916.

The objects of the convention were the standardization of all data relating to the reports and classification of accidents at coal and metal mines, quarries and

metallurgical plants. One of the main objects of the convention was to bring about greater coöperation between the various state organizations and the Federal bureaus. The committee has drawn up a series of forms designed to include every possible kind of accident and a form suitable for any of the mines or plants mentioned in such a manner as to comply with state as well as Federal requirements and thereby simplify the work demanded of companies by requiring only one report which would be suitable for all purposes.

The recommendations made by the committee are as follows:

1. That all statistical reports be for the calendar year.
2. That there should be an effort on the part of the Federal Government to establish a statistical clearing house to prevent duplication of reports, and that the information once collected for a department or bureau should be made available for use by any other Federal department, bureau, or state government.
3. That, though all the information called for by these forms is desirable, it is definitely known by the committee that some of the states may find it impracticable to adopt them immediately, by reason of the fact that they are hampered by insufficient appropriation. The committee, therefore, also requests that each state shall provide sufficient data, so that its proper officials may comply with the recommendations contained herein.
4. That copies of this report be printed by the Federal Bureau of Mines and given as wide circulation as possible by mailing copies to members of Congress, governors, Department of Mines, industrial commissions and operators in each state.
5. It is further recommended that all persons interested in the mining industry do all in their power to have the state mining laws so amended as to provide for the collection of the data called for by the standardized forms.

Three general forms are recommended, and these are all that is required to be filled out by the operator or the proper state official. Thirteen tables have also been drawn up from which the data from forms 1, 2 and 3 may be compiled for publication in the state's annual report by modifying the headings to conform to any class of mine or plant. The tables are arranged to segregate the data received on the forms according to fatal and non-fatal accidents or accidents both by industries and by occupation.

The forms and tables as given in Bull. 194 are exhaustive and are the result of thorough research and experience on the part of the committee. The coal-mining industry is represented on this committee by James E. Roderick, chief of the Department of Mines, Harrisburg, Penn., who was named chairman, and James Dalrymple, chief inspector of mines, Denver, Colo. The metal-mining industry is represented by George H. Bolin, state mine inspector, Phoenix, Ariz., and W. D. Orem, state metal mine inspector, Helena, Mont. The other members of the committee are L. W. Hatch, chief statistician, New York Industrial Commission, Albany, N. Y.; John Bohlander, president Illinois State Mining Board, Pekin, Ill.; and Albert H. Fay, mining engineer, Bureau of Mines, who was named secretary of the committee. In its report, the committee states that inasmuch as the members of the committee representing the metal-mine industry were not present, the committee did not feel justified in making any extensive recommendations that would have a bearing upon metal mining. The work was, therefore, confined largely to the standardization of forms relating particularly to the coal-mining industry.

Oliver Iron Mining Co. Adopts Labor Co-operation Policy

THE Oliver Iron Mining Co., an extensive operator in the Lake Superior iron district, has adopted and put into operation a "mutuality plan" at all its mines, open pits and shops. While similar ideas have been carried out by mine operators in other sections, this is the first systematized step in the iron districts, and its initiation and operation will no doubt be watched closely by various mining concerns in that section.

The plan, as outlined, establishes a medium whereby employees may make known any grievances that they may have which are of sufficient importance to merit the attention of the employers. Though this has been the policy of the company, the lack of a systematic attempt to bring about a mutual interchange of ideas has resulted in frequent misunderstandings, and it is with the purpose of correcting this condition, strengthening the bond between company and employee and securing a closer coöperation that the Oliver Iron Mining Co. has adopted the "mutuality plan."

The administration of the plan has been vested in P. F. Chamberlain, of Virginia, Minn., who holds the title of Mutuality Chairman. Mr. Chamberlain is well known on the iron ranges, where he has spent several years and occupied various positions in the mining field. His appointment is looked upon most favorably by operator and miner alike.

Believing the matter to be one of great interest to the mining industry, the plan is herewith outlined:

MUTUALITY PLAN OF THE OLIVER IRON MINING CO.

To the end that the merits of any grievance of an employee may be determined by his fellow employees, the mutuality plan of the company will operate, in part, through committees composed of employees. There shall be one committee for each underground mine and one for each open pit. There shall be a joint committee appointed for each headquarters shop, office and laboratory. Each committee shall have a membership of three or five, depending upon the number of employees represented by the particular committees. These committees shall be known as local mutuality committees, and shall be composed only of employees who are in no position of authority. No foreman or boss may serve on any such committee.

The president of the company will appoint a mutuality chairman who will be charged with the duty of administering the mutuality plan. He shall look after the selection and organization of committees, preside as chairman at all general and special meetings thereof, and perform such other duties as may be necessary in giving full scope to this plan, but he shall have no vote in the deliberations of any committee.

In the selection of the members who will constitute the first local mutuality committees, the mutuality chairman shall procure from the local superintendent of each underground mine and open pit, and each headquarters shop, office and laboratory, a list of ten men who in the judgment of such local superintendent are qualified for membership in local mutuality committees representing such underground mine, or open pit or such headquarters shop, office and laboratory. On receipt of such list, the mutuality chairman will make inquiry among the employees to be represented by the particular committee to ascertain the standing of the ten men so designated among such employees. Acting upon the information so procured relative to the qualifications and standing of such men, the chairman will then select from such list the appropriate number of men for membership in the particular committee. If such committee should have a membership of three, one shall be selected to serve for three months, one for four months and one for five

months; if it should have a membership of five, two shall be selected to serve for three months, two for four months and one for five months.

The chairman will meet with each committee so selected and outline to the members their duties as such committeemen. One of their number will be selected as secretary. On such first meeting, and on any subsequent meeting when conditions may warrant, the chairman shall require of each committeeman the names of three employees who, in the opinion of such committeemen, are qualified to act as members thereof. From the list so procured, the chairman shall select committeemen to fill the vacancies caused by expiration of terms, or otherwise. After the selection of the members of the first committees as aforesaid, all committeemen selected to fill other than unexpired terms shall serve for a period of 90 days. The chairman will notify each committeeman by letter of his appointment to membership in the particular committee for which he is selected, and shall furnish a copy of such letter to the local superintendent and to the other members of the committee.

Regular meetings of each committee will be held once every three months, and special meetings shall be called by the chairman at such other times as in his judgment conditions may warrant. The chairman shall provide convenient places for the meetings of such committees and shall preside at such meetings. The secretary of the committee shall make a full and complete report of each meeting, which will be kept on file in the office of the chairman. Members of the committees will receive no extra compensation for their services.

It shall be the duty of the local mutuality committee to pass upon and recommend for adjustment, or such other disposition as in the judgment of the committee a particular case may warrant, all complaints of employees represented by such committee coming within any or either of the following classifications: The treatment of employees by those in authority; conditions surrounding employees in their places of work; all tools with which employees perform their work; living conditions on locations owned by the company; and medical attention.

All complaints to be passed upon by a local mutuality committee must be in writing and signed by the aggrieved employee or by some member of the committee, and must show on their face that the subject matter thereof has first been presented, without relief, to the foreman or other person in authority directly interested. If any employee through diffidence or timidity, is unwilling to first state his grievance personally to the foreman, he may take the matter up verbally with any member of his committee, whose duty it shall be to thereupon act as mediator in behalf of such employee and seek to adjust same with such foreman, and in so doing he shall not disclose the identity of the complainant. If no adjustment is made after a grievance has been stated to the foreman or other person in authority by an employee or a committeeman in his behalf, complaint thereof shall be made in writing by the employee or the committeeman or the secretary of the committee, and by such secretary forwarded to the mutuality chairman.

As soon as a complaint is received by the chairman, he will notify the local superintendent of the nature thereof and of the day, hour and place fixed for hearing same, and direct that at such time and place the members of the committee, witnesses and interested parties be required to be present. At such time and place the chairman will convene the committee and examine each witness separately. The testimony shall be taken down by a stenographer. After the witnesses have been heard, all persons other than the chairman, committeeman and stenographer will be excluded from the room. The chairman will take no part in the deliberations of the committee, who shall thereupon, by a majority vote, arrive at a decision upon the evidence produced, and make appropriate recommendations. If the committee finds in favor of the foreman or other person in authority, their decision shall be final; if they find in favor of the complainant, their recommendations shall be reduced to writing and referred by the chairman to the local superintendent. If such superintendent refuses to adopt the recommendations, the chairman will refer them to the general superintendent or district manager; if such general superintendent or district manager refuses to adopt them they will be referred to the president, whose decision shall be final. Upon the

adoption of such recommendations by the local superintendent, general superintendent, district manager, or president, as the case may be, prompt compliance therewith shall be required.

Each member of each local mutuality committee shall be observant of the manner in which the work is performed and vigilant in the interests of his fellow employees, and shall call to the attention of the foreman or other person in authority, anything of an irregular nature in the works or in the handling of men. If such matter is ignored by the foreman or other person in authority, it shall be the committeeman's duty to bring it regularly before his committee.

To the end that diffident or timid employees may have ready resource to the committee with their complaints, all committeemen shall at all times be attentive to such complainants from such employees, and give such complaints the same consideration as if the subject matter thereof had come to the attention of such committeemen in the first instance.

If at any meeting of any local mutuality committee, such committee shall find, upon evidence produced, that any foreman or other person in authority is not in accord with this mutuality plan as outlined herein, they shall so report in writing. Such foreman or other person in authority will thereupon be directed to get into line with the mutuality plan under penalty or dismissal.

Aside from causes due to cessation of work or general conditions in the iron industry over which the company has no control, either of the following grounds shall constitute adequate cause for dismissal from the service of the company: Insubordination; creating discord or confusion among workmen through agitation; soliciting membership for any organization while in the works or on the property of the company; willful neglect of duty; membership in any organization advocating anarchy or violence; and incapacity.

In all cases of dismissal of employees by foremen or other persons in authority, if such employee feels that he has been discharged without just or adequate cause, he may make complaint in writing to the local mutuality committee representing the works in which he was employed, setting out in full the circumstances of such dismissal. Such complaint shall be immediately filed with the chairman, and it shall be his duty to convene the committee for an investigation of such complaint. Before proceeding with the hearing however, he shall call upon the employment record bureau for a complete statement relative to the service of such complainant as an employee of the company, and such record may be produced in evidence before the committee at the hearing of the complaint. If, upon the hearing, the committee finds that any one of the foregoing grounds for dismissal is sustained by the proof, such discharge shall be final. If the committee finds such grounds are not sustained, appropriate recommendations shall be made and adopted. A full report of such hearing shall be made, and one copy shall be kept on file by the chairman and another forwarded to the employment record bureau.

Nothing herein shall be construed to prevent the mutuality chairman, with the consent of the president, from adding to the number of a committee or to the membership thereof, if, in the judgment of the chairman, such action shall be deemed necessary or advisable in furthering the operation of this mutuality plan, but no committee may be abolished, or the membership thereof reduced, except by consent of the employees evidenced by a majority vote of committee to be affected.

There shall be kept posted on bulletin boards located at each underground mine, open pit and headquarters shops a notice which shall set forth the names of the current committees for that particular mine, pit or shop. This bulletin or notice shall also contain a brief statement of the method whereby complaints may be regularly made.

In order to facilitate the making of suggestions by employees for the betterment of the service, suggestion boxes will be placed in all dry-houses, shops and other places where employees congregate on the property. These boxes shall be maintained for the use of any employee desiring from time to time to make recommendations as to the operation and conduct of the work in the department where he is employed. All suggestions must be in writing, signed by the person making them, and inclosed in a sealed envelope addressed to the local superintendent. A sign will be placed above the box stating the purpose thereof.

Lithium hydroxide is a constituent of the electrolyte of the Edison storage battery, and other lithium salts are used in pharmaceutical preparations.

Mineral Industries in the Katanga*

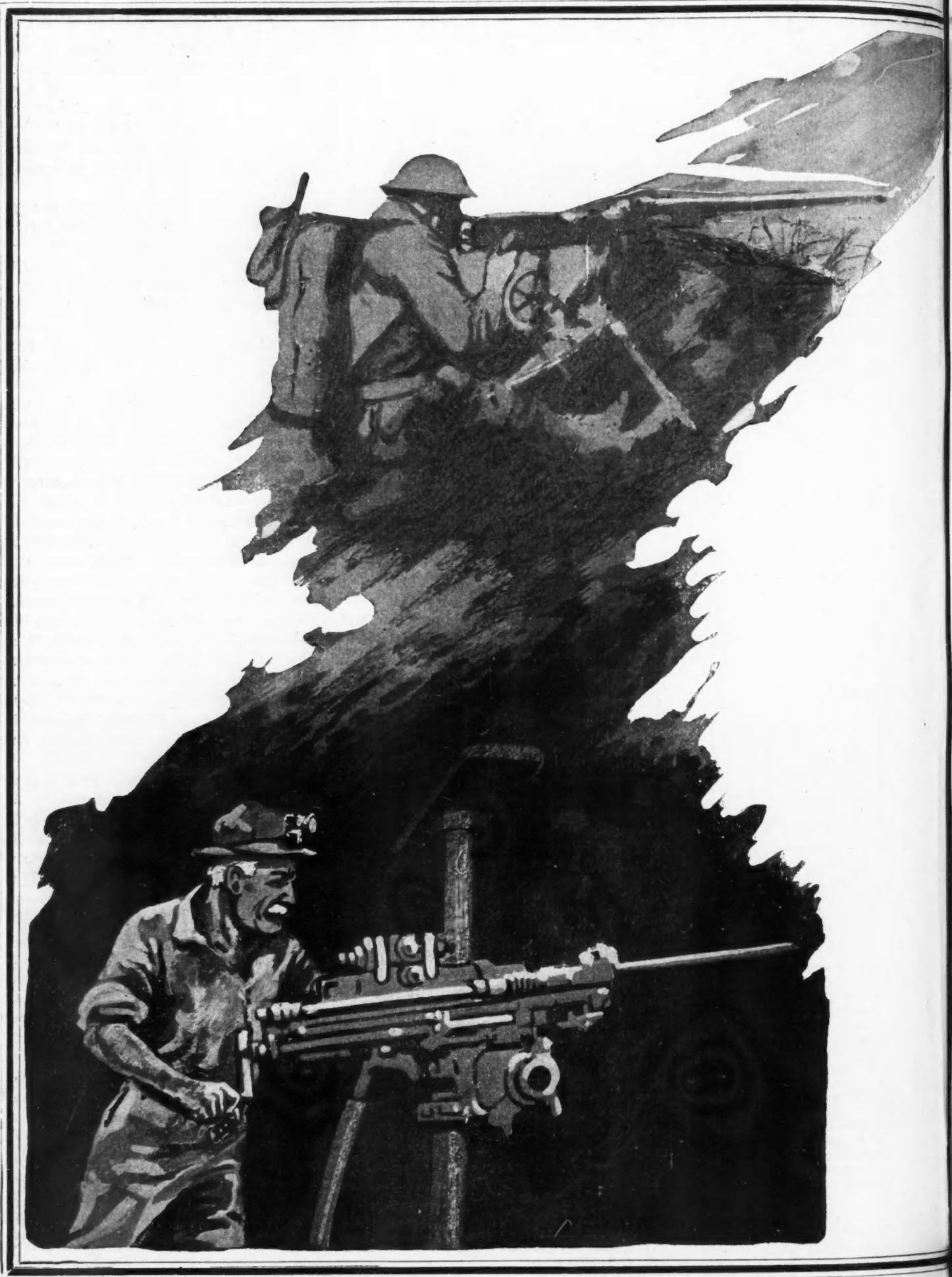
The acting British vice consul at Elisabethville, Belgian Kongo, in a report submitted to his government and published in the *Board of Trade Journal* for Apr. 25, states that the mineral industry of the Katanga is practically confined to the operation of L'Union Minière du Haut Katanga. The company holds the mineral rights over a large area of country known to contain copper, tin, and gold.

Up to the present only the copper has been worked on a large scale, and practically the whole of the copper produced has been obtained from the richer ores of two mines only, the Star of the Kongo and the Kambove. The Likasi and Chituru mines, in the Kambove district, are now being opened up, and a branch railway has been constructed from the main line to the mines. The blast-furnace process of extraction has been employed since 1911. The central smelting plant is at Lubumbashi, near Elisabethville, and at present consists of five blast furnaces, of which four are in continuous operation. Two additional furnaces are in course of construction and will be ready for use soon. The completed plant will have a daily capacity of 100 tons of copper. The output of the furnaces during the first nine months of 1917 was 19,766 metric tons [metric ton = 2204.6 lb.] as compared with 21,273 tons in the calendar year 1916 and 13,483 tons in 1915. It is estimated that the output for the year 1918 will be 40,000 tons. Wood, cut locally, is used for power purposes, and coke for smelting is obtained from a colliery in Rhodesia. The plant, machinery, and stores for the mines and smeltery have been obtained from Europe and the United States, chiefly from the latter since the outbreak of war. Many smaller requirements are obtained from South Africa. It may be mentioned here that, including the cost of fuel and freights, about £40,000 to £60,000 [roughly \$200,000 to \$300,000] per month is paid out to Rhodesia and the Union of South Africa.

Enormous quantities of ore have been proved of a lower grade than it is possible to treat economically by smelting, and after exhaustive experiments a plant is in course of preparation for the treatment of these ores by leaching and the electrical deposition of the copper. This plant is to have a yearly capacity of 50,000 tons of copper. The program of expansion and development, beginning from the present time up to the year 1921, provides for an expenditure of £3,000,000 [\$15,000,000]. From 1911 until the outbreak of the war the whole of the L'Union Minière's output was sold to Germany. Since the commencement of hostilities it has been sent to the United Kingdom. The company employs a force of 450 Europeans and 7000 natives.

Alluvial gold is known to exist near Ruwe, not far from the Lualaba River. A small quantity of the metal has been taken out, but the deposit is not being worked at present. Tin is found on several of the properties of L'Union Minière. At present no work is being done, but there seems a possibility of the Busanga tin fields being opened up in the near future. Transport and labor are the chief difficulties to contend with. Diamondiferous pipes have been found on the Kundalungu Plateau, west of Lake Mweru, but no work is being done.

*Commerce Reports, June 3, 1918.



The Old Miner

By Berton Braley

I'M A BIT too old for fightin', but when workin' on my shift,
As my noisy drill is bitin' at the ore seam in the drift,
I feel kind of like a soldier, and it seems this shakin' drill
Is a trusty young machine gun that is shootin' with a will;
And I sight along its piston like a gunner in the line,
And I guess it sort of thrills me when I run this drill of mine;
For it's makin' holes for powder that will shoot the copper free
To be used to make munitions for the cause of Liberty.

SO I KEEP this drill a-throbbin' an' I listen to its song
Like a bunch of rapid firers that is goin' mighty strong;
And I finds myself a-thinkin' "Here's a round or two for Fritz,
That'll cause him some discomfort in his innards when it hits."
And although I'm just a miner, rather gray and bent and lame,
I can feel I'm smashin' Boches by my labor, just the same,
As my drill is jumpin', thumpin' at the copper-bearin' rock
Which'll go to make munitions that'll give the Hun a shock.

I WOULD LIKE to shoot a Lewis or a Browning gun in France,
But I'm dim eyed and rheumatic, and I'll never have the chance.
Yet I find some consolation when I fancy this machine
Is a snappy new machine gun that is drillin' Teutons clean;
I can think I'm right in battle as I hear its ringin' bark
And imagine every bullet that I'm sendin' hits the mark.
And although that's all a vision, and it goes and leaves me flat,
I can still feel like a soldier as the drill sings "Rat-a-tat!"
For I'm minin' the material that goes to feed the guns
With shells an' rifle cartridges to land among the Huns;
So I'll call myself a fighter while the air drills bark and drum,
For I'm helpin' send the Kaiser and his gang to Kingdom Come!

Iodide Copper Method with Sodium Fluoride

BY A. L. REESE.*

In determining copper by the iodide method, the interference of ferric salts may be prevented by the addition of sodium fluoride. A stable compound of ferric fluoride is thus formed, so that no reaction of the ferric salts with the potassium iodide is possible. Specific details of the process.

AFTER having made several hundred determinations for copper with the following modification of the well-known "iodide method," the consistent results obtained as against the electrolytic and the permanganate methods, and the fact that I have not seen the method described in any of the American journals, lead me to take the liberty of bringing it to the notice of other chemists.

The method depends on the action of sodium fluoride on acid solutions of ferric salts, with the iron of which it forms a stable compound of ferric fluoride, Fe_2F_6 , preventing any subsequent reaction between these salts and potassium iodide. The affinity of fluorine for iron is so strong that if a solution of sodium fluoride be added to one containing ferrous and cupric salts the latter will be immediately reduced to the cuprous state, or if in acetate solution, cuprous oxide will be precipitated. The idea of employing sodium fluoride to prevent the reaction between ferric salts and potassium iodide occurred to the late R. Wightwick Roberts in 1898, and the process described was evolved by Arthur Fraser, a chemist in England.

The following reagents are required: A standard solution of sodium thiosulphate of such strength, for convenience, that 1 c.c. will equal 10 mg. of copper; a solution of sodium acetate (about one of salt to five of water) and just acid with acetic acid; a solution of sodium fluoride, about 45 grams to a liter of water. The method is as follows:

Weigh one gram of ore and transfer to a No. 3 beaker, digest with 7 c.c. of nitric acid until action becomes quiet, add 5 c.c. of hydrochloric acid and a slight excess of sulphuric acid, in order to convert all the bases to sulphates. Evaporate on the hot-plate until most of the free sulphuric acid is removed. Cool, add about 25 c.c. water and boil until the sulphates are in solution. Cool, add enough sodium acetate solution to neutralize the excess of sulphuric acid, when the solution will become red, due to the formation of iron acetate. Then add enough sodium fluoride (a slight excess does no harm and is better than not enough) to discharge the red color. The iron will then be combined with the fluorine to form Fe_2F_6 , which will prevent any subsequent reaction between ferric salts and potassium iodide.

Keep the volume of the solution to about 100 c.c., add about three grams of potassium iodide and titrate the liberated iodine in the usual manner with a standard solution of thiosulphate, using starch as an indicator. Observe all the necessary precautions used in the regular iodide method, particularly to keep the volume to

about 100 c.c., especially in low-grade ores, and titrate to get the end reaction and not simply to discharge the blue color.

In ores with a dark gangue or those heavily oxidized, the end reaction may be slightly obscure. A little experience, however, will soon teach the operator to distinguish between this and the regular end-point; or the difficulty may be removed by filtering off the gangue. In case of over-titration the end-point may be reached by titrating back to blue color with potassium permanganate, observing the amount, and again titrating with thiosulphate, having determined the value of the permanganate in terms of the thiosulphate solution.

In ores containing lead or bismuth, starch should be added occasionally during titration, as the yellow color due to the former and the brownish color due to the latter may be erroneously attributed to free iodine; otherwise bismuth seems to have no effect on the results.

With low-grade ores of 1 or 2% copper, the reaction with potassium iodide is often slow, especially when the presence of a large quantity of iron has led to the addition of an excess of sodium acetate, and the blue starch-iodide color keeps returning in a disconcerting manner. Thiosulphate must be added, however, until the blue color remains permanently discharged.

With sulphide ores containing much antimony or arsenic, a slight variation in the process is necessary, as the antimonious and arsenious acids are likely to be partly reduced during drying by unoxidized sulphur and, by reacting subsequently with the liberated iodine, may cause an apparent shortage in the copper contents. It is well, therefore, with such ores, after evaporating to dryness and driving off the residual sulphur, to evaporate a second time with the three acids. Then, after dissolving in water and before adding sodium acetate, a solution of potassium permanganate of a known value in terms of thiosulphate is added, drop by drop, until the last drop permanently changes the green color to a grayish violet. If the oxidation by the nitric acid has already been complete, one drop of permanganate will be sufficient. Then proceed as before, deducting 0.02% from the thiosulphate reading; or just destroy the violet and bring back the green color with a delicate solution of ferrous sulphate, and make no deduction.

In making up the solution of sodium acetate and that of sodium fluoride, I have found it best to make them concentrated almost to point of saturation. In evaporating in such large beakers, the usual precaution is necessary of finishing up on a low heat, until the "spitting period" is over, when evaporation may be made to dense white fumes without further trouble.

This method combines speed with accuracy by eliminating the great amount of manipulation necessary in other methods, as the ore is weighed into a beaker and remains there until contents are washed down the sink. It also furnishes the operator with an excellent method for controls. On account of the prohibitive price of platinum, the method is convenient for the small laboratory. It will save both time and labor for the large laboratory by yielding results that will check with the electrolytic method, with proper care and skill.

*Chief Chemist, United Verde Copper Co., Clarkdale, Ariz.

Mineral Production of Queensland

From the official report of the Queensland Under Secretary for Mines, published in the *Queensland Government Mining Journal*, it is noted that in 1917 the value of the mineral output was £4,012,977, a decrease of £8029 from the preceding year. Weather conditions and market prices were favorable, but other factors, such as scarcity of labor in the more remote districts, industrial disputes, and high costs, were responsible for failure to make a larger production. A satisfactory feature of the 1917 record is the substantial increase in the coal output, attributed to an improvement in trade generally.

The total gold production of 1917 amounted to 179,305 fine oz., compared with 215,162 fine oz. in 1916. Silver production was 241,639 oz. in 1917, and 243,084 oz. in 1916.

The production of other minerals and metals in 1917 was as follows, in long tons, the figures for 1916 being added in parentheses: Tin, 1177 (1707); lead, 480 (615); copper, 19,062 (19,520); wolfram, 353 (370); manganese, 21 (643); bismuth, 4 (4); bismuth-wolfram ore, 131 (137); molybdenite, 111 (81); antimony, none reported (193); scheelite, 9 (none); arsenical pyrites, 32 (none); fluorspar, 71 (none) chromic iron ore, 756 (none).

The production of non-metallic minerals was, in long tons: Coal, 1,048,473 (907,727); limestone for flux, 135,703 (142,018); ironstone for flux, 25,065 (44,161); fireclay, 10,602 (8708). Gems, including opals, were produced in 1917 valued at £14,308 (£15,233).

Dividends paid by the mining companies of Queensland were £366,098 (\$1,781,616), which was a decrease of £74,399 (\$362,063) from the amount for the preceding year. The total number of persons employed in the industry, including those in mills and other works connected with mining operations, was 11,157, which is a few hundred less than the number employed in the previous year.

Only 12 fatal and 64 non-fatal accidents were recorded during 1917. The death rate per 1000 persons employed in metalliferous mines was 0.70; in coal mines, 1.79; in all mines, mills, and metallurgical works, 1.07.

Sixteen new mines were opened during the year, and eight that had been closed down for extended periods were reopened; 12 discontinued operations.

Many improvements in the distribution of air were made in the more active metal mines, and in the collieries the quantity of circulating air was increased by the available appliances, or by the introduction of auxiliary fans.

Union Sulphur Co. Offers Use of Patents to Freeport Company

The recent decision of the U. S. District Court in Delaware in favor of the Union Sulphur Co., and against the Freeport Sulphur Co., for alleged violation of patents of the former, gave rise to a report that curtailment of the sulphur output was threatened and that the Government would commandeer the mines of both companies. The facts in the case, as related by Henry Whiton, president of the Union Sulphur Co., are briefly as follows:

After the court had rendered decision in favor of the Union company, the latter, owing to needs of the Government for all available sulphur, petitioned the court not to issue a restraining order against the Freeport company for the duration of the war, so that the supply of sulphur might not be reduced. The Union company offered the use of its patents to the Freeport concern for the duration of the war, with the consent of the court, preferring to take its chances for royalties later rather than impede necessary production of sulphur. However, the Union company's claim for royalties on patents belonging to it and alleged to have been used by the Freeport company is still maintained, and, under decision of the District Court, the Freeport company is enjoined from distribution of dividends or dissipation of assets until final decision is reached in the U. S. Court of Appeals.

At a meeting of the sulphur section of the War Industries Board recently, the Union company offered to place its plant at the disposal of the Government, but the general opinion that prevailed was that, in event of the Government taking over direction of the output, it would probably be done in the same manner as with steel companies; that is, the company would continue its operation as before, but the War Industries Board would direct shipments of all the sulphur produced.

Swedish Iron and Iron-Ore Exports

The export of pig iron and partly manufactured iron from Sweden during the first three months of 1918, according to *Commerce Reports*, aggregated 90,000 metric tons, a reduction of 7700 tons, or 8%, from the total for the corresponding period of 1917.

The following table shows the various kinds of iron exported and comparison of exports of the first quarter of 1917:

SWEDISH IRON EXPORTS—JAN. TO MAR. 1918 (INCLUSIVE), IN TONS

Articles	Jan.-Feb.-Mar.	
	1917	1918
Pig iron	41,400	43,400
Ferrosilicon	4,400	4,500
Iron sponge	800	1,100
Scrap	300	.....
Bar iron	900	1,000
Ingots	1,900	1,200
Blooms	1,200	500
Rough bars	5,700	6,600
Billets	1,800	3,800
Heavy tubes	1,400	1,100
Bar iron, hammered	2,400	2,100
Hot-rolled iron	21,800	11,800
Cold-rolled or cold-drawn iron	2,000	1,700
Rolled iron	3,500	6,100
Sheet iron	1,700	1,400
Pipes:		
Hollow	1,500	1,900
Cold-drawn	300	300
Others	800	400
Wire, iron	1,900	1,400
Spikes	1,100	100
Horseshoe nails	1,800	500
Total	98,600	90,900

The export of iron ore for the same period aggregated 347,000 tons, as compared with 803,000 tons for the corresponding quarter of 1917, a reduction of 456,000 tons. Iron-ore shipments were to Germany.

Employer's Duty in Reconstructing the Crippled Soldier*

We must count on the return from the front of thousands of crippled soldiers. We must plan to give them on their return the best possible chance for the future. Dependence cannot be placed on monetary compensation in the form of a pension, for in the past the pension system has proved a distinct failure in so far as constructive ends are involved. The only compensation of real value for physical disability is rehabilitation for self-support. Occupation is, further, the only means for making the man happy and contented. The injuries of many soldiers disqualify them from pursuing again their former employment. The schools of training prepare these men for some work in which their physical handicap will not materially interfere with their production.

The education of the adult is made up largely of his working experience. The groundwork of training in his past occupation must under no circumstances be abandoned. The new trade must be related to the former one, or be, perhaps, an extension or specialization of it. For example, a man who had done manual work in the building trades may by instruction in architectural drafting and the interpretation of plans be fitted for a foreman's job, in which the lack of an arm would not prove a serious handicap. A trainman who had lost a leg might wisely be prepared as a telegrapher, so that he could go back to railroad work, with the practice of which he is already familiar.

Whatever training is given must be thorough, for an adult cannot be sent out to employment on the same basis as a boy apprentice. He must be adequately prepared for the work he is to undertake.

The one-armed soldier is now equipped with working appliances which have supplanted the old familiar artificial limb. They are designed with a practical aim only in view; they vary according to the trade in which the individual is to engage. For example, the appliance for a machinist would be entirely different from that with which a wood turner would be provided. Some appliances have attached to the stump a chuck in which various tools or hooks can interchangeably be held. The wearer uses these devices only while at work; for evenings and holidays he is provided with a "dress arm" which is made in imitation of the lost natural member.

An important factor in the success of reëducational work is an early start, so that the disabled man shall have no chance to go out unemployed into the community. In even a short period of exposure to the sentimental sympathy of family and friends, his "will to work" may be so broken down that it becomes difficult again to restore him to a stand of independence and ambition. For this reason, therefore, the plan for his future is made at as early a date as his physical condition admits, and training is actually under way before the patient is out of the hospital.

In the readjustment of the crippled soldier to civilian life, his placement in employment is a matter of the greatest moment. In this field the employer has a

definite responsibility. But the duty is not entirely obvious. It is, on the contrary, almost diametrically opposite to what one might superficially infer it to be. The duty is not to "take care of," from patriotic motives, a given number of disabled men, finding for them any odd jobs which are available, and putting the ex-soldiers in them without much regard to whether they can earn the wages paid or not. Such a procedure cannot have other than pernicious results. In the first years of war the spirit of patriotism runs high, but experience has shown that men placed on this basis alone find themselves out of a job after the war has been over several years, or, in fact, after it has been in progress for a considerable time.

A second weakness in this method is that a man who is patronized by giving him a charity job comes to expect as a right such semi-gratuitous support. Such a situation breaks down rather than builds up character, and makes the man progressively a weaker rather than a stronger member of the community. We must not do our returned men such injury.

The third difficulty is that such a system does not take into account the man's future. Casual placement means employment either in a makeshift job as watchman or elevator operator—such as we should certainly not offer our disabled men except as a last resort—or in a job beyond the man, one in which, on the cold-blooded considerations of product and wages, he cannot hold his own. Jobs of the first type have for the worker a future of monotony and discouragement. Jobs of the second type are frequently disastrous, for in them a man, instead of becoming steadily more competent and building up confidence in himself, stands still as regards improvement and loses confidence every day. When he is dropped or goes to some other employment, the job will have had for him no permanent benefit.

The positive aspect of the employer's duty is to find for the disabled man a constructive job which he can hold on the basis of competency alone. In such a job he can be self-respecting, be happy, and look forward to a future. This is the definite patriotic duty. It is not so easy of execution as telling a superintendent to take care of four men, but there is infinitely more satisfaction to the employer in the results, and infinitely greater advantage to the employee. And it is entirely practical, even in dealing with seriously disabled men.

A cripple is debarred by his disability from performing only certain operations. In the operations which he can perform, the disabled man will be just as efficient as his non-handicapped colleague, or more so. In the multiplicity of modern industrial processes it is entirely possible to find jobs not requiring the operations from which any given type of cripples are debarred. For such jobs as they can fill, the cripple should be given preference.

The industrial cripple should be considered as well as the military cripple, for in these days of national demand for the greatest possible output there should not be left idle any men who can be made into productive workers.

With thoughtful placement effort, many men can be employed directly on the basis of their past experience. With the disabled soldiers who profit by the training facilities the Government will provide, the task should be even easier.

*By Douglas C. McMurtrie, Director of the Red Cross Institute for Crippled and Disabled Men, New York.

This, then, constitutes the charge of patriotic duty upon the employer: To study the jobs under his jurisdiction to determine what ones might be satisfactorily held by cripples. To give the cripples preference for these jobs. To consider thoughtfully the applications of disabled men for employment, bearing in mind the importance of utilizing to as great an extent as possible labor which would otherwise be unproductive. To do the returned soldier the honor of offering him real employment rather than a charity job.

Repairing and Oiling Mine Cars

By B. T. C.

It is customary at most mines, when a mine car is in need of repairs, to send a mechanic and his helper underground from the machine shop to do the work. Almost invariably these men will stretch such a job into at least half a day, and if possible a full shift will be used up, no matter how trivial the repair may be. If the repair is more than can be made underground, the men will have the car brought to the surface, where it may lie around for some time before it can be attended to. Often mechanics are not available when wanted underground, and a delay is thus caused through having the mucker make what repairs he can to keep a car in operation, or in looking for another car to take its place. Repairs made by laborers often do a car more harm than good, as they are generally made with a bar or a double jack, and when the car finally comes to the surface there are numerous bolts and rivets to be replaced and parts of the body to be straightened. Usually the men will oil their own cars, using whatever oil is most convenient, whether it be a high-grade machine oil, a heavy grease or a common black oil, and whenever a car begins to run hard, regardless of the real cause, they will resort to more oil as a remedy.

During the first six months of 1917, at a mine moving 500,000 tons of ore and waste a year, which was trammed by between 150 and 200 shovelers, hand trammers, mule drivers and storage battery handy men, requiring about 230 mine cars, this manner of repairing and oiling cars was rather closely observed. It was estimated that not less than \$3000 per year was being wasted through time lost by the men in fixing their own cars and in looking for cars in good condition when something happened to the ones they were using. It was also evident that a more systematic method of oiling and repairing by a special man would do a great deal toward decreasing the upkeep cost.

The following costs were obtained during this period, January to June, 1917: Total cost of oils, \$152.94 of car repairs, \$1191.33; cost per "ton 1000 ft." of oils \$0.00017; of car repairs \$0.0012. The number of "ton 1000 ft." per car was 4260.

REPAIR MEN ASSIGNED TO LOOK AFTER CARS

During the second half of 1917, a mechanic and one helper were put on the mine payroll, solely for the purpose of oiling and repairing cars. These men made daily inspection of the cars underground, attending to those needing it. Whenever a car was noticed in bad condition, the repair men were notified, and one or both would leave their regular runs to attend to it.

On the various levels, space was provided for making repairs of a more serious nature. When a car was badly damaged, it was left at these places and promptly looked after by the mechanics. If any forge work were necessary, the car was taken to the surface, where a separate shop was provided especially for this work.

Enough spare cars were kept on each level, in conveniently situated though unused places, so that if one were broken another was immediately available. Spare chains, car hooks, grease caps for roller bearings, bolts, etc., were kept on hand. All parts subject to repeated damage, such as car hooks, were bolted instead of riveted on, permitting more rapid repair. At times when only minor repairs were necessary, the mechanic and his helper would inspect every four days and keep in good condition all of the 250 mine cars in use. Each car was inspected at least once every 10 days.

PROPER LUBRICATION OF ROLLER BEARINGS STUDIED

The question of car oiling was rather carefully investigated at this time. All mine cars are equipped with roller bearings, which reduce car resistance to about half of that required for plain bearings. The use of this type of bearing has permitted an increase in the size of cars used in mule haulage from 30-to 40-cu.ft. capacity, and the length of train from six to seven cars. To operate roller bearings to the best advantage, it is necessary to have the bearings full of lubricant at all times, the rollers floating in grease. If this is not done, the resistance is as great as if not greater than with well-oiled plain bearings. Several oils and greases ranging in price from 6 to 15c per lb. were tried out in the bearings, with the following results:

With oils, there was a constant leakage around the wheel, and the oil would not remain in the bearings long enough to lose its lubricating qualities.

Greases of ordinary consistency were too thick and would ball up in the axles. There was not enough heat generated in the bearings to cause them to become soft and run into the roller bearings.

Mixtures of oil and grease in various proportions did not seem to have the desired lubricating qualities, and when made soft enough to be forced into the bearings with a grease gun, they tended to run out, as did the oil alone.

Samples of non-fluid oils or transmission grease of the consistency of soft vaseline were finally tried out, and were entirely successful. These greases are of moderate price, about 12c. per lb., and can be readily injected with a hand-operated grease gun. They will not run out of the bearings, although they flow freely to all parts. It has been found unnecessary to oil mine cars with these greases more than once a month, and in many cases once in six weeks is sufficient, and then only a small quantity is required (0.62 lb. per axle).

CAR DUTY INCREASED UNDER NEW SYSTEM

The following costs were obtained during this period, July to December, 1917: Total cost of oils, \$364.07; of car repairs, \$2666.22; cost per "ton 1000 ft." of oils \$0.00015; of car repairs, \$0.001. The number of "ton 1000 ft." per car was 9952.

For a full year's operation these figures represent a saving in expense of \$100 for oil, and \$1000 on car re-

pairs, besides the estimated saving through having all the cars in use, and in good running condition all of the time, of not less than \$3000. This is a yearly total of \$4100, or a saving of \$0.008 per ton on all ore and waste moved. These figures were obtained while this system of car repairing was being installed, and now that it is in full operation and working smoothly, it is estimated that \$500 per year can be saved on oil, \$1500 on car repairs and \$3000 in time, making a total of \$5000 a year, or \$0.01 per ton of ore and waste moved.

The following tables give monthly car repair costs and unit costs as the work was performed underground:

TABLE I. MONTHLY REPAIR COST PER CAR FOR DIFFERENT CAR TYPES AND KIND OF SERVICE

Type of Car	Repairs per Car		Oiling per Car		Character of Service
	Labor	Supply	Labor	Supply	
Timber trucks	\$0.10	\$0.122	\$0.10	\$0.06	Very light
40-cu. ft. side dump	1.19	.44	.23	.14	Heavy mule and electric
35-cu. ft. side dump	1.09	.12	.38	.13	Heavy mule and electric
30-cu. ft. side dump	.98	.52	.19	.09	Heavy mule and electric
30-cu. ft. end dump	.39	.11	.0	.02	Light mule and hand tramping
Small end dump	.15	.08	.10	.03	Hand tramping

TABLE II. UNIT COST OF REPAIRING AND OILING CARS

Type of Car	Kind of Repair	Time		Labor	Supplies
		Hours	Minutes		
Timber trucks	Car inspection		9	\$0.14	
	Oiling		15	.252	\$0.122
	Hooks on cars	1	30	1.62	.47
	Putting on roller bearings	2	0	2.00	34.07
40-cu. ft. side dump	Car inspection		8	.14	
	Oiling		19	.283	.14
	Changing car hooks	2	42	3.84	1.71
	Repairs to car door	1	26	1.69	.02
35-cu. ft. side dump	Car inspection		8	.15	
	Oiling		18	.288	.14
	Changing car hooks	2	41	2.91	1.14
	Repairs to car door	1	2	1.09	
30-cu. ft. side dump	Car inspection		6	.10	
	Oiling		23	.394	.14
	Changing car hooks	3	2	3.03	1.49
	Repairs to door	1	20	1.36	
30-cu. ft. end dump	Car inspection		9	.28	
	Oiling		19	.35	.14
	Changing car hooks	5	36	5.87	1.66
	Door repairs		50	1.22	
Small end dump	Car inspection		9	.16	
	Oiling		18	.29	.14
	Repairs to car door	1	22	1.47	.02
	Car body hinges	4		4.08	.06

South Africa's Mineral Production in February

The Union of South Africa in February, 1918, produced 660,210 fine oz. of gold, valued at \$13,647,593, and of this the Transvaal contributed the entire output, according to *Commerce Reports*. However, as compared with the month of November, the Transvaal's yield of gold decreased by 113,750 fine oz., carrying a monetary valuation equivalent to \$1,317,824. The coal production of the Union amounted to 769,923 tons (2000 lb.), or 71,639 tons less than for January; and the output of the Transvaal and Orange Free State amounted to 486,383 and 63,865 tons, respectively. Of the 182 tons of tin mined in the Union, the Transvaal is credited with the whole output; and again this was also true of the 275 tons of copper produced in the Union. Asbestos was produced in the Union to the extent of 520 tons; and the Transvaal's output was 182 tons. The value of the gold output on the Witwatersrand amounted to \$13,179,596, to which \$458,658 must be added in order to complete the figures for the entire Transvaal Province. The working profits of the mines on the Witwatersrand and outside districts amounted to \$2,809,898 and \$101,574, respectively.

There were 1,976,457 tons of ore milled in the Transvaal. This is, however, a decrease of 226,649 tons, as

compared with the preceding month. Taken per ton, the working costs averaged 21s. 8d. (\$5.27) for February, which shows an appreciable increase when compared with 19s. 7d. (\$4.77) for October, 19s. 11d. (\$4.85) for November, 20s. (\$4.87) for December, and 20s. 8d. (\$5.03) for January.

Laborers employed upon all of the mines of the Union of South Africa totaled 268,619, and of this number 223,988 were engaged in the Transvaal.

The analysis of the mineral production by the Transvaal Chamber of Mines contains the statement that the operations of the gold mines for the month of February were seriously handicapped by floods caused by the abnormal rainfall. However, notwithstanding adverse effect of water in some of the mines, and the consequent damage resulting therefrom, the fact that there were 500 stamps less in operation is partly responsible for the decreased production of gold.

Mining in Algeria

According to a recent supplement to *Commerce Reports*, mining in Algeria, a country of rich mineral resources, especially in iron and phosphates, has suffered from labor shortage, transportation difficulties, and loss of markets. No figures of production are given, but the following data regarding exports reveal the extent of mining developments.

MINERAL EXPORTS FROM ALGERIA IN 1915 AND 1916

	(In metric tons)	
	1915	1916
Antimony ore	9,022	28,473
Copper ore		1,098
Iron ore	818,705	938,684
Lead ore	15,046	23,731
Zinc ore	16,796	28,973
Natural phosphates	225,891	380,211
Sea salt	1,875	3,910

In 1916, 32 metric tons of mercury was exported, none being shipped in the preceding year.

Building-Construction Data

The number of carpenter and labor hours necessary to complete each stage of construction of a 200-man barracks at Camp Meade, Maryland, is given as follows by N. B. Garver in the *Journal* of the Western Society of Engineers, together with the lumber required: Foundation posts: carpenters 20, laborers 60 hours, lumber 1000 bd.ft.; framing complete: carpenters 375, laborers 72 hours, lumber 20,700 bd.ft.; sub-floors and roof: carpenters 390, laborers 50 hours, lumber 19,400 bd.ft.; trim: carpenters 530, laborers 85 hours, lumber 25,000 bd.ft.; outside sheathing: carpenters 450, laborers 40 hours, lumber 5900 bd.ft.; undersheathing and ladders: carpenters 60, laborers 15 hours, lumber 2000 bd.ft. Total hours on lumber erection: carpenters 1825, laborers 422. Total lumber erected, 74,000 bd.ft. Lumber erected per carpenter per day, 407 bd.ft. Carpenters received 62½c. per hour and laborers 30c. Most of the men employed were ordinary workmen, and many had little or no knowledge of their "trade." Economy was disregarded.

Production of Nitrate in Chile in 1917 was 65,100,000 quintals of 11.4 lb. each, according to the *London Economist*. Of this 60,800,000 quintals was exported.

Correspondence and Discussion

American Red Cross Care Committee for American Soldiers

The American Committee of Engineers in London has received a request from the American Red Cross Care Committee for American Soldiers, whose address is 154 New Bond St., London W., for copies of American technical magazines, for the use of American hospitals in England, France, and other European countries where such are established. Although many London offices receive regularly the American mining, electrical, railway, mechanical, excavating, and other technical periodicals, there is no regular system of distribution by which such publications can reach wounded officers and soldiers of the American Army.

We therefore beg that you will publish this letter in your columns, together with the request that any individuals or companies having spare copies not needed for their files forward the same either directly, or through the medium of the local Red Cross, to Mrs. Miller, American Red Cross Care Committee, 154 New Bond Street, London, W. C. W. PURINGTON,
Honorary Chairman, American Committee of Engineers in London.
London, May 14, 1918

The Price for Manganese Ore

In the *Journal* of June 8, there was an article criticizing the Administration about "fixing the price for manganese ore." The fact of the matter is that the price for manganese ore is not fixed, but, in order to stimulate the production of domestic ore and to assist the country in the present crisis, the War Industries Board requested the American Iron and Steel Institute to hold a meeting of all the important manganese ore buyers in the United States, get their views on what could best be done to help the situation and to agree upon a uniform schedule, so that the producer would know exactly the value of his product and would not be obliged to shop around from one buyer to the other, endeavoring to get the highest-priced business.

These meetings were held in the office of the Steel Corporation and were presided over by Mr. Kerr, the vice president of that concern. The consensus of opinion of every one was that the thing to do was to raise the prices sharply, eliminate penalties for iron, allow a premium for low silica, and penalize for high silica just as moderately as possible. It was also decided to make uniform terms and for every one to pay 80% of the value of the ore against bill of lading, and not endeavor, as we had all been doing, to induce the buyer to ship on open account without any advances against bill of lading.

The *Journal* states in its articles that the prices fixed were about the current market prices. In this it was

certainly very much misinformed. Take, for example, the grade of 40% domestic manganese ore. The old Carnegie schedule for 40% to 40.99% was 92c. f.o.b. Pittsburgh; Seaboard Steel and Manganese Corporation was 76c. f.o.b. Chicago; E. E. Marshall was 90c. f.o.b. his Eastern furnaces; Bethlehem was \$1 f.o.b. Lebanon; Miami, 83c. f.o.b. Chicago, and E. J. Lavino & Co. 90c. delivered at its Pennsylvania and Virginia furnaces, and at Anniston, Alabama.

The new schedule price for 40% to 40.99% manganese is \$1.02 per unit, f.o.b. South Chicago, or about
19c. higher than Miami,
16c. higher than Bethlehem,
26c. higher than E. E. Marshall and E. J. Lavino & Co.
26c. higher than Seaboard,
18c. higher than Carnegie.

Under the circumstances, we cannot help but feel that a correction printed in the *Journal* would be acceptable, as no one is working harder for the cause at the present time than the American Iron and Steel Institute.

New York, June 11, 1918. FERROMANGANESE.

Fine Grinding and Porous-Briquetting of Zinc Charges

Regarding the subject of briquetting and Messrs. Sulman & Picard's letter in the May 11 issue of the *Journal*, it is a misnomer to refer to any briquetting work I have done or propose regarding zinc distillation as "porous," for I find 3000 to 5000 lb. pressure to the sq.in. desirable, and briquet an almost anhydrous mixture. If I did otherwise the briquets would burst in baking at red heat because of escaping moisture, and it would be impossible to handle pulverized caustic lime, as I do without hydration. Woolsey McA. Johnson has described a porous-briquet method, and probably Messrs. Sulman & Picard make a porous briquet, using direct steam in the liquefying of pitch and heating or warming the mass prior to pressing, as is usual. It is best to have a clear understanding of the different methods of briquetting, and the word porous hardly applies to the form I recommend.

I can think of no situation in metallurgy where the porous briquet is as advantageous as a hard, dense substance formed without cellular structure, and not allowed to swell or expand from escaping gas or vapor. The exception might be in blast-furnace practice, where all the fuel of the charge is in the briquet, no extraneous coke being used; but because a briquet cannot be practically made that is as solid or inert as anthracite, I doubt the necessity of porosity for the purpose of giving combustion surface in blast-furnace work. If such is desired, put in hay or fiber, which burns out, producing channels, but leaving the mass hard and compact.

The dense briquet occupies less space, is less friable, conducts heat better, heats more quickly, and uses a less

proportion of binder, if the grinding is graduated in mass, say from 50 to 200 mesh, which may define the usual fine-grinding. Briquetting all fine or gritless material is as much a mistake as briquetting all coarse sizes would be.

I recall reading a patent issued to Picard on briquetting, but I was ignorant of the paper or any results obtained pertaining thereto, and of Mr. Hoover's article, as referred to by Messrs. Sulman & Picard. I should have noticed Mr. Ingalls' allusion in his "Metallurgy of Zinc," but did not recall it, and accept the correction of Messrs. Sulman & Picard that they and not Mr. Johnson made the first public statement regarding fine-grinding in contact briquetting.

Briquetting in almost any form will bring results better in every respect than loose-mixture charging in zinc retorts, but the expense and convenience of the act must be considered with the degree of economic efficiency attained, which appears to be much in favor of the hard and anhydrous-pressing fine-grinding process with minimum voids, and thus minimum use of pitch or other binder. It seems to me that the type of press used plays an important economic part, as the plunger types are slow and wear excessively, and the usual Belgian wheel is inadequate in pressure, giving around 1000 lb. per sq.in. effective pressure. I used a new type of rolling press, with no plunger action, that showed a pressure at least three times greater than the Belgian wheel form.

Messrs. Sulman & Picard and myself agree as to results in an academic sense, and as to the practical necessities, but the effects I obtained required a materially different series of acts and apparatus and yielded intensified results over those possible under the Picard patent. I would compare the art of briquetting with that of flotation, as being academically established, but requiring further economic development to warrant commercial practice.

Flotation is here to stay and involves an immense economic advance in metallurgy, but it has its accompanying train of evils, as it upsets badly the mechanical hearth roasting or desulphurizing practice in all ores which formerly required that process; and as the flotation concentrates are almost impossible to sinter on grates like the Dwight & Lloyd, and absolutely impossible in Huntington & Heberlein pots, the preparation for blast-furnace smelting is serious. I know of one American smelter who is almost ready to shut down because about all his custom stock is flotation slimes; yet a proper briquet would enable this smelter to desulphurize. Of course the issue involved is that flotation slimes are so fine that the dust nuisance becomes prohibitive. As flotation is on the increase, are not American smelters forced to adopt briquetting of slimes to meet the issue?

The kind of a briquet used in roasting reactions is not the same as that used in blast-furnace smelting, it is admitted, as the binder for desulphurizing should carry no carbon if acid making is to be practiced.

With efficient apparatus and practice, the costs of briquetting will disappear in the economies consequent thereto, and flotation slime will be a desirable product, because from it can be prepared a briquet of artificial composition that will be better than a mixture of lump ore, fuel and fluxes. This will hold true in smelting

and desulphurizing as well as in zinc retorting, which latter process cannot exist much longer unless charges are briquetted.

The subject, as I see it, is large. The germ is in embryotic form, and can blossom only through the culture of research, as did flotation.

I thank Messrs. Sulman & Picard for their attention.

PARKER C. CHOATE,
Research Metallurgist.

Essex, Mass., May 19, 1918.

Tungsten Occurring in Manganese Oxide

The note of Prof. W. S. Palmer in the *Journal* of Apr. 27, announcing the occurrence of tungstic oxide in manganese dioxide (psilomelane) from three distinct localities in Nevada, is of interest as probably being the first published statement of such an association.

Awhile ago I had occasion to examine a specimen of psilomelane which also yielded a small amount of tungstic oxide. As was the case with Professor Palmer, I then made a search of the lists of analyses in Dana's "System" and such other literature as was available, but could find no mention of the occurrence of tungsten in manganese oxides. To preclude the chance of contamination, a new sample was secured, which was found to contain approximately 1% WO₃; barium was also found in fairly large proportion and but little iron.

This psilomelane came from a considerable depth in the Homestake mine, in South Dakota, where the black oxide of manganese is occasionally found filling comparatively small fissures in a body of rhyolite. It occurs in a spongy or cellular form, some of the cavities containing more or less black powder. Hand panning tests, as with the Nevada material, showed no visible concentration of tungsten mineral. The wolframite ore, mined in the neighborhood, is found only comparatively near the surface, in the Cambrian or "flat formation," which rests unconformably on the nearly vertical schists. In this wolframite the manganese occurs in much smaller percentage than the iron, the ratio Mn:Fe in the concentrates averaging something like 1 to 4, or 1 to 5.

A specimen of pyrolusite, mined a few miles away, showed no trace of tungsten.

W. J. SHARWOOD.

Lead, S. D., June 4, 1918.

Platinum in New South Wales

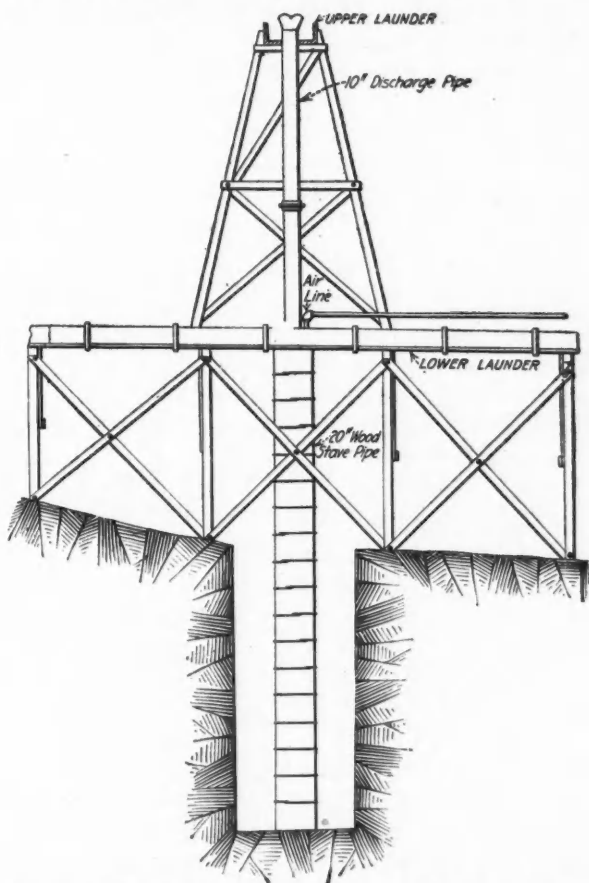
Platinum occurring as alluvia in a placer deposit at Fifield, New South Wales, has been reported by the Geological Survey of that state, according to the *Chem. Tr. Journ. and Chem. Engr.* The platiniferous wash consists mainly of sandy clay in which are embedded small rounded and angular pieces of quartz, and occasional pebbles and boulders of white quartz, most of which are only partly waterworn. Over 400 loads of wash dirt from 10 claims have been treated in a puddling machine for an average yield of 4 dwt. platinum and $\frac{1}{2}$ dwt. gold to the load. As much as 8 $\frac{1}{2}$ oz. platinum has been obtained from 16 loads from the prospector's claim. The results obtained in the deep ground at the northern end are not satisfactory, but sufficient prospecting has not yet been done to prove the position of the main gutter.

Details of Milling and Smelting

Air Lift for Handling Tailings

BY H. A. CAMPBELL*

Tailings from the mill of one of the largest copper companies in the Southwest are brought to a consistency of four or five parts of liquid to one of solid and allowed to flow by gravity through launders for about a mile



TAILINGS ARE ELEVATED 15 TO 30 FT. WITH AN AIR LIFT where they then have to be lifted from 15 to 30 ft. and carried over a dam into a settling pond or dump. About 7000 gal. per min. of this mixture is handled, and three 10-in. centrifugal sand pumps, direct-connected to 150-hp. motors, were previously used. This method was found to be very expensive, as the tailings were sharp and cut out the casings and impellers of the pumps very rapidly, the average life of a pump not exceeding four days of continuous operation. Large motors were necessary, as the efficiency of the pumps dropped rapidly to a low point as wear occurred.

To obviate these difficulties, an air-lift system was installed and has proved a solution of the problem. At various points in the lower launder, openings were made discharging each into a 20-in. wood-stave pipe, which was set in a pit a sufficient depth to give proper submergence and closed at the lower end. Inside of this

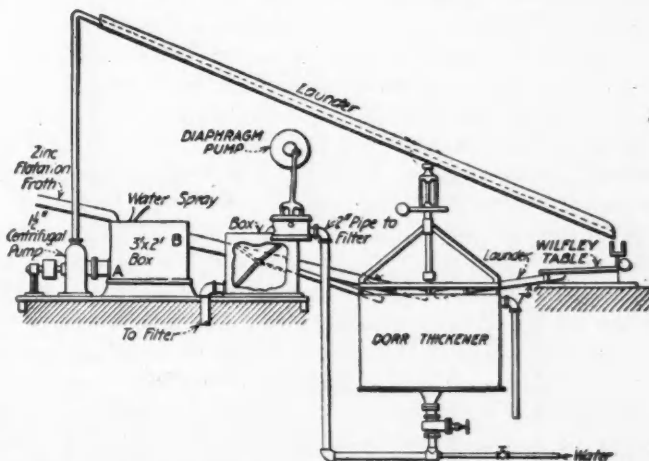
a 10-in. discharge pipe, fitted with a footpiece, is placed, through which air is introduced at the bottom and which discharges directly into the upper launder. This pipe has no bends and no obstructions inside, so very little wear can occur and renewal will be practically unnecessary. Three of these installations are able to handle the maximum tonnage. A separate compressor, driven by a 40-hp. motor, is used for each air lift, although all three could easily be handled from a central plant if local conditions made it desirable. Compressors and motors are housed and require little attention. Operating costs and repairs have been cut to a small fraction of what they were with sand pumps, and the inconvenience of frequent shut-downs is eliminated.

Treatment of Flotation Concentrates

BY ALGERNON DEL MAR*

At a mill treating a silver-lead-zinc ore the following scheme of manipulation of the zinc flotation concentrates has proved successful in breaking down the froth, in separating some lead from the zinc concentrates and in delivering the thickened zinc concentrates to the filter at the right consistency for good work:

The zinc flotation froth from the flotation machine flows down a launder to a rectangular box with two discharge openings A and B. The opening A leads to a centrifugal pump and the opening B to a Dorr thickener. B is in use automatically whenever the centrifugal pump is not in operation. The froth is fairly well broken down



LAYOUT OF APPARATUS FOR PROPOSED SYSTEM OF HANDLING FLOTATION CONCENTRATES

in the pump and the action is completed on the Wilfley table to which the pump delivers. The table separates the coarser particles of lead, which may all be smaller than —200 mesh mesh, and acts as a safety valve should there be a selective lead flotation cell preceding the zinc cells, which might possibly be out of commission. In the plant under observation there is a noticeable increase of

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lead on the Wilfley table whenever the lead cells are not in operation. The zinc concentrates from the table flow to the settling box in the Dorr thickener.

At the lip of the diaphragm pump is a box from which a launder runs to the Dorr tank and another to the filter. By turning a board back and forth, the stream of pulp may be directed to either. The advantage in this arrangement is that the pulp need only be sent to the filter when of the right consistency, for a vacuum filter will not pick up thin pulp. A very thick pulp produces a wet cake, a pulp of the consistency of molasses a fairly dry cake, and so it is possible to regulate the pulp to suit requirements. When the pump is started, the pulp is naturally thin from the addition of water in the pump for priming and at the bottom of the Dorr tank, so the stream is directed into the Dorr tank. The water is turned off, and when the pulp is of the right thickness it is sent to the filter. When the pulp becomes too thin, the pump is shut off. If for any reason the filter is not in operation, the pump may keep the pulp in circulation until it is ready, but the overflow from the Dorr thickener will naturally contain more mineral than when allowed to settle after each pumping.

There is a two-inch pipe from the diaphragm intake to the filter, ending at the level of the lower circumference of the drum. If for some reason the filter is filled with pulp to thin for effective filtering, a valve is opened and the thin pulp is pumped back to the Dorr thickener. This contrivance allows the operator to force water through the filter to clean the canvas and to get this water out of the filter without draining away valuable mineral.

Will other operators suggest practical kinks?

Formulas for Ore Sorting

BY GIBERTO LUNA*

The final result sought in ore sorting is economy in the expense of the metallurgical treatment through a cheap separation, from the mine ore, of such waste or low-grade material as can be easily distinguished by the experienced eye of the sorter, thereby reducing the weight of the ore treated and proportionately increasing its grade. As there intervene several elements, such as milling or smelting charges, grade of the discarded material, cost of sorting, etc., it becomes interesting to determine by simple mathematical formulas what the relations among those elements are, in order to ascertain whether or not sorting is advisable and to what extent it can be carried to advantage.

The fundamental reasoning at the basis of ore sorting must be that the rejected material is to be considered as a loss which is to be offset by a gain in the value of the finished product of the sorting operation. Then the saving accruing from sorting will become apparent by comparing the loss against the gain. In order to establish what the loss is, assume that, instead of sorting, the waste be allowed to go to the metallurgical operations and that it has the same grade as the average of the mine-run of ore. Let C and A , respectively, represent the grade of ore before and after sorting; B , the grade of the rejected material; N , percentage rejected of the weight of the unsorted ore;

M , milling or smelting charges, including loss in tailings; V , current price of the metal exploited; P , cost of sorting per ton of sorted ore. Then every ton of sorted ore will require for its production $\frac{1}{1 - 0.01N}$ tons of unsorted ore and will give $\frac{0.01N}{1 - 0.01N}$ tons of waste. If there were no sorting and the waste were beneficiated, there would be an apparent yield of $\frac{0.01NCV}{1 - 0.01N} - \frac{0.01NM}{1 - 0.01N}$ coming from the waste supposed to have a grade C . This amount is lost by rejecting $\frac{0.01N}{1 - 0.01N}$ tons of waste per ton of sorted ore, and it is this loss which must be overbalanced by the rise in value of the sorted material. This rise is per ton of sorted ore $(A - C)V - P$.

If now this gain is measured against the loss, then:

$$((A - C)V - P) - \left(\frac{0.01CVN}{1 - 0.01N} - \frac{0.01NM}{1 - 0.01N} \right) = \text{saving in sorting} \quad (1)$$

per ton of sorted ore. The following relations hold:

$$A + \left(\frac{1}{1 - 0.01N} - 1 \right) B = \frac{C}{1 - 0.01N}$$

whence

$$A(1 - 0.01N) + 0.01NB = C$$

and

$$A - C = 0.01N(A - B)$$

then formula (1) becomes

$$\frac{0.01(M - BV)N}{1 - 0.01N} - P = \text{saving of sorting} \quad (2)$$

per ton of sorted ore.

This formula has been worked out on the assumption that M remains constant whatever the tonnage, which is the most common case and occurs when the ore is shipped or the mine output is large enough to keep the mill supplied to its capacity in spite of the reduction from waste rejection in sorting. With the small operator this frequently is not the case, and if the amount of ore treated were reduced by the sorting, the mill cost per ton would increase because of the fixed charges and the saving as calculated by the above formula would have to be reduced by the amount of that increase.

In order to figure by how much the mill cost is advanced by the reduction of tonnage treated, it should be considered as made up of two elements, one invariable and the other variable. The invariable element of the mill cost per ton is represented by those charges directly proportional to the tonnage, such as consumption of chemicals, loss in tailings, etc., and the variable element by all the fixed charges and changes inversely as the tonnage. If Y and Z represent respectively the variable and the invariable elements of the mill cost, then

$$M = Y + Z$$

As the fixed charges of the plant cannot supply an opportunity for saving, from the viewpoint of sorting, M will have to be exchanged for Z in formula (2)

resulting in $\frac{0.01N(Z - BV)}{1 - 0.01N} - P = \text{saving per ton of sorted ore}$. Which formula shows that the full advantages of sorting are derived when the milling cost remains unaffected by the reduction of tonnage consequent on waste rejection.

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Company Reports

Annual Report of Judge Mining and Smelting Co.

The report of the Judge Mining and Smelting Co., which operates a silver-lead property, having subsidiary values in zinc and copper, adjacent to the Daly West mine at Park City, Utah, shows a net profit for the year 1917 of \$58,550. Sales of ore and concentrates netted \$953,729, and sundry receipts were \$39,135; total expenses were \$934,314. Dividends aggregating \$480,000 were paid and reduced the balance on hand at the end of the year to \$133,840, in comparison with \$555,290 at the beginning of 1917. The mine output was 65,427 tons of ore, which yielded 11,736 tons of lead concentrate and 5470 tons of zinc concentrate. The metal content of these products was 585,680 oz. of silver, 531.5 oz. of gold, 7,919,720 lb. of lead, 428,000 lb. of copper and 976,406 lb. of recoverable zinc. The existence of a new ore zone was established during the year. The electrolytic zinc reduction works was placed in operation, but difficulties were experienced in obtaining chemicals, and it was not run at capacity.

Consolidated Interstate-Callahan Mining Co., Quarterly Report

The Consolidated Interstate-Callahan Co. reports for the first quarter of 1918 a net surplus of \$138,087. The cost of improvements was \$11,509, operating costs totaled \$317,307, and total net receipts, including \$5160 from miscellaneous sources, were \$466,903. The tonnage mined was 43,419, and that milled, 35,881, averaging 21.02% zinc, 6.77% lead and 2.27 oz. silver per ton.

The cost of mining was \$4.72 per ton, and of milling \$1.98 per ton, the total cost of \$6.70 showing a decrease of 60c. per ton compared with the quarter preceding. Satisfaction is expressed with the result obtained by flotation treatment of the tailings dump, which contains 250,000 tons, assaying 12% zinc, and should net the company more than a million dollars.

Nipissing Mines Co., Ltd.

The Nipissing Mines Co., Ltd., Cobalt, Canada, reports for 1917 a production of 3,798,802 oz. of silver from 2961.3 tons of its own ore, in addition to which there was a production of 1,779,631 oz. from custom ores. The gross value of its own production was \$3,756,890, and the total cost of production was \$1,057,987, leaving net receipts of \$2,698,902, or 71.84% of the gross value. After payment of \$1,935,000 in dividends, a net surplus of \$2,731,599 was carried to the balance sheet.

Ore produced amounted to 74,063 dry tons, about 80% of this coming from underground work, the remainder from dumps. Included in this figure is 1048 tons of

high-grade ore, the remaining 73,015 tons going to the low-grade mill. The high-grade ore and metallics treated averaged 1960 oz. per ton, the low-grade 31.13 oz. per ton. Owing to favorable flotation results and the rapidly increasing cost of supplies for cyanide treatment, concentrating tables were installed to precede the cyanide treatment, the resulting concentrates going to the high-grade mill. New construction, cost of supplies and higher wages contributed to increase production costs by 80c. per ton. Forty stamps ran 80.68% of the possible running time, crushing 247.94 tons per day, or 6.2 tons per stamp per day. The tables present operating and cost data for the year

TABLE I. COST OF PRODUCING SILVER AT NIPISSING MINES

	Per Ton Ore	Per Oz. Silver
Development and exploration	\$2.115	\$0.03725
Stoping	1.452	0.02556
Assaying and engineering	137	0.0241
Administration and office	545	0.00961
Surface and dwellings	103	0.0182
Insurance and taxes	1.967	0.03464
General and legal	370	0.00651
High-grade mill	714	0.1257
Low-grade mill	5.310	0.09352
Hauling dumps	075	0.0132
Shipping residue	061	0.0108
Shipping cobalt ore	002	0.0003
Depreciation	817	0.1439
Marketing product	1.320	0.02326
Corporation, N. Y. office, and traveling	235	0.00415
	\$15.223	\$0.26812
Less rents, interest, and sale of sundry supplies	963	0.1695
Total cost of production	\$14.260	\$0.25117

TABLE II. TREATMENT COSTS ON LOW-GRADE ORE AT NIPISSING MINES, 1917

	Cost per Ton
Crushing at mine	\$0.1666
Aerial tramway	0761
Surface tramway	0561
Washing plant	2567
Crushing and elevating	0720
Battery	3470
Tube mills and classifiers	9636
Treatment	1.8852
Filtering and discharging	1836
Clarifying and precipitation	3010
Refining	1166
Heating	1551
Water supply	0414
New construction	3224
Residue dam	0393
Flotation and research	3561
Consulting	0557
Total	\$5.3945

TABLE III. CONSUMPTION OF SUPPLIES AT LOW-GRADE MILL, NIPISSING MINES, 1917

	Total Pounds	Cost per Pound	Total Cost	Pounds per Ton	Cost per Ton
Sodium cyanide	338,024	\$0.327	\$108,405.46	4.629	\$1.4847
Caustic soda	61,867	039	2,423.43	0.847	0.0332
Lime	367,125	0046	1,697.09	5.029	0.0232
Aluminum ingots	10,162	554	5,637.41	0.139	0.0772
Pebbles	452,007	0108	4,905.41	6.190	0.0672
Steel balls	20,000	0489	978.00	0.0274	0.0134
Coal	2,379,240	0039	9,222.32	32.585	1.263
Borax	9,212	1062	978.40	0.126	0.0134
Sodium sulphide	105,345	0348	3,671.08	1.456	0.0503
Power			55,165.70		2.555
Fuel oil (gallons)	24,838	115	2,882.13	0.0340	0.0395
Coke	38,450	008	309.48	0.0526	0.0042
			\$196,275.91		\$2.6881

Although the cost of labor, materials and supplies increased considerably, the cost per ounce of silver produced, namely, 25.12c., was only about one cent higher than in 1916.

Barnes-King Development Co.

The report of the Barnes-King Development Co., which operates gold mines at Kendall and Marysville, Mont., shows net earnings of \$444,254 for 1917. Dividends of \$40,000 were paid, cash on hand at end of year was \$156,500, and the total profit and loss surplus was \$731,818. The production of the North Moccasin mine was 26,790 tons, assaying \$8.53 per ton; of the Kendall, 7923 tons, assaying \$2.95 per ton; of the Piegan-Gloster, 20,525 tons, assaying \$10.43, and of the Shannon 2359 tons, assaying \$15.17 per ton.

Magma Copper Co.

Magma Copper Co. reports a net production, after deducting concentrating, smelting and refining losses, of 10,148,632 lb. of copper, 537,995 oz. of silver and 5979 oz. of gold during 1917. Net cost of producing copper was 16.01c. per lb., and the average selling price was 26.423c. per lb. The financial statement is as follows:

	1917	1916	1915
Operating income.....	\$3,235,070. 57	\$2,555,935. 71	\$1,023,675. 70
Operating expense.....	2,083,947. 85	1,376,967. 65	353,128. 41
Net income.....	\$1,151,122. 72	\$1,178,968. 06	\$670,547. 29
Other income.....	11,136. 09	796. 00	338. 91
Total income.....	\$1,162,258. 81	\$1,179,764. 06	\$670,886. 20
Dividends.....	504,000. 00	480,000. 00	240,000. 00
Depreciation.....	94,272. 68	82,431. 48	59,157. 18
Balance.....	\$563,986. 13	\$617,332. 58	\$371,729. 02

Tharsis Sulphur and Copper Co., Ltd.

The annual report for 1917 of the Tharsis Sulphur and Copper Co., of Glasgow, operating three pyritic copper mines, with connecting railways, near the port of Huelva, Spain, and extensive metal works in Scotland, shows a considerable shrinkage in actual net profits as compared with the previous year, although earnings are slightly above the average for the previous three years. The net gross profits of \$1,270,930 were reduced by \$352,043 for administrative charges, taxes, etc., and by \$149,601 written off property and plant accounts, leaving an actual net of \$769,287. From this profit \$760,391 was paid as dividends. In the preceding computations British monetary units have been reduced to U. S. Currency at the standard ratio of \$4.8665 to the pound sterling.

At the Tharsis mine, preparation for renewed extraction from the Sierra Bullones lode was pushed, and 196,663 cu.m. of overburden was removed, an increase of 7525 cu.m. over the year 1916. From the north lode 108,280 cu.m. of overburden was removed, and large quantities of pyrite will soon be available. From the Calañas mine 117,700 cu.m. of overburden was removed, a decrease of 4936 cu.m. The ore extracted amounted to 402,097 tons, an increase of 12,900 tons as compared with the previous year. A labor shortage interfered with operations of the metal works, but because of improved facilities provided by the new plant, the quantity of ore treated was greater than in the previous year.

Interesting sidelights on this old mine may be gained from a table given in the report, which covers the financial statistics for its 51 years' existence from 1867 to date. A total gross profit of \$73,105,522 was appropriated as follows: Written off property and plant accounts, \$12,803,056; salaries, management, income

taxes, interest, etc., \$8,079,217; dividends paid, \$51,747,597; miscellaneous charges, \$475,652; totaling, as stated, \$73,105,522. The total dividends are 938½% of the capital, indicating average yearly earnings of about 18½% on the investment. This continuity of dividends, coupled with the fact that earnings of recent years are running at 10 to 15%, is remarkable.

Broken Hill Proprietary Co., Ltd.

The Broken Hill Proprietary Co., which operates a silver-lead-zinc mine and smeltery at Broken Hill and a steel plant at Port Waratah, New South Wales, reports for the year ended Nov. 30, 1917, as follows, British monetary units being reduced to U. S. Currency at the standard rate of \$4.8665 to the pound sterling: Profits during the first half-year were \$1,312,831 and for the second half-year \$1,415,572, totaling for the year \$2,728,403. This compared with \$1,946,532 for the previous year. The increased profits were due to large shipments of zinc concentrates and to the rise in the price of silver. Labor troubles caused a suspension of work at the mine during two months, and at the steel works productive operations were suspended for three months. Satisfaction is expressed at having placed the steel industry of Australia upon a sound and permanent basis. The total capital investment in the steel plant now amounts to \$12,563,843, of which sum \$2,096,216 was expended during the year 1917.

The results obtained from the slime flotation plant, using the Bradford process, were gratifying, the extent of the improvement over previous performances being indicated by the following facts: The zinc content of the zinc concentrates was increased from 45½% to 48¾%, and during the half-year now current the assays have increased to an average of 49½%. In the lead concentrates, the zinc assay has been reduced from 11% to less than 9%, and the lead content has increased from 56½% to 61½% and the silver from 80½ to 83¼ oz.

International Nickel Co.

The report for the fiscal year ended Mar. 31, 1918, of the International Nickel Co. shows net earnings of \$10,129,988. The company is the most important producer of nickel in the world, with mines in the Sudbury nickel-copper district of Ontario. During the year \$5,555,339 was spent in new construction: At the new refinery at Port Colborne, \$4,385,276; at the Copper Cliff plant, \$1,057,074; and at the Oxford works, \$112,989. Total earnings were \$16,181,501, from which general office expense of \$610,024 and an estimated provisional reserve for state and federal taxes of \$3,590,836 left \$11,980,641 as net income. Items of depreciation and depletion aggregated \$1,850,653, leaving net profits of \$10,129,988, as stated above. Dividends of \$8,064,984 were paid during the year.

War conditions had their effect on the company's operations, but plants were run at capacity throughout the year except as they were affected by the abnormally severe winter. The new refinery at Port Colborne, Ontario, is nearing completion. It is noted that the company's policy of expansion has resulted in preventing a serious shortage in the supply of nickel for war requirements.

Events and Economics of the War

The offensive against the Allies in Italy thus far has proved a costly failure; completely checked in the mountains, the Austrians succeeded in crossing the Piave at several points and winning part of the Montello hills; all of the ground was later recovered, the enemy being forced back across the river and suffering very heavy losses; serious disorders exist in Austria, and the entire Cabinet has resigned. A night attack by the Germans on Rheims from three quarters was completely checked. Riots against German rule are reported in Kiev, in the Ukraine. In a speech in Commons, Lord Curzon intimated that the government has abandoned its program of home rule and conscription for Ireland. Turkish troops attacked the American Consulate at Tabriz, Persia, and looted an American hospital there.

In the United States, prices of iron and steel for the third quarter were agreed upon on June 22 by the War Trade Board and the American Iron and Steel Institute and approved by the President the following day. The War Trade Board ruled on June 19 that many less essential commodities may be licensed for export. The board has also issued a new commodity list for European Holland and Denmark in which no unmanufactured metals are included. Increases in freight rates became effective on June 25.

New Plans for Coal Distribution

Plans for the distribution of coal within the various states have been formulated and put into operation by the U. S. Fuel Administration. The War Industries Board will decide what consumers shall have preference in securing coal, but the Fuel Administration has been asked to help in compiling preference lists by obtaining reports and recommendations on individual firms from the state and local fuel administrators.

The crux of the new distribution plan lies in the compilation of such lists. All consumers of coal, except domestic consumers, will be recorded under the following classifications:

(1) Railroads; (2) Army and Navy, together with other departments of the Federal Government; (3) state and county departments and institutions; (4) public utilities; (5) retail dealers; (6) manufacturing plants on War Industries Board's preference list; (7) manufacturing plants not on War Industries Board's preference list.

The first six classes will be given preference in coal shipments in cooperation with the plans of the War Industries Board. The distribution to consumers in the first two classes will be handled from Washington. Washington will also supervise shipments to a few vitally important plants.

The list of consumers entitled to preference will be obtained through a questionnaire sent to every manufacturing plant in the country using more than 500 tons of coal annually. With these lists to guide them, together with weekly reports which will be required from each plant, the state and local fuel administrators and

district representatives will give attention to building up proper stocks of coal at all essential war plants.

In order to control the distribution of coal to domestic consumers and industrial plants by retail dealers, the latter will be required to make special reports to the state fuel administrators, from which deliveries to manufacturing plants not on the preference list can be curtailed when necessary.

Under this plan, each consumer should arrange for shipments from the same source of supply as last year, if possible. If diversion of coal for the war program or if the zoning system will not permit this, the consumer should make every effort to form new connections, preferably under a contract arrangement, wherever a supply is available, before calling on the state fuel administrators for assistance. The plan is designed to fix definitely the responsibility and authority of the latter.

Price-Fixing

According to the *Boston News Bureau*, a certain eminent economist says that in our attempts to solve our war revenue problems we should have but one purpose in view—to win the war as quickly as possible. We should cast aside all sentiment, all politics, all attempts to make the burden easier for a small cohort of rich men or a large element in our population. He adds: "For one thing we should cast aside that uneconomic freak known as price-fixing. This policy might be modified to the extent that unjust boosting of prices by certain individuals should be subject to regulation. A grocer who buys butter at 40c. per lb. and sells it for \$1 is a stupid profiteer. On the other hand, an attempt to fix the price of milk at 12c. per quart involves too many correlated elements to make the attempt worthy of serious consideration.

"A general policy of price-fixing—and by this I do not mean regulatory restraint of greedy individuals—can easily lose the war for us. What we want is production of war essentials and to curtail consumption of our non-military population. High prices will stimulate production and they will curtail consumption by non-combatants better than the appeals of Hoover backed by the country's entire press. Cruel as it may sound, I do not think price-fixing should be applied to any commodity, so far as the general range of price is concerned. It is only when prices are boosted out of line with the general range that a severe curb should be put on individual greed. Next year if we wish to have a wheat crop of a billion and a quarter bushels and the curtailment of the use of wheat by non-combatants, nothing could be better than a temporary rise to \$5 per bushel. You not only would have an enormous stimulation of production, but a great surplus would be left over. Price then probably would drop to \$1.50 per bushel, for the sake of argument, and the equilibrium would be rapidly restored."

W. C. Potter for Aircraft Board

William Chapman Potter, of New York, who was nominated on June 17 by President Wilson to be a member of the Aircraft Board, has been identified with production work of one kind or other since he entered business life as a mining engineer 21 years ago. Mr. Potter is 44 years old. He was born in Chicago and was educated at the Chicago Manual Training School and the Massachusetts Institute of Technology, being graduated from the latter in 1897. After spending the first four years of his career in prospecting in the West and with various mining companies as engineer, he was appointed mining engineer for the Atchison, Topeka and Santa Fé R.R., but resigned two years later to enter an engineering firm.

In 1904 he was engaged by the Guggenheim Exploration Co. and became resident manager of the Guggenheim interests in Mexico. He gave up that position the following year to accept the post of general manager of the interests of the American Smelting and Refining Co. and the American Smelters Securities Co., both in this country and Mexico. Mr. Potter served both as a director and member of the executive committees of those companies. He became president of the Intercontinental Rubber Co. in December, 1911.

In addition to his post as vice president of the Guaranty Trust Co., Mr. Potter recently has been a director of the Allis-Chalmers Co., the Maxwell Motor Co., and the Richmond Radiator Co. He is a Republican, but never has taken an active part in politics. He is a member of the Metropolitan and the New York Athletic clubs. His home is at 177 East 71st St., New York.

Mexican Labor May Enter U. S.

Restrictions on the importation of Mexican labor to be used in certain specified occupations were removed by an order of the Secretary of Labor that became effective on June 20. The shortage in unskilled labor is said to be responsible for the order, which provides that, during the present emergency, Mexicans entering this country to engage in agricultural work, in railroad section maintenance and in lignite coal mining will be exempt from the head tax, literacy test, and contract labor provision imposed by previous rulings.

To insure the departure at the end of the emergency of such Mexicans as may thus be admitted, they will be required at the time of their admission to open a postal savings account at their port of entry. Their employers are to hold back from each man's wages 25 cents for each day's service, which will be deposited to his credit in the local postal savings bank and will be paid to him with interest when he returns to Mexico. After the amount thus withheld for each workman reaches \$100, only \$1 per month will be taken out of his pay.

Hope is expressed that the exemption may be broadened so as to include the entire mining industry as well. Owing to the importance of mining in Mexico, it is believed that many thousands of men who have had extended experience in mining operations could be secured and used to advantage in those camps where production is being lost through lack of sufficient labor.

Obtain Labor Through Federal Bureau, President Urges

The President has issued the following statement:

For more than a year it has been our pride that not our armies and navies only but our whole people is engaged in a righteous war. We have said repeatedly that industry plays as essential and honorable a role in this great struggle as do our military armaments. We all recognize the truth of this, but we must also see its necessary implications—namely, that industry, doing a vital task for the nation, must receive the support and assistance of the nation. We must recognize that it is a natural demand—almost a right of any one serving his country, whether employer or employee—to know that his service is being used in the most effective manner possible. In the case of labor this wholesome desire has been not a little thwarted owing to the changed conditions which war has created in the labor market.

There has been much confusion as to essential products. There has been ignorance of conditions—men have gone hundreds of miles in search of a job and wages which they might have found at their doors. Employers holding Government contracts of the highest importance have competed for workers with holders of similar contracts, and even with the Government itself, and have conducted expensive campaigns for recruiting labor in sections where the supply of labor was already exhausted. California draws its unskilled labor from as far east as Buffalo, and New York from as far west as the Mississippi. Thus labor has been induced to move fruitlessly from one place to another, congesting the railways and losing both time and money.

Such condition is unfair alike to employer and employee, but most of all to the nation itself, whose existence is threatened by any decrease in its productive power. It is obvious that this situation can be clarified and equalized by a central agency—the United States Employment Service of the Department of Labor, with the counsel of the War Labor Policies Board as the voice of all the industrial agencies of the Government. Such a central agency must have sole direction of all recruiting of civilian workers in war work, and, in taking over this great responsibility, must at the same time have power to assure to essential industry an adequate supply of labor, even to the extent of withdrawing workers from non-essential production. It must also protect labor from insincere and thoughtless appeals made to it under the plea of patriotism, and assure it that when it is asked to volunteer in some priority industry the need is real.

Therefore, I, Woodrow Wilson, President of the United States of America, solemnly urge all employers engaged in war work to refrain after Aug. 1, 1918, from recruiting unskilled labor in any manner except through this central agency. I urge labor to respond as loyally as heretofore to any calls issued by this agency for voluntary enlistment in essential industry. And I ask them both alike to remember that no sacrifice will have been in vain, if we are able to prove beyond all question that the highest and best form of efficiency is the spontaneous coöperation of a free people.

Sulphur Distribution To Be Regulated

The Chemical Alliance has pledged itself to coöperate with the Chemical Division of the War Industries Board in allocating and distributing sulphur-bearing materials during the war. Resolutions to this effect were passed at a meeting of the Alliance in New York on June 7. Sufficient sulphur is available for making sulphuric acid and other much-needed chemicals, but it is considered necessary to perfect the distribution so that every munitions plant may receive its proper share. More than 250 acid plants in the country receive their raw material from the Gulf Coast region, and it is thought needful to regulate the supply. A committee was appointed at the meeting to confer with the officials of the Chemical Division of the board.

Remember the Comfort Fund of the 27th Engineers.

Industrial News from Washington

BY PAUL WOOTON, SPECIAL CORRESPONDENT

Against New Tax on Zinc Ore

Regardless of the form of tax that it may be decided to levy on producers of zinc ore in the Miami district of Oklahoma and adjoining territory in Missouri and Kansas, "the Government cannot and will not derive as much revenue from this industry for the year 1918 as that collected for 1917." The Ways and Means Committee of the House was advised of the foregoing by A. Scott Thompson, of Miami, who appeared as representative of the mine operators in his district. Mr. Thompson objected to the excess-profits tax because of the short life of a mine in the Miami district; because of the low percentage of the successful mines, and because it is impossible to charge the expenses of losing ventures, in the district as a whole, against the few profitable mines.

"The same group of men," said Mr. Thompson, "might have four or five ventures which were losses. Then they might incorporate a new venture and make a successful project of it. They cannot take into account their losses on the losing ventures in figuring up their taxes upon the successful venture. The only incentive for capital or for the prospector is the one chance in ten of large and quick profits. This incentive or hope is removed by the existing tax law.

"When spelter was worth 25c., the producer of the ore got no part of that increase. We never did receive 6½c. for our product; \$135 per ton was the highest price paid, and even then that was for the very high grade ore, which was produced by only a few of the mines.

"The producers in our district are producing 50% of the zinc in the United States, but they do not have a word to say as to the fixing of the price for their product. The spelter buyer appears once a week and says he will give you so much, and it is based on 60% ore. At the present time, our ore is bringing \$45 a ton, no higher than it was during the pre-war period.

"Steps are being taken now to prepare the zinc business for after-the-war trade relations. Active and large work is being carried on to develop many new uses of the metal. It is necessary in the framing of the new law that not only the original zinc capacity, prior to the war, be sustained, but that the tax shall so be arranged that it will not destroy the incentive for development both in mining and smelting of the new capacity brought into service by the zinc industry so quickly and satisfactorily to meet the demands put upon it by war conditions, and that this capacity may be available for the expansion of our export business after the war."

Hennen Jennings, during his appearance before the committee, expressed the opinion that the elimination of all excess-profits taxes on gold mining and the encouraging of maximum outputs might in reality bring in greater revenue for the Government

than the tax, for larger dividends paid to shareholders would mean greater revenue from individuals. Mr. Jennings presented an elaborate argument showing the advisability of stimulating the production of gold in order to stabilize the nation's credit, which has been pledged on the gold basis.

The War Minerals Appropriation

Discussing the proposed appropriation for increasing the U. S. Bureau of Mines investigations of war minerals, Representative Mondell, of Wyoming, made the following statement on the floor of the House:

"The Federal Government can render some assistance. The Federal Government ought to render all the assistance it can in reason, but my personal opinion, based on some knowledge of the situation, is that after all there is not so much that the Federal Government can do in the matter of encouraging the protection of steel alloys at this time. As a matter of fact there is some question as to the need that there shall be much done by the Federal Government in that direction. I say that, after having agreed to give these people all they ask.

"The present market price of all these metals—tungsten, chromium, vanadium, and the like—is very high. The demand for them is very great. The situation itself stimulates production to the very limit. I question whether we can do very much to help, though I am willing to spend \$200,000 in trying."

Cuts Imports of Copper Ore

Imports of copper ore, except for shipments made prior to June 10, have been cut off by the War Trade Board. The order does not apply to copper ore from Cuba or that on rail from Canada or Mexico. All outstanding import licenses have been revoked. The board explains the reason for the regulation as being "to bring about the importation of copper concentrates instead of the bulkier crude ore."

Imports of asphalt for the remainder of the year have been limited to 30,000 tons from Venezuela and 32,000 tons from the island of Trinidad. The tonnage imported is to be allocated by the War Industries Board.

Imports of gypsum have been limited to such supplies as may be carried upon sailing vessels or barges which may be designated for the purpose.

Excepted from Freight Increase

In the *Journal* of June 15, in naming the exceptions in which the 25% increase of freight rates will not apply on bullion and other smeltery products, it was erroneously stated that "rates from points in Colorado and El Paso, Tex., to Atlantic seaboard points shall be \$6.50 per net ton." This should have read "shall be increased \$6.50 per net ton."

Oliver Twist Asks for More

Just like that!—and there was a \$1200 hole in the treasury. That's where all the money goes. Real money, too—not like that Potsdam stuff that Hans and Fritz spent when junketing in Belgium. There's the reason for our weekly impersonation of Oliver Twist in asking for more. The money comes merrily into the Comfort Fund and it runs out more merrily still. Dollars are slippery things to hold on to, as we all know from experience, and in meeting the needs of the Twenty-seventh they slip swiftly away like the sands of time or, perchance, like Jerry O'Leary.

The crater referred to in the Comfort Fund was caused by a purchase of tobacco alone for B and C companies, as well as for Regimental Headquarters and the sanitary detachment of the mining regiment. The total seems large, but really means but a small amount per capita. It is interesting to note here just how much "makings," etc., was figured on per man in the order. The estimate follows: 1 tin Prince Albert, 1 tin Tuxedo (both 15c. size), $\frac{1}{2}$ plug chewing, 5 packs Fatimas, 5 packs Camels, 2 packs Chesterfields, 1 book papers, and 1 sack Duke's Mixture.

No danger of smoking one's self to death on that, is there? Try it and see. But just the same, it took \$1200 to furnish it to about one-third of the regiment. Remember, too, that tobacco is only one of the things that is furnished, *as wanted*, from the fund. The Comfort Fund for the 27th Engineers is only incidentally a "smoke" fund. Send in your check today. Register yourself or your company (or both) as backing the mining regiment by getting your contribution on the following list:

Previously acknowledged.....	\$13,664.00
Students of Wisconsin Mining School.....	50.00
A. M. Plumb.....	5.00
C. W. Snow.....	2.50
Charles A. Mitke.....	5.00
A. A. Hassan.....	10.00
A. A. Hassan, Jr.....	5.00
Emin A. Hassan.....	5.00
Bernard MacDonald.....	5.00
C. F. Rand.....	50.00
Calumet & Arizona Mining Co. and New Cornelia Copper Co.....	400.00
Oscar Lachmund (fourth contribution).....	10.00
C. N. Bell.....	10.00
C. S. Witherell.....	25.00
W. G. McBride.....	25.00
Karl Eilers.....	50.00
R. T. Hancock.....	5.00
E. E. White.....	100.00
S. Ringlund.....	10.00
H. Foster Bain.....	10.00
Marc Bailey.....	10.00
Charles le Vasseur (second contribution).....	5.00
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 L. Thomas.....	10.00
E. F. Eulich.....	10.00
Liberty Bell Gold Mining Co.....	200.00
H. De Witt Smith.....	15.00
Francis Thomson.....	10.00
New Idria Quicksilver Mining Co.....	100.00
F. P. Burrall.....	25.00
Livingston Wernecke.....	5.00
Total.....	\$15,142.50

Make your checks payable to W. R. Ingalls, treasurer of the Association of the 27th Engineers. Because of the work involved in administering the Comfort Fund, contributions are acknowledged only by publication in the *Journal*.

Iron Ore and Steel Prices Fixed for Third Quarter

Spurred by increasing requirements for steel, the War Industries Board on June 21 added 45c. per ton to the base price of Lake Superior iron ore. The changes were approved by the President on the following day. Demand for steel from fabricators in the Chicago district and from the shipbuilding industry which secures its supplies from mills selling on a Chicago basis, and the increased freight rates, were the principal causes for the advance.

Ore producers were able to show actual losses under the new freight rates. The losses averaged 51.48c. per ton for the five principal ranges, according to John A. Savage, who was in charge of the presentation to the price-fixing committee. The freight-rate increase added 33.6c. per gross ton to the costs of the mine operators who sell f.o.b. lower Lake docks.

With Mr. Savage were W. G. Mather, of the Cleveland-Cliffs Iron Co.; O. B. Warren, of the Mace Mining Co.; T. D. Heed, of the Judson Mining Co., and G. A. St. Clair, of the Vermilion range of Minnesota, Section 30 Mining Co. Other mining interests represented included M. A. Hanna & Co., through J. D. Ireland; the Newport Mining Co., C. N. Turner and M. Andrews; the Lake Superior Iron Ore Association, W. L. Tinker; Pickands, Mather & Co., H. G. Dalton, and Rogers, Brown & Co., A. A. Fowler. Also in Washington in behalf of an ore increase were J. A. O. Preuss, State Auditor of Minnesota; B. F. Burtless, secretary of the Michigan State Tax Commission; R. C. Allen, Michigan State Geologist, and other officials of the states benefiting under ore leases.

The official announcement of the changes in the steel agreement follows in full:

The President has approved the agreement made by the price-fixing committee of the War Industries Board with the representatives of the iron-ore, pig-iron and steel interests, that the maximum prices now prevailing on iron ore, pig iron and iron and steel products be continued in effect for the three months ended Sept. 30, 1918, with the following exceptions:

1. Lake Superior iron ore: Base prices of Lake Superior iron ore delivered to lower Lake ports are increased 45c. per gross ton on and after July 1, 1918, subject to the following condition: These increased prices are based on the advances in rail freight rates effected June 25, 1918, and on the present Lake rates, and in the event of any increase or decrease in either rail or Lake rates, said prices shall be increased or decreased accordingly on all deliveries made during the continuance of such increased or decreased freight rates.

2. On and after July 1, 1918, the basing point for steel bars, shapes and plates will be Pittsburgh, Pennsylvania.

No new contracts calling for delivery of any of the above commodities or articles on or after Oct. 1, 1918, are to specify a price unless coupled with a clause making the price subject to revision by any authorized U. S. Government agency, so that all deliveries after that date shall not exceed the maximum price then in force, although ordered or contracted for in the meantime. It is expected that all manufacturers and producers will observe the maximum prices now fixed.

Imports of Monazite Sand Restricted

The War Trade Board has placed monazite sand upon the list of restricted imports. All outstanding licenses for its importation have been revoked as to shipments from abroad after June 20, 1918. Special arrangements have been made, covering the importation of the minimum necessary quantities required for consumption in the United States during the remainder of 1918.

Efforts to Save Tin Bearing Fruit

WASHINGTON CORRESPONDENCE

The War Industries Board announces decided results from its efforts to conserve tin. Wastes, both those due to indifference and to faulty practice, have been eliminated to a marked extent. All use of tin in coating articles for ornamental purposes is to be discontinued. Other savings have been made by curtailment uses which do not injure any user, provided all act alike. The board expresses the opinion that, despite certain disorganization of industry, it probably will be necessary to curtail the use of tin for purposes in themselves useful and desirable but in no way connected with vital needs. The board announces the following results as having been already accomplished:

The Bureau of Standards has completed an investigation of bearing metals and suggested elimination of all but four grades. It is stated that a saving of about 25% in the amount of tin will be effected. The bureau is making similar investigations concerning solder. Can companies have reduced the percentage of tin in their solder to 40, thus saving from 8% to 10% without injury to the industry.

Most of the business in brass and bronze ingots and castings is directly or indirectly for Government account. Considerable reduction could be made in tin content without reduction of efficiency. Large savings have already been made by automobile and other machine manufacturers by substituting for all metal bearings, case bearings with thin lining shell ($\frac{1}{16}$ to $\frac{1}{8}$ in.) of high-grade babbitt. Straits tin is often specified on the assumption that it is the purest tin. Banca is even purer than Straits or Australian, and electrolytic tin is as pure.

Manufacturers of tinfoil and collapsible tin tubes have made large savings by reducing the tin content and by substituting other materials for containers. A plan is now being perfected for the recovery of a large part of the tin used in foil and tubes. Consumers of articles packed in foil or tubes will be induced to turn the containers in at the nearest Red Cross center as donations. Smelters and other users of tin will then purchase at market rates the lots thus collected by the Red Cross. It is estimated that this will recover some 3000 to 5000 tons of tin per annum, and bring the Red Cross an added income of from \$4,000,000 to \$5,000,000.

Plans for conserving tin plate have long been in the hands of the committee on the conservation of tin plate. In cooperation with the trades concerned, large economies have already been effected. The manufacture of plate for many less essential uses, such as roofing, for store boards, for fire doors, etc., has been eliminated by agreement. Tobacco manufacturers have just reached an agreement by which black plate will be substituted for tin plate for most tobacco cans, effecting a saving of probably 750,000 base boxes of tin plate per annum. In addition, the quantity required for export has been greatly curtailed by the regulations of the War Trade Board restricting export to plate which is to be used for specific war purposes.

Tin at Hongkong in 1917

The exchange value of silver during 1917 prevented Hongkong tin exporters and the Yunnan tin miners from securing as great a return in local currency for their exports as the miners and exporters of the Malay States, says *Commerce Reports*. However, the year was the greatest in the history of the South China tin fields, particularly as regards the United States, which took tin from Hongkong to the amount of 14,317,969 lb., valued at \$6,670,074 gold, as compared with \$1,401,377 in 1916, \$983,885 in 1915, \$769,538 in 1914, and \$1,632,212 in 1913. The total exports for the year are placed at 10,500 long tons, of which China and Japan took about 1500 tons, Europe about 2000 tons, and the United States the remainder. The year opened with a stock of about 3600 tons, or about three times the normal stock,

of tin on hand and a rather uncertain prospect. It closed with a stock of about 1500 tons on hand and a strong demand from the United States for all the tin the market could furnish at prices comparing equitably with the rest of the world.

Quotations during the year covered a wide range. Hongkong prices reached \$120 local currency, or about \$69.60 gold, per picul of 133 $\frac{1}{2}$ lb. in June, and went down to as low as \$93 local currency, or \$60.45 gold, per picul in October. Nevertheless, much of this apparent fluctuation is in reality fluctuation in exchange, and though gold prices of tin have been high, the returns of sales to Yunnan producers and Hongkong refineries have been little, if any, above the average.

A considerable export trade in wolfram and wolframite developed during 1917, the United States coming strongly into the market for the ore in the latter half of the season. During the closing month of the year, wolfram was being shipped out of Hongkong territory, including Swatow, to the amount of about 250 tons per month, valued in round figures at \$1500 gold per ton. The ore is obtained mostly from pocket deposits over a considerable area in Kwangtung Province, but it is also being mined successfully in Hongkong territory. Late developments seem to indicate that the field is a notable addition to the world's supply.

Ross Wins Against Burrage

Thomas W. Proctor, master appointed by the Supreme Court to take testimony in the \$2,500,000 suit of Louis Ross against Albert C. Burrage, vice president of the Chile Copper Co., has filed his report. We take this excellent abstract of it from the *Boston News Bureau*:

The case was first brought before Judge Braley on May 28, 1913, Ross having sued Burrage for 5% of Burrage's profits in the formation of the Chile Copper Co. Ross was represented by Sherman L. Whipple and Burrage by Henry F. Hurlburt.

The principal points of controversy were three in number: In the first place, Ross claimed that he brought the property to Burrage's attention within the terms of a contract which he had with Burrage entitling him to a 5% commission on certain properties described in the contract. Burrage claimed that it was understood between himself and Ross that the Chuquicamata property—the basis of the present Chile Copper Co.—was not included in the agreement. Upon this issue the master found for Ross and against Burrage.

Second: In May, 1912, Ross gave to Burrage an option on his 5% interest in the Chuquicamata property for \$100,000. Ross claimed that he was induced to give his option by fraudulent representations made by Burrage and a failure on the part of the latter to disclose to him facts within his (Burrage's) knowledge, which in fairness he was bound to disclose. Burrage denied that he had made any false representations or that he had deceived Ross by withholding any information. On this issue the master finds that while Burrage did not actively make false representations, he failed to disclose matters within his knowledge affecting the value of the property, with the purpose and intention of thus securing from Ross a better trade than he could otherwise secure. The finding is in effect that Burrage was guilty of a failure to make the full disclosures which his fiduciary relation to Ross required.

Third: Burrage claimed that even if Ross was deceived or misled in May, 1912, yet with a knowledge of all the material facts Ross ratified the option in December of the same year. Ross claimed that whatever he did, which could be construed as a ratification, he did while still misled and deceived by Burrage's failure to disclose material facts; that in December he had not learned of the concealments which Burrage had made in the May transaction. On this issue again, the master found with Ross and against Burrage. His finding is in explicit terms that when Ross ratified the May agreement he did not know that Burrage had deceived or misled him in securing the agreement.

The three principal issues in the case, therefore, are all decided in Ross' favor.

Ross first brought the copper deposits of Chuquicamata to the attention of Burrage while in London in June, 1910. Ross visited the mines in 1911, and on his reports and options, which he obtained, Burrage was able to interest the Guggenheims, who, after an investigation, formed the Chile Exploration Co. with 10,000 shares. Of this Burrage received 5000 shares, which were subsequently exchanged for 1,000,000 shares out of a total issue of 4,000,000 shares of the Chile Copper Co. of Delaware, 3,000,000 shares going to the Guggenheims.

The question what relief Ross is entitled to on the above stated facts—whether 5% of the stock of the Chile Exploration Co. which Burrage received, equivalent to 100,000 shares of the stock of the Chile Copper Co., or 5% of Burrage's share of the Chile Copper Co., equal to 50,000 shares of the stock of that company—is not determined by the master, but is left for the court to decide.

A second suit heard at the same time involving another 5% commission in the formation of the Chile Copper Co. was decided adversely to Ross and one Plews, as plaintiffs. It seems that Arthur S. Plews, of London, who first brought the property to Ross's attention, was given a 5% commission note by Burrage. Ross subsequently bought this commission note for joint account of himself and Plews and turned it over to Burrage at the latter's request. Ross claimed that he and Plews were entitled to the 5% commission accruing from this contract. This contention was not sustained by the master.

Swedes to Develop Oil Slates

According to *Commerce Reports*, the Swedish Government has submitted to the Riksdag a request for the approval of a preliminary agreement between the naval administration, the Svenska Emmissionsbolaget, and the Centralgruppens Emmissionsbolag, regarding the delivery of oils to the navy. It is the intention of the two companies to erect a factory at Kinnekulle, for the production of oil from the slate deposits found near there.

The Minister of Marine states that great difficulties have been experienced by the navy in obtaining oils, and that the present supply is low, so that this proposition is most important when considered with the maintaining of the naval defense. He further accentuates the importance of a domestic oil production with regard to the industrial life and transportation of the country. This scheme is thought to be a good one, because there are extensive deposits of oil-bearing slate within the country, which would make it possible to produce large quantities of oil.

Mineral Imports Committee Disbands

WASHINGTON CORRESPONDENCE

Having concluded its work, the Committee on Mineral Imports and Exports has disbanded. The committee has made recommendations covering all the mineral substances which came within its purview. C. K. Leith, the chairman of the committee, has been appointed mineral advisor to the War Industries Board in matters pertaining to the conservation of shipping. J. Edward Spurr has accepted an invitation to take charge of the war-minerals investigation for the U. S. Bureau of Mines. Pope Yeatman also was a member of the committee. His principal activity, however, has been with the War Industries Board, where he continues in charge of the non-ferrous division.

Work connected with questions arising from the enforcement of the programs outlined by the Committee on Mineral Imports and Exports will be handled by the staff assembled by Mr. Leith and Mr. Spurr.

Manganese in Nevada*

Nevada has not been formerly looked on as a promising state for manganese, but some good though small deposits have been found. At Golconda there are examples of high-grade manganese ores and some very good ore has been found. These deposits have been described briefly by E. C. Harder. They are believed to consist of deposits formed from waters issuing from surrounding sedimentary rocks, and occur interstratified with siliceous and calcareous tufa in a bedded deposit. At Pioche there are examples of manganese iron ores. A recent estimate of the U. S. Geological Survey places the probable ore in two Pioche deposits at 550,000 tons and possible ore at 1,000,000 tons, carrying approximately 12% manganese, 34% iron, 13% silica, and less than 0.1% phosphorus. Though this type of ore has up to the present been used only to a limited extent, more use may be made of it in the near future.

In view of the fact that little attention has been paid hitherto to this metal, the extent of the mineralized sections of the state, and the common association of manganese minerals with silver deposits, it is not unlikely that there may be some other good deposits found. Recently encouraging reports have come of discoveries in different parts of the state, especially from near Las Vegas, Ely, and Golconda. The latest reports from Las Vegas indicate there are being shipped 60 tons daily, and there is hope of increasing this soon to 200 tons. Reports from Ely state they are making daily shipments of 20 to 25 tons and with improved transportation can increase this amount. If shipments of 220 tons daily could be maintained, they would have considerable influence on the general situation. In round figures a daily shipment of this amount would total 80,000 tons yearly, and, as the estimated amount imported last year has been placed at about 500,000 tons, it is readily seen what an appreciable effect the Nevada supply would have.

Attention should be directed first to securing ores of shipping grade and thus avoiding preliminary treatment. Some concentrating tests have been made by the Mackay School of Mines to improve the grade of the low-grade silica-bearing ores, and the results have been promising.

The only purchaser of manganese ores in the state is the Western Ore Purchasing Co., which will sample and purchase manganese ores in less than carload lots, thus enabling prospectors to obtain money with which to extend the development of their property without delay.

The freight rates in effect Mar. 29, 1918, are per ton of 2000 lb. Manganese ore is usually purchased on the long-ton basis of 2240 lb., and allowance should be made for this fact in estimating the assay value of ore. The rates are:

Golconda to Hazen, value \$50, \$1.45 per ton; value \$100, \$2.20 per ton.

Reno to Hazen, value \$50, \$0.60 per ton; value \$100, \$0.90 per ton.

Schurz to Hazen, value \$50, \$0.60 per ton; value \$100, \$0.90 per ton.

Hazen to Pittsburgh, no value stated, \$11.00 per ton.

Hazen to Chicago, no value stated, \$9.00 per ton.

*Excerpt from a bulletin of the University of Nevada, "Manganese," by W. S. Palmer.

Editorials

James Douglas

DR. JAMES DOUGLAS died on June 25 at an advanced age. News of his death coming just as we were going to press, we are obliged to defer publication of a biographical sketch of his distinguished career until next week.

Doctor Douglas was veritably the dean of the mining and metallurgical profession. He was, moreover, a great deal more than an engineer and a scientist, for, together with those faculties, he possessed the remarkable endowment that caused him to become a great administrator. Indeed, we may say more. He was a philosopher and a teacher of men. For the last quality, we think, the mining industry of the world, and especially of North America, owes more to Doctor Douglas than for anything else. It was he who led in tearing away the veil of secrecy that formerly shrouded and hampered mining technology. Our marvelous progress during the last 20 years has been based upon the general and generous exchange of information—more upon that than anything else. In promoting that great philosophy, Doctor Douglas led the way and exhibited a spirit that spread widely and pervadingly.

The Problem of Taxation

THE wealth of the United States is variously estimated at 220 to 250 billion dollars. The annual income of the people at 38 to 50 billion. The annual savings at 11 to 15 billion. Such estimates cannot be anything but rough approximations. We are inclined to think that for both total wealth and annual income the higher of these figures is probably nearer the truth than the lower. The Bankers Trust Co. in a recent study based on income-tax returns for 1916 estimated the total national income at 50 billion dollars, of which 11½ billions is the income of corporations and other business enterprises, and 38½ billions the total income of family groups (27,304,000 in number), of which 30½ billions is received by families with less than \$6000 per annum. As to the net saving of the people, we are disposed to regard the estimate of 15 billion as too high and 11 billion as too low. Let us assume 12 billion. These figures indicate the total from which we may draw in paying for the war. The 40 million workers, diminished by the number who have been withdrawn for military service, are not going to produce any more in 1918 than they did in 1916 and 1917. Allowing for the impressment of idlers, for the increased employment of women, old men and boys, for the speeding up by many workers (offset by the slowing up of many others), we shall do mighty well if we maintain the total national income at 50 billion dollars. Manifestly we cannot spend on warfare any more than our total gross income, nor even anything closely ap-

proaching it; for the people who are not directly engaged in military operations and in munitioning must use the major part of their income in order to live, even after practising the most rigid economy.

The total expenditures of the Government in the fiscal year ending June 30, 1918, will probably be about \$12,300,000,000, out of which \$4,750,000,000 will represent advances to our Allies, leaving about \$7,550,000,000 as our own expense, at least 54% of which will be met by ordinary receipts and taxes. We must bear in mind that the advances to our Allies are spent mainly in this country and therefore draw upon our productive capacity just like our own expenses. However, it should be distinctly understood that these expenditures, together with an important part of our own, are for capital account and will constitute a basis for future income. Ships, shipbuilding plants, chemical works, houses, railway improvements, part of the railway equipment in France, etc., may be considered as a basis for future revenue.

Secretary McAdoo estimates that the financial requirements of 1918-19 will be \$24,000,000,000, and proposes to raise one-third of that by taxation, thus preserving the ratio of 1917-18, which, as has been remarked previously, was more than one-half with respect to our own expenditures. It is doubtful whether the Government can spend \$24,000,000,000, even if it wants to. This would mean the absorption of about one-half of the national income in war work, or, expressed differently, the labor of about one-half of the population. We are already witnessing, indeed, an even greater use of labor and plant in certain industries, e.g. in iron and steel, but that one-half of the people should carry the other half—for that is what it comes to—seems impossible, in spite of the most rigid economy and postponement of non-essential work.

There is thoughtless talk about taking all the needed money out of the rich. The bulk of the income of the country accrues to the mass of workers. The income of the rich is insufficient to pay the bill for the war, even if the whole of it should be taken. Nor can there safely be any great levy on capital. Industry cannot be carried on without capital. Labor cannot be employed. In the interest of labor and in the interest of public welfare capital must not be curtailed.

There is just one road to economic safety, and that is the road of increasing production itself. In the words of Sir Felix Shuster, a great British banker, "If only the leaders of labor would keep before them as one of their aims that of efficiency, as the leaders of industry have done, then many difficulties would be overcome."

Taxation, he said, must be high for many years, and to meet it the nation must produce more and consume less; spend less and save more. Every effort must be made for an increased output of individual effort and national production, and if that be done there would be no reason for doubt as to the future.

The Name of the A. I. M. E.

AT THE meeting of the American Institute of Mining Engineers in Washington on June 21, at which time a Washington section was organized, it was announced that a proposition is to be referred to the membership to change the name of the organization to the American Institute of Mining and Metallurgical Engineers. Another title that had been contemplated is American Institute of Mining and Metallurgy, but that had not been received favorably, and the referendum will be limited to choice between American Institute of Mining Engineers and American Institute of Mining and Metallurgical Engineers.

The idea in changing the name is to broaden it, and especially to satisfy a good many metallurgists and metallurgical engineers who are not mining engineers, and perhaps never saw a mine. This argument seems to us to be rather frivolous. The name of such an organization cannot possibly be descriptive of the occupations, interests and activities of all of its members. Nor is there any good reason why it should be. The Engineers' Club comprises a good many members who are not engineers. Not by a long shot is every member of the Bankers' Club a banker. There are some lawyers in the Lawyers' Club, but that is all that anybody can safely say. The American Institute of Mining Engineers comprises a good many members who are interested in mining, but who are not mining engineers. It comprises members who are not even interested in mining, but are concerned only with the uses of mineral products. A metallurgist is not necessarily a metallurgical engineer.

The rejected title of American Institute of Mining and Metallurgy is broad, comprehensive and dignified. But as between American Institute of Mining and Metallurgical Engineers and American Institute of Mining Engineers, it seems to us better to preserve the old title than to adopt the new, ornate, rather rococo, and certainly clumsy designation that is now proposed.

The Price of Manganese Ore

IN SPEAKING of the price for manganese ore in our issue of June 8, we may have conveyed an erroneous impression in implying that the rate had been fixed by the War Industries Board, whether arbitrarily or by agreement with the producers of ferromanganese acting through the American Iron and Steel Institute. It has been brought to our attention that what the War Industries Board did was to get the important buyers of manganese ore together to regularize commercial practices and agree upon a uniform schedule. The consensus of opinion was that the proper thing to do was to raise prices sharply, eliminate penalties for iron, allow a premium for low silica and penalize for high silica just as moderately as possible. It was also decided to make uniform terms, every one to pay 80% of the estimated value of the ore against bill of lading, and not to endeavor, as all had previously been doing, to induce shipments on open account without any advances against bill of lading.

We confess our error respecting prices, the new schedule being based on delivery at South Chicago, and, allowing for freight, etc., being about 18c. per unit

higher than the old Carnegie schedule, on the basis of 40% ore. The method of regularizing buying practice is also commendable and should be stimulating to producers. Nevertheless, we have a case of price-fixing by a combination of buyers, apparently with the sanction of the War Industries Board. This is infinitely better, no doubt, than the imposition by the latter of a restrictive maximum, which, indeed, would be madness in this juncture, but it would have been better still we think (and this was the main thought in our first comments) to have natural competition and free bidding for the desired supplies. It was necessary only for one important buyer to introduce improved methods of buying, after which all others would have been compelled to do likewise.

Night Lettergrams by Courier

THERE is something both humorous and suggestive in the Western Union Telegraph Co. taking night-letter telegrams and dispatching them by courier to Boston, Philadelphia, Washington, and other points reached by an overnight journey. The practice was probably illegal, encroaching upon the privileges expressly reserved by the United States in its mail service, although the telegraph company may be able to offer a suitable defense. However, as to perpetrating any fraud upon the public, the skirts of the telegraph company are clear enough. The U. S. mail service has been so bad in recent years that no one mailing at the end of the day a letter for Boston or Washington could be sure that it would be delivered there the next morning, although the railway time to either place is only six hours. With good luck there might be delivery the next morning; with bad luck not until late in the day, or even not until the second day. Therefore, the practice has arisen among business houses of sending by night-letter telegram messages that surely must be delivered the next morning. Nobody cared how the telegraph company transmitted the messages, so long as it got them there.

We suggest that the U. S. Postoffice Department take a leaf out of the telegraph company's book. If the Postoffice Department will send a messenger to our office to get the message, will forward it to Boston, Washington, etc., by special courier, will deliver it by messenger the first thing the next morning, we are sure that everybody would just as lief have the Government perform this service and charge the same price as the telegraph company. But will the Government do it, or will it let us continue to worry about delayed letters?

The Government's Handicap

IN A RECENT address in Detroit, John D. Ryan epitomized one of the great troubles—we may say the greatest trouble—the Federal Government has in conducting its business efficiently:

"The greatest difficulty experienced now in the production of aeroplanes is the lack of timber output, and the chief cause is the fact that the Government is doing the work. We are conducting the greatest lumbering operations in the world's history," said Mr. Ryan, "but because of the methods in which Government business must be done it is impossible to do business as a corporation would do it. The safeguards and restrictions

thrown by law around Government expenditures are such that the Government cannot do business in war time as it should. That is the reason I have asked Congress to permit the organization of a lumbering corporation within the Aéroplane Production Department, just as was done in the case of the Shipping Board.

"The Government," he continued, "is not organized for the purpose of doing business such as a corporation would do. The corporation is the outgrowth of centuries of business experience. The corporation substitutes for the individual. The Government does almost the opposite, and it is organized in almost an opposite direction."

A great business administrator, a man who has built great industries and run them, was speaking. This was the voice of practical experience, not of socialistic babbling. Except for the shipbuilding corporation, we should have mighty few ships. Except for the War Finance Corporation, we should do but little commercial financing. Hoover needed the Wheat Corporation. If we are to have a Government management of the mineral industry, we hope that it will be through the medium of a corporation, as we have previously urged.

The Index—Volume 105

WE INTEND to publish the Index to Volume 105 early in August. Believing that many who receive the Index do not bind their copies, and in compliance with the Government's request to conserve paper, we will send the Index only to those who request it by postcard.

If you want a copy of the Index, send in your request promptly.

BY THE WAY

Frank A. Vanderlip, according to the *Boston News Bureau*, said recently: "In a French trench a shell exploded. Every man in that trench went down, save one—the young officer in charge. That man stepped up onto the firing bench and looked out and saw coming toward him a charge of German soldiers. That man loved France in his very soul. He could not bear to see another foot of France taken away. He turned to those men lying in the trench and shouted: 'Dead men, get up!' And, stunned and wounded as they were, enough of them got up so that they manned the guns, drove back the enemy, and held the trench for France. And I feel that Liberty is going to say to all of us: 'Get up, dead men! Wake up!' So feel in your souls what your duty is that you can do the superhuman thing. Get up and fight this war."

The war has caused shortages of important materials, according to the *Wall Street Journal*, and the solutions of problems arising therefrom are big factors in the scientific world today. Lack of dyes, acids and chemicals has, in large measure, been overcome, and other products, previously produced only abroad, are being duplicated synthetically or replaced by substitutes. At present there is a crying demand for potash.

Announcement is made that the potash shortage will, before long, be relieved, at least to a big degree. For some time the abundance of water plants and sea growth in the Panama canal has been a hindrance to shipping. Recent analysis has shown that this supposed useless matter contains from 4% to 6% pure potash. It is proposed to construct industrial plants in the Canal Zone, which will put forth a substantial yield of potash and at the same time clear the canal of its present nuisance. Another nail in the German potash bonanza.

A survey has been undertaken by the Government looking to putting its dollar-a-year volunteers on substantial salaries. These men heretofore have accepted nominal compensation under a law forbidding the Government to accept services without pay. Information on the several hundred of them now serving in the War Industries Board and other war agencies, including their duties, connections with private interests, and the value of their services, has been gathered by the House Ways and Means Committee in response to urgent requests of a number of Government officials that the nominal pay system be abolished in the interest of efficiency and of promoting direct responsibility to the Government. Reports of department heads show, it is said, that most dollar-a-year volunteers heretofore have been paid much higher salaries than the Government could afford to give, even if the suggestion of several department heads for a \$5000 limit is adopted. Secretary McAdoo, who believes the nominal pay system leads to allegiance divided between the Government and private business interests, already has transferred all but three or four war assistants in the Treasury to salary rolls.

Most of us have become so accustomed to daylight saving that we never give the new time a thought, says the *Sun*. A few stubborn fellows refuse to keep step in the procession, and with unadjusted watches annoy themselves and amuse their friends. For them the 8:23 leaves at 7:23. But the cows that were not going to give down appear to have conformed to the summer order, the chaps who were sure they would oversleep are awake when they should be and twilight has come to have a meaning for the ordinary citizen. Not only have we received an hour, but it is a delightful hour, in which man may labor or loaf in comfort and peace. The Interstate Commerce Commission has been poking around to uncover weaknesses in the system. It has not been able to disclose many. Next year the regulations may be altered in minor details to meet the requirements of a few towns and cities, but these changes will not be of general importance or interest. The investigators have turned up some enterprising towns on the boundary lines of time belts which had informally but effectively adopted daylight saving before Congress decreed it, and which cheerfully set their clocks ahead another hour when the country made the change. These communities have no complaint to make; they find it possible to remember train time and town time, and to regulate their goings and comings accordingly. Strangers within their bounds may be confused at first, but they soon learn to take care of themselves and their watches.

Personals

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

G. L. Sheldon, of Ely, Nev., is visiting various districts in Beaverhead County, Montana.

Carl O. Lindberg, of Los Angeles, has accepted a position with the U. S. Bureau of Mines, at Washington.

A. H. Brown, metallurgist, is in charge of the mill of the Schumacher Gold Mine, Ltd., at Schumacher, Ontario.

A. C. Bedford is chairman of the National Petroleum War Service Committee, and his office is in New York.

Kirby Thomas has returned to New York from Arizona, where he had examined properties in the Globe district and the Bradshaw Mountains.

William Fraser, for several years superintendent of the Davis Daly properties at Butte, Mont., has gone to California for a two-months' vacation.

L. W. Ledyard has been appointed manager of the molybdenite mines of the recently organized Indian Peninsula Mining Co. near Amos, Quebec.

Ernest Harms, for the last 16 years metallurgist and manager of the Cia. Metalúrgica de Torreón, Mexico, has resigned, and is now in El Paso, Texas.

Roy H. Marks has left the employ of the Equity Creede Mining Co., of Creede, Colo., and is now with the United Verde Extension Mining Co. at Jerome, Arizona.

F. W. McNair, president of the Michigan College of Mines, is taking up war work for the Government in Washington, where he expects to remain for an indefinite period.

Dr. E. A. Schubert, for many years in charge of the mining interests of the Norfolk & Western R.R., at Roanoke, Va., has resigned to give attention to private interests.

J. M. Hyde, metallurgist of San Francisco, recently visited the sulphur deposits of western Texas, preliminary to studying the treatment of sulphur ores for the Government.

Dr. Victor Delmage, of the Canadian Geological Survey, has gone to Vancouver Island to investigate a reported discovery of quicksilver and to examine copper deposits on the west coast.

Charles E. Law, of Vancouver, who was connected with Lord Rhondda's enterprises in British Columbia and Alberta for three years, is now in Northern Alberta in connection with the development of a potash industry.

D. C. Livingston, head of the geological department of the Idaho School of Mines, will devote the entire summer to the search for war minerals in Idaho, working in cooperation with the U. S. Geological Survey.

J. S. Coupal, manager of the Engineering Management Corporation, 165 Broadway, N. Y., will soon return from Venezuela, where he has been for several weeks making an investigation of magnesite and copper deposits for American interests.

Edwin E. Eaton, mining engineer, Crown Point, N. Y., has accepted a position in the manganese section of the U. S. Bureau of Mines. He will be engaged for some time in investigating methods of washing and treating manganese ores in the Appalachian region.

Prof. G. A. Roush, assistant professor of metallurgy, Lehigh University, Bethlehem, Penn., has been appointed supervisor of training, inspection division, Ordnance Department. He will have charge of the training of inspectors, recently instituted by the War Department.

George W. Fowler, of Sussex, N. B.; **B. C. Prowse**, Charlottetown, P. E. I.; **A. E. Way**, Toronto; **Charles W. Cleveland**, Halifax, N. S., and **W. D. McKay**, Ottawa, recently spent two weeks investigating gold properties in the West Shining Tree district of Northern Ontario.

Robert J. Anderson, who has been U. S. Government resident chemist at Youngstown, Ohio, attached to the Government laboratories of the Youngstown Sheet and Tube Co., has been transferred to the Bureau of Aircraft Production and is now in Pittsburgh at the general laboratories of the Signal Corps.

G. Montague Butler has been appointed director of the Arizona State Bureau of Mines to succeed Charles F. Willis, resigned.

Mr. Butler will continue to serve at the University of Arizona as dean of the College of Mines and Engineering. As director of the Bureau he will lay emphasis upon geological investigations, and will soon begin to collect the data required for the preparation of a reconnaissance geological map of Arizona.

Obituary

William E. Hidden, a mining engineer of Newark, N. J., died recently, aged 65 years. He was the discoverer of the minerals hiddenite, kunzite and rhodolite. He was born in Providence, Rhode Island.

Edgar A. Collins, who last year was appointed resident manager for the Ridder mine of the Russo-Asiatic Corporation in the Altai, in Siberia, died of pneumonia on June 3 at Ben Lomond, Calif. He had recently returned to the United States from Siberia, where the Bolshevik revolution had caused a suspension of his company's mining operations. He was formerly superintendent of the Combination mine, at Goldfield, Nev., and later in charge of the Commonwealth mine, at Pearce, Ariz. At the time of his death Mr. Collins had just undertaken with Albert Burch an investigation of chromite deposits of California for the U. S. Bureau of Mines.

Cyrus Osborne Baker, whose death on June 13 was announced in the last issue, was president of Baker & Co., of Newark, N. J., refiners of gold, silver and platinum. Mr. Baker died of a sudden attack of heart disease at Briarcliff Manor, N. Y., in his sixty-first year. He was born and educated in Newark, where he early engaged in the business of refining gold and silver, to which he added platinum as that metal became better known. He first experimented with platinum in the '70s, and with his associates gradually developed a business in it. His interest in platinum brought him in touch with prominent electricians, and he later joined the Electric Light Association. Mr. Baker was a member of the Sons of the American Revolution, the Lotus Club, of New York, the Essex Club, of Newark, the Algonquin Club, of Boston, and the American Institute of Electrical Engineers. His home was in East Orange, N. J., but he had traveled extensively in recent years. He is survived by his wife and his brother, Charles W. Baker, of the American Zinc, Lead and Smelting Company.

Dr. William B. Phillips, geologist, died at his home in Houston, Tex., on June 7, aged 61 years. He was born in 1857 at Chapel Hill, N. C., and was educated at the University of North Carolina, where both his father and grandfather had been teachers. Upon his graduation, when he was 20 years old, he went to Saxony, where he studied at the Freiberg School of Mines. For a time after obtaining his degree, he was employed as chemist at the North Carolina Experiment Station. Later, from 1886 to 1888, he taught agricultural chemistry and mineralogy at the University of North Carolina, following in his father's steps. From 1888 to 1892 he practiced as a mining engineer at Birmingham, Ala. During this time he accepted a position in chemistry and metallurgy at the University of Alabama, which he held for two years, then becoming chemist for the Tennessee Coal, Iron and Ry. Co. At this period, he also served on the staff of the "Engineering and Mining Journal." In 1901 he became director of the University of Texas mineral survey, remaining until 1905, when he again took up private work. In 1909 he was recalled to take charge of the newly created bureau of economic geology and technology at the university. He resigned this position in 1914 to take the presidency of the Colorado School of Mines, which office, however, he gave up a year later, preferring private practice. He was the author of about 300 scientific and technical articles. Dr. Phillips was a member of the American Institute of Mining Engineers. He was a Mason and a member of the Phi Beta Kappa and Phi Kappa Sigma fraternities.

Grove Karl Gilbert, geologist, died suddenly of angina pectoris at Jackson, Mich., on May 1, 1918. He was born in 1843 and was graduated from the University of Rochester in 1862. He later received the honorary degree of LL.D. from the universities of Wisconsin and Pennsylvania. Mr. Gilbert was one of the group of American geologists who first became prominent because of their connection with the series of transcontinental surveys which eventually led to the organization of the U. S. Geological Survey. He was a geologist on the Wheeler Survey from 1871 to 1874 and on the Powell Survey from 1875 to 1879.

Upon the organization of the U. S. Geological Survey in 1879, he joined its staff, becoming chief geologist in 1889 and retaining this rank until 1892. Preferring research to administrative work, however, he gave up this position, and in 1892 resumed the series of studies that led to the production of papers which are recognized as classics in American geological science. The latest of these give the results of his researches into the transportation of debris by running water, based upon studies in the hydraulic mining district of California, and display the same mastery in observation, deduction and presentation which were such striking characteristics of the earlier volumes on Lake Bonneville and the Henry Mountains. Although for the last five or six years Mr. Gilbert had not been in robust physical health, he continued active, and at the time of his death had well advanced toward completion a paper summarizing the results of his years of observation and thought upon the structures of the basin ranges.

Societies

The National Exposition of Chemical Industries will be held for the fourth time in the Grand Central Palace, New York, during the week of Sept. 23. Its advisory committee is composed of Charles H. Herty, chairman; Raymond F. Bacon, L. H. Baeckland, Ellwood Hendrick, Henry B. Faber, Bernard C. Heese, A. D. Little, William H. Nichols, R. P. Perry, H. C. Parmelee, G. W. Thompson, F. J. Tone, T. B. Wagner and M. C. Whitaker. The coming exposition will be the largest chemical exposition ever held. The program is in active preparation and will be a series of symposiums on the development of chemical industries in the United States, notably since July, 1914.

American Electrochemical Society—The technical committee recently appointed includes the following: Electro analysis—W. T. Taggart, chairman; G. B. Frankforter; chlorine and caustic—A. H. Hooker, chairman; C. W. Marsh, M. L. Griffin; electric furnaces—Carl Hering, chairman; H. W. Gillett, M. H. Bennet; electrodes, carbons—Acheson Smith, chairman; G. K. Herzog; carbides, abrasives, refractories—R. A. Witherspoon, R. H. White, Otis Hutchins; ferroalloys—Theodore Swann, chairman; D. A. Lyon, G. E. Weissenburger; fixed nitrogen—W. S. Landis, chairman; C. G. Atwater, F. S. MacGregor; industrial electrochemistry (not otherwise provided for)—M. deK. Thompson; electrometallurgy—J. W. Richards, chairman; iron and steel—R. Turnbull, R. F. Flinterman, R. E. Zimmerman; copper smelting—R. W. Deacon; copper refining—Charles S. Witherell; zinc—O. C. Ralston; electrolytic iron—C. F. Burgess; gold and silver—H. H. Alexander; tin group—E. F. Kern; miscellaneous—Mn, Mg, Ni, Ce, etc.—Alcan Hirsh. The following executive committee was appointed by the board: F. J. Tone (ex officio), J. W. Richards, C. G. Fink, Carl Hering, A. T. Hinckley, H. C. Parmelee, C. G. Schluenderberg.

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.

Blasting Powder—William Treese, Silverton, Ore. (U. S. No. 1,265,975; May 14, 1918.)

Classifier, William A. Brunner, Salt Lake City, Utah. (U. S. No. 1,265,734; May 14, 1918.)

Crushing and Amalgamating Mill, David W. Church, San Diego, Calif., assignor, by mesne assignments, to Rudolph A. Dalluge, Los Angeles, Calif. (U. S. No. 1,266,406; May 14, 1918.)

Zinc—Distilling Furnace and Condenser, Electric. John Thomson, New York, N. Y., assignor to John Thomson Press Co., Jersey City, N. J. (U. S. No. 1,265,973; May 14, 1918.)

Electric Furnace—Hans Nathusius, Friedenshütte, Kreis Beuthen, Germany. (U. S. No. 1,265,945; May 14, 1918.)

Hot-blast Stove—James I. Larimer, Joliet, Ill. (U. S. No. 1,265,923; May 14, 1918.)

Refractory Material and Process of Making Same—Charles B. Stowe, Lakewood, Ohio. (U. S. No. 1,265,545; May 7, 1918.)

Editorial Correspondence

SAN FRANCISCO—June 19

The United States Tariff Commission will hold a conference on antimony, quicksilver, tungsten ores and products, in the assembly room of the Chamber of Commerce, during the week of June 24, to which all producers, importers and consumers interested will be invited. The conference is for the purpose of securing information in regard to disturbances and changes in these American industries. The topics to be discussed fall under three heads: The condition of the American industry before the war, in relation to foreign competition; the effect of the war on the industry, and competition with foreign producers after the war.

Diversion of Power to the more essential industries required by war demands is causing some uneasiness in the mining districts of California. The Chamber of Commerce of Grass Valley recently prepared a petition, which is approved by the city trustees, asking the State Railroad Commission to give the mining industry due consideration. Shortage of water in mountain streams and reservoirs means diminution in the amount of electrical energy. If the program which includes gold among the non-essentials is carried out, the present water situation will seriously affect the Grass Valley and Nevada City districts, as well as a number of other gold-mining districts in the state. The gold miners in some districts are taking the position that though gold may not be in itself an essential, under the ruling of the Government, its support of a comparatively large population is important, in that it provides the working miners and others in the communities with the means to support war activities, and that with their earning power reduced their contributions to the support of the Government must in like measure be curtailed. But they overlook the fact that gold is in itself as essential as iron and steel or any other metal or mineral. A recent communication by Secretary McAdoo encourages this view, which is held by the principal gold mining operators. Economy in the use of power, is, of course, essential, and the conservation of water, particularly at this season, in California, is likewise a necessity. But the powers that rule in the matter of the distribution of power and water need have no misapprehension about the California gold miner. He cannot afford just now to waste anything. He is so tight up against the necessity of economical practice that by the time he has provided his payroll and paid his material and supplies bills he has nothing left to be wasted.

DENVER—June 20

Increase in Freight Rates ordered by the Director General of Railroads, amounting to 25% of present charges, hits the Colorado producers, especially the miners of low-grade lead ores, and to a lesser extent the producers of copper ores. The advance is particularly drastic as applied to rates upon smeltery products, which will be practically doubled. The cost of smelting and refining will also be materially increased by the increased freight charges upon coal, coke, limenock, and other technical necessities. Although the new rates do not become operative until June 25, they affect almost all ores purchased by the smelters during June, as it takes several weeks to sample and smelt these ores and load out the products. The smelters are finding it necessary to take the new rates into account in making present purchases. They say that their present operations will not permit of the absorption of additional costs, and that it will be necessary to make the entire amount of the advance a charge against the ore purchased. With respect to lead, the smelters will deduct 50c. per 100 lb. from the New York quotation, and use this reduced quotation in place of the full New York quotation as heretofore. In the case of copper, the smelters will deduct 6c. per lb. from the casting quotation upon all grades. These conditions apply to all purchases made on and after June 5. It is of interest to note that when lead is selling at \$7.25 per cwt., the selling price on low-grade lead ore, say 5 to 10%, is on the basis of \$3.65 per cwt., which shows that about 50% of the product is taken for

freight and treatment charges. As the percentage of lead advances above 10%, the price to the producer materially increases, which leads some observers to think that the Government or the smelter is in need of lead.

Colorado School of Mines will make compulsory military training a part of its regular course at Golden, beginning Sept. 1 next, for all students who are physically fit, regardless of nationality. Efforts are being made by the trustees to have the War Department assign as instructor, Maj. Louis R. Ball, of the class of 1900. The subject of such training was brought before the board two weeks ago by Dr. Victor C. Alderson, president of the school, who explained the necessity of the training, not only from a patriotic point of view, but also from that of the physical development of the men. He stated that the studies could be so arranged that the training would not interfere with work, and the trustees immediately adopted the rule. Dr. Alderson also announced four new courses for the school for the coming year. One is on metallurgical problems, the second on hygiene and sanitation, the third on metallography and the fourth on electrometallurgy. These four courses will materially increase the efficiency of the graduates, as with these the entire subject of metallurgy is covered and will form one of the most complete courses given in any mining school in the world, if not the most complete. Dr. Alderson will continue next session a course on finance, entirely new in mining schools. He took it up last season and it was so successful that he has determined to make it one of the important classes in the coming year. "The school of mines gives a technical course, and the studies, naturally, are along this line," said Dr. Alderson. "It is a well-known fact that men pursuing a special line of study know little if anything of finance. They know their own special line. That is true especially of a mining course. Our graduates know the mining game in all its various ramifications, but they don't know finance. In other words, they are mining experts, but know nothing of business." From reports that are coming to the registrar of the school, the attendance next season will be fully 200, and possibly more.

PHOENIX, ARIZ.—June 18.

A Unique Deposit of Manganese Ore has recently been discovered in the Black Canyon district of Yavapai County. Ore occurs in massive nodules and in veins and seams in a bedded layer of volcanic ash, lying at the base of the mesa formations characteristic of that region. It is low in iron and carries from 31% to 41% manganese, with some adhering particles of the ash. The outcrop has been explored along several miles, and the discovery presents possibilities of important tonnage. The material is easily recovered from the loose ash. Operations have been begun by H. O. Howard, of Phoenix, and explorations to determine the extent of the occurrence may be made. The deposit is 14 miles from the Santa Fé branch at Turkey Creek. Tiptop mine, in the Bradshaw Mountains, has been sold to a syndicate represented by H. C. Wilmot, of New York. The property is one of the earliest discoveries in the region, and in the 70's and 80's produced enormously of high-grade silver ore. Considerable tungsten ore occurs in the vein, and it is intended to treat the dumps and fills for tungsten and low-grade silver. H. O. Howard, of Phoenix, has taken an option on the Security Group, adjacent to the Tiptop, and has done several hundred feet of work opening up an adit on the vein. The Silver Museum mine, also in the Tiptop district, has been under development for Buffalo interests, but work has been suspended. The Cash mine, controlled by the late Colonel Getchel, is under option and is being examined. The property is situated near the Senator mine, owned by Phelps-Dodge interests.

GOLDFIELD, NEV.—June 20

An Interesting Manganese Prospect is being opened by Charles Ward in the vicinity of Sodaville. Ore containing 40% manganese also carries more than 2% tungstic acid and a trace of tin. No method of separat-

ing the tungsten from the gangue has been evolved, but experimental work is under way. The tungsten is probably contained in intimate association with manganese and iron and cannot be tabled with success. It is thought that this ore showing is directly connected geologically with the nearby hot soda springs. Leasing is being done at Olinghouse, and good-grade gold ore is produced. W. H. Shewan is operating the St. Anthony tungsten mine, some distance west of Lovelock, and milling garnetiferous ores at the Fanning mill. Toulon mill, in the same section, is operating on tungsten ores from Mill City, in addition to shipments from Sodaville. At Mill City, intensive tungsten mining is being systematically conducted by three independent operators. The source of scheelite in this district is about 50 miles east of Lovelock and nine miles from the main line of the Southern Pacific R.R. Each operating company, of which there are three, is producing shipping ore from several different tunnels and shafts. The ore is found in numerous parallel garnetized shear zones in granodiorite. In some cases the ore lies between lime and granitic rocks. Two mills are under consideration. W. J. Loring, L. A. Freedman and W. C. Pitt are the principal operators. Tungsten producers are unanimously in favor of fixing the price of their product at slightly higher figures than prevail at present.

WALLACE, IDAHO—June 16

Construction of Pine Creek Branch of the Oregon-Washington R.R. & Navigation Co. is to begin at once, according to advices received from Washington. Two miles were completed late last autumn, but the high water washed out the roadbed and prevented a resumption of construction work until this spring, when it was expected that the line would be completed. However, Government control of railroads blocked all construction work, and little hope was entertained that Pine Creek would have a railroad until after the war. Although three mines that would be served by the railroad could make shipments, they were all closed down.

PICHER, OKLA.—June 20

The Ways and Means Committee of the Tri-State Mine Safety and Sanitation Association has been working on a plan for bettering the zinc situation. Temple Chapman, chairman, has issued a report on the matter, a part of which is as follows: "We are again confronted with a weaker ore market and higher working costs. The draft and harvest are taking our miners, and the 25% increase in freight rates will increase the cost of coal and supplies. I believe mining costs today for the bulk of the Joplin-Miami output are approximately as follows: Operating cost, \$38 per ton; royalty, \$8; and depreciation and depletion, \$10 per ton, making a total of \$56 per ton. The value of all ores, zinc and lead, loaded last week was about \$50 per ton, thus showing a definite loss. Spelter production has been greatly reduced and is now about 420,000 tons per annum. Of this amount, Joplin ores yield 200,000 tons of metal, or nearly half the total. Scarcity of labor and fuel threatens a further reduction of spelter."

CALUMET, MICH.—June 19

Modification of the Freight Order providing \$15 per car as the minimum rate at which any class of freight might be hauled on a Government-controlled railway, no matter how short the haul, so that only the 25% increase shall apply on copper rock and ore shipments, came as a distinct relief to the copper mines of the Lake Superior district and undoubtedly will prevent the closing of some of the properties. However, an order has gone into effect which applies demurrage rates to cars used for handling copper rock, meaning that a car of rock held at a mill, either filled or empty, or at a mine shaft, for more than the specified length of time without extra charge, will be taxed. This will prove a big item, it is feared, for often it is impossible to have a car hauled away from the shafthouse as soon as it is filled, or, in case the mill bin is filled, perhaps the car cannot be dumped at once. Few of the mining companies own their own rock cars, the Cop-

per Range probably being the only one aside from those that own and control their own rock-hauling railroads, such as Calumet & Hecla, Quincy, Isle Royale and Winona. Furthermore, the Copper Range railroad does not come under federal control.

DULUTH, MINN.—June 21.

Iron Ore Underlying Syracuse Lake will be mined by John R. Van Derlip, Fred B. Snyder and other Minneapolis men who have secured a 50-year lease from the state. They have agreed to pay 50c. a ton royalty to the state and to provide all necessary machinery. According to F. A. Wildes, state mine inspector, there is about 3,000,000 tons of iron ore in the bed of Syracuse Lake, and the state will get \$1,500,000 from the miners if this total is taken out. The board granting the lease was made up of the Governor, the Attorney General and the State Auditor. It was the first lease made under the law passed in 1917.

SPOKANE, WASH.—June 19

Coeur d'Alene Antimony Mining Co., operating on Pine Creek, in the Coeur d'Alenes, is completing the installation of a flotation plant. The old mill has been completely remodeled with new equipment, and the K. & K. flotation system will soon be in operation. Tests made in Los Angeles by the K. & K. company on ores from this property are said to have effected a remarkable saving, and are expected to solve for antimony producers the troubles they have had in securing proper mining methods. The light antimony ore does not respond to the usual methods employed in lead concentration. The new mill will soon be ready for operation and will begin work on the ore in the bins, estimated at 2000 tons. The mine also has large ore reserves blocked out. M. E. Jolly is president of the company.

Spokane Mine Owners say that the new Union Pacific line up Pine Creek will be an important development for the Coeur d'Alene district, and permission to build a railroad from Spokane to Republic probably

will be sought. This would open the copper, gold, silver, and tungsten districts of Spokane and Colville Indian reservations. This line was to have been built in 1918, but surveying was suspended because of war conditions. Another railroad greatly wanted to open up a large mineral district is a line up Methow, in Okanogan County, to connect with Great Northern at Potosi, Authority for construction of this line probably will be asked. The management of Electric Point mine, in Stevens County, has surveyed for a railroad which it hopes to have built this summer from Leadpoint to Northport, 10 miles.

VICTORIA, B. C.—June 15

Electrically Cast Pig Iron is being produced in British Columbia, the new plant having been installed by the Aetna Iron and Steel Co. at Port Moody. It is a six-ton furnace, with a capacity of about 20 tons of pig iron a day. Power is obtained from the Western Power Co. of Canada, 1300 hp. being used in operation. Pig is manufactured from scrap, and the first runs were satisfactory. Contracts for 2000 tons of pig iron have been obtained, a part of which will go to Japan.

Mineral Resources of British Columbia are receiving attention from the Dominion government. Dr. Victor Dalmage, assistant geological surveyor of the Canadian Mines Department, is reporting on two deposits containing mercury on the west coast of Vancouver Island and later will examine certain copper properties. Dr. E. Psitevin, Dominion mineralogist, is investigating platinum occurrences of the placer districts of the provincial interior and is to go into the matter of British Columbia chrome resources.

Matters of Difference between the Consolidated Mining and Smelting Co. of Canada and the mine operators of British Columbia, it is hoped, will be satisfactorily adjusted within the next few months. The Dominion government has authorized the investigation of the company's schedule of charges and

in fact its affairs in general, by a commission, the personnel of which has been announced and seems to be satisfactory to all concerned. Deliberations have been delayed owing to the fact that the members want a more exact definition of their powers. The inquiry, however, is to take place. It is assented to by the company, the management of which has agreed to provide every facility for thorough investigation, and it is believed that the outcome will be the establishment of a better understanding.

Imposition of an Import Duty on all raw ores coming into Canada was referred to during the closing days of the last session of the House of Commons. There is no doubt that, generally speaking, this would meet with considerable favor in British Columbia, but it would not be welcomed by the Consolidated Mining and Smelting Co. of Canada, the largest smelter of Western Canada. The argument against it appears to be strong, and it is considered doubtful whether, under the circumstances, the Federal Administration would adopt such a policy. In the first place, referring only to this Province and without any special knowledge of the conditions in the other Provinces, the imports of ore from the United States are not sufficiently large to warrant it. Second, the importations that have taken place, if the representations of the smeltery officials are to be taken at their face value, have their basis in good sound reason. British Columbia lead ores carry excess zinc. A lead furnace cannot operate with over 12% zinc in the charge. As the British Columbia ores carry more, they must be diluted, and consequently it is necessary to import from Washington lead ores nearly free from zinc. It goes without saying that the Canadian company in order to get this foreign lead must outbid the American smelters nearer at hand, and the former maintain that what they are doing is not to the disadvantage of the Canadian operators, from whom the complaints have come, but rather to their advantage, as it is to render possible the treatment of their product.

The Mining News

ARIZONA

Cochise County

GOLDEN RULE (Manzora)—To resume operations soon. Has been developed and is equipped with a four-stamp mill with plates and tables.

MARBLE DEPOSITS have been discovered in the range of hills south of Dragoon and are being developed by A. T. Kolb of Pasadena, California.

Pima County

GUNSIGHT (Ajo)—Litigation settled and shipping to begin at once.

MAGNATE COPPER (Tucson)—Started second crosscut at right angles to first, both being driven through same formation.

Pinal County

GRAND PACIFIC (Superior)—Drifting toward vein from A level, 100 ft. below tunnel No. 2.

MAGMA CHIEF (Superior)—Preparing to diamond drill. Tunnel is now in 2020 feet.

Santa Cruz County

CONSOLIDATED ARIZONA (Nogales)—Shafts to be sunk to open up orebodies. New machinery to be installed.

HARDSHELL (Patagonia)—Shipping manganese. High grade ore shipped and low grade to be treated upon completion of mill.

WORLD'S FAIR (Patagonia)—To install 100-ton mill.

Yavapai County

BULLARD (Jerome)—New machinery installed.

CALUMET & JEROME (Jerome)—Have struck vein matter carrying copper at 1400 feet.

GADSDEN COPPER (Jerome)—Installation of pump and excavation for station and sump on 1000 level completed. Sinking has been continued.

GREEN MONSTER (Jerome)—Dorothy May shaft down over 580 ft. and in diorite.

JEROME SUPERIOR (Jerome)—Shaft in formation carrying iron and quartz with traces of copper.

SQUAW PEAK (Jerome)—Crosscutting formation at 300 level.

UNITED VERDE (Jerome)—Steamshovel operations soon to be started. W. E. Vanderhoff is to take charge.

GOLD KING (Prescott)—Building road to railroad. Shipping to begin soon.

POCAHONTAS (Prescott)—Shipping to begin soon.

BLACK GIANT (Cuprite)—Completed installation of machinery. Little Giant shaft being sunk deeper. Sulphide ore has been opened up.

ARKANSAS.

Baxter County

CRAWFORD-ANSELL (Mountain Home)—Operating lease on Shiras Brothers' land. Mining carbonate of zinc. First car of ore in mine bins.

Marion County

GROUND HOG (Buffalo)—J. and C. Co. completed a 75-ton mill on the property recently.

TEMPLE (Buffalo)—Completed mill recently. Mine producing zinc carbonates. C. A. Ludlow is in charge.

MONKEY HILL (Flippin)—Completed remodeling of plant, installing new compressor. To produce zinc blende. A. N. Stanfield in charge of operation for States Lead and Zinc Co.

ZINC BASIN (Rush)—Okla.-Ark. Mining Co., operating Zinc Basin mine on Clabber Creek, completing the installation of a 100-ton mill and mining zinc carbonate.

CALIFORNIA

Amador County

LATHAM-SIMONDS (Jackson)—Cyanide plant, working Argonaut tailings, closed on account of high costs of materials and freight. Plant cost \$36,000.

Butte County

CHROME DEPOSIT at Berry Creek operated by W. S. Day and Fred Nix producing large amount of ore, which is shipped to eastern markets.

Eldorado County

CHROME DEPOSITS near Coloma being mined by F. L. Runge, of Placerville.

INDEPENDENCE (Georgetown)—Supplies and materials received at Slate Mountain in preparation for development.

Glenn County

CHROME DEPOSITS near Newville being mined by F. R. Adams. Expect to ship a carload a day to eastern markets.

Humboldt County

HORSE MOUNTAIN COPPER (Eureka)—Two carloads, or about 100 tons, of chrome ore ready for shipment. Ore occurs in large kidneys and was mined by L. Harpst for the company. Ore to be hauled by motor trucks to Essex for rail shipment over the Northwestern Pacific R. R. and has been purchased by the California Chrome Co.

MANGANESE ORE mined in the Shower Pass district being hauled 28 miles to Carlotta by motor trucks for rail shipment to San Francisco. George Littlefield, superintendent.

Inyo County

PINE CREEK TUNGSTEN (Bishop)—Sawmill machinery to be installed near Pipe Creek falls. Road to proposed milling plant to be provided.

COPPER KING (Revenue Canyon)—Flotation plant nearing completion. Large de-

posit high-grade ore said to have been disclosed. All machinery electrically driven.

Mono County

LUNDY DISTRICT reported to have been active during the winter. Parrett mine worked all winter, extracting considerable high-grade ore. Ed. Mason and other leasers preparing to work May Lundy. Hake mines are to renew operations. Hotel at Lundy will be opened in June. Road from Lundy to the main tourist road between Yosemite and Lake Tahoe has been put in good condition. The district lies west of Mono Lake.

Nevada County

DELHI (Columbia Hill)—Temporarily closed down on account of high costs of materials and labor.

ALCALDE GOLD (Grass Valley)—Negotiating for Kenosha mine, situated in Deadmans Flat mining district near Grass Valley.

PRIMROSE (Nevada City)—To be reopened by L. J. Price, of Selma, Fresno County.

Placer County

CHROME SHIPMENTS from Forest Hill are increasing weekly. Nine motor trucks are now hauling ore to Colfax for rail shipment over the Southern Pacific. Ore reported to be high grade.

Plumas County

LONE STAR (Cromberg)—Hydraulic mine being overhauled for operation next season. Water to be carried by ditch now being dug. Dam also to be constructed.

ENGELS COPPER (Engelmine)—Superior mine development progressing favorably.

MOONLIGHT (Greenville)—E. C. Trask and Louis Coffey installing 15-ton mill for copper ore. Mine developed by 500-ft. tunnel. Copper ore carries silver.

WALKER COPPER (Portola)—Flotation plant treating 90 tons a day; 25-ton capacity expected soon. Winze from 300 tunnel level deepened to 425 ft., showing ore the whole length.

Riverside County

GOLD PARK CONSOLIDATED (Palm Springs)—Vanadium disclosed in the California Boy claim. Shaft down 335 ft. and 200 ft. of crosscutting has been done. Development of this and other gold mines in the district has established motor car service from Los Angeles.

Shasta County

AFTERTHOUGHT (Ingot)—To construct an electrolytic zinc plant and a reverberatory furnace to treat copper concentrates.

Tehama County

MANGANESE PEAK (Paskenta)—Reported sold by Alonzo Luce and associates to Los Angeles men. Outcrop appears extensive. Early assessment work was done, but high cost of haulage prevented mining at manganese prices then paid. Manganese occurs in lenticular bed interstratified with red and gray jasper.

Tulare County

PORTERVILLE MAGNESITE (Porterville)—Reported that company has placed an order with the Southern Pacific R. R. for 30 cars to be used in shipping magnesite. This would indicate that the mines will immediately resume operation. W. W. Kamin is president.

COLORADO

Boulder County

BISMARCK (Caribou)—Worked by lessees. Silver-lead-copper ore opened up.

CONGO CHIEF (Caribou)—High-grade silver-lead ore cut at 90 ft. in new shaft on vein. Vein shows improvement at depth. Drifts to be driven at 100 level, and shaft sinking continued. Shaft equipped with electric hoist and pumps.

ROYAL GEM (Caribou)—Being worked by New Orleans company. E. C. Wenzel is manager.

BOULDER CANYON (Ferberite)—Grimm mill has been operating at full capacity since Apr. 1, treating high-grade tungsten ore purchased directly from producers. Beginning this month, the mill to begin handling low-grade ores on a custom basis. Dry concentration process used on high-grade ore, and wet methods on low grade. George V. Bland is president and manager.

FAIRFAX (Salina)—Being developed by Charles Walstrom under lease.

HOOSIER (Salina)—Being developed under lease by Pickard, McClure & Cone. A 90-ft. crosscut has been driven 300 ft. from the portal of the tunnel.

RICHMOND (Salina)—Leased to H. H. McDaniels and Hilton. Surface shafts have

been sunk and payable gold and silver ore has been opened.

DURIAS (Springdale)—Silver ore opened by recent development. Winze being sunk on vein. G. W. Gordon is manager.

GOLDEN AGE (Springdale)—Mine and mill working two shifts. New truck has been added to equipment to haul ore from mine to mill. New 120-ton flotation installation operating successfully.

VASCO (Tungsten)—Lessees opening up tungsten ore in development work. Some shipments made.

HUMBOLDT (Ward)—Grand View tunnel has been cleaned out and placed in working order. Advancing heading, which is now driven 800 feet.

UTICA (Ward)—Property being reopened following settlement of litigation. C. A. Knabe is manager.

WHITE RAVEN (Ward)—Shaft being sunk to 800 level. Formerly developed as a gold mine, but recently silver ore has been opened. Charles Davis is superintendent and I. A. Ewing is manager.

Clear Creek County

CONSOLIDATED MINES (Alice)—Developing Yukon property. Raising 200 ft. from lower tunnel to connect with upper tunnel.

TERRIBLE (Silver Plume)—A raise on the vein has opened a rich pocket of gray copper ore.

INGRAM (Fall River)—Sinking shaft which has been cleaned out and repaired.

COLORADO CENTRAL (Georgetown)—Constructing 100 ton mill to treat dumps of Ocean Wave and Marshall mines. Ore containing silver, lead and zinc, to be crushed, hand picked, ground, and concentrated by tables and flotation.

WIDE WEST (Georgetown)—Air compressor and electric power being installed at Hall tunnel and mine buildings under construction. Tunnel to be driven 500 ft. further to cut Wide West group. Development on Dorothy vein under way. Joseph Terry is manager.

ORE SHIPMENTS from Idaho Springs during May amounted to 56 cars.

HUMBOLDT (Idaho Springs)—Reopened and development work is in progress. Burns-Moore crosscut tunnel to be advanced to cut Humboldt vein. This tunnel has been driven 4200 ft. and has cut an 8-ft. vein of soft low-grade milling ore.

SCEPTER (Idaho Springs)—Stoping lead and zinc ore on tunnel level. Ore concentrated at Jackson mill. Crosscutting to shaft on Astor lode to be done.

PRIMOS CHEMICAL (Urad)—New mill treating 165 tons of ore daily. Two four-horse teams employed to haul concentrates from mill to Empire on Colorado & Southern Ry. A new ball mill has recently been installed. Company plans to begin construction of another milling unit.

Garfield County

GENERAL REDUCTION (Debeque)—To install first 50-ton unit of Scott process to treat oil shale. Eugene A. Sunderlin, Colorado Springs, is managing director.

San Miguel County

TELLURIDE DISTRICT SHIPMENTS of concentrates during May were as follows: Smuggler-Union and Black Bear, 43 cars to Pueblo and 25 to Durango; Tomboy, 45 cars. Total, 113 cars.

BELMONT-WAGNER DEVELOPMENT (Telluride)—Fire at Alta mine destroyed stables, four mules, compressor building, blacksmith shop, upper tramway terminal and snow sheds on May 29. Rebuilding has commenced.

Summit County

BLUE RIVER (Breckenridge)—Denver company to operate Fox Lake and other properties on Yuba Dam flats. Ore contains copper and bismuth in flat vein similar to that of Molly B. Work has started under direction of M. M. Howe.

MONTE CRISTO (Breckenridge)—Mill operating, but concentrate shipments delayed on account of slow breaking up of snow roads.

AMERICAN METALS (Buffehrs)—About 75 tons of 80% molybdenum concentrate produced in new milling plant per month.

Teller County

EL PASO EXTENSION (Cripple Creek)—New oreshots opened in development work by leasing company operating Index mine. Main shaft to be sunk to 1250 level.

EL PASO GOLD KING (Cripple Creek)—Shaft down 1007 ft. to be sunk deeper.

IDAHO

Boundary County

IDAHO CONTINENTAL (Port Hill)—Working three shifts in mill, two in mine, and producing 28 tons ore per day. Owned by A. Klockman and associates, of Spokane, Washington.

Idaho County

NEW YORK (Ten Mile)—Five stamps installed and five more on ground. Free gold recovered on plates and two concentrators.

YELLOW PINE (Ten Mile)—Two-stamp mill paying all costs of development.

Shoshone County

AJAX (Burke)—Suspended work in drift from Moonlight shaft and drifting west on Oom Paul level.

AMAZON-DIXIE (Mullan)—Cutting station on 1106 level preparatory to crosscutting north and south.

MAYFLOWER (Mullan)—Recently resumed work. To develop. Portal of tunnel within 200 yd. of railroad.

NATIONAL COPPER (Mullan)—To close down. Oxidized condition of low-grade ore made close mill recovery impossible. Company has 500-ton mill, new hoist and other equipment.

BEAR TOP (Murray)—Lease held by the Henrietta Development Co. taken over by Patrick Burke. Large body of lead ore opened.

JACK WAITE (Murray)—Inactive since midwinter, being occupied in reconstruction of 10-mile road. Shipments soon to begin. Considering building mill this summer.

BIG CREEK (Wallace)—To install crusher and jigs at portal of tunnel.

INTERSTATE-CALLAHAN (Wallace)—Work confined to development while extensive changes are being made in the mill. Flotation plant treating zinc tailings dump.

SENATOR (Wallace)—Crosscut being driven from Star workings to cut the Flynn vein on Flynn group.

CALEDONIA (Wardner)—Efforts to find ore shoot in the lower or Keating tunnel have been without success. Ore in upper workings is nearing exhaustion.

DOUGLAS (Wardner)—Lease surrendered by Anaconda Copper Mining Company.

LAST CHANCE (Wardner)—To be closed down and abandoned by Federal Mining and Smelting Company.

KANSAS

Joplin District

SILVER FOX (Baxter)—New mill well under construction six miles west of Baxter. Installing machinery.

QUAKER VALLEY (Baxter Springs)—To build 150-ton mill at estimated cost of \$50,000. Rollers, crushers, engines, boilers and sludge tables to be purchased. W. W. Wakeman is superintendent.

PLAYTER BROS. (Joplin)—Sinking new shaft on lease west of mine they recently sold.

CRESCENT (Miami)—Office, change house and other buildings built. Sinking shaft and to erect mill soon.

DEARMOND (Miami)—Water being successfully handled. Mill again operating.

MINNESOTA

Mesabi Range

DRAPER (Calumet)—Overburden to be stripped by Winston-Dear, of Hibbing, for Savage interests. John F. Murphy is superintendent.

SOUTH AGNEW (Hibbing)—New timber shaft being sunk.

MISSOURI

Joplin District

BADGER (Joplin)—To begin work July 15 on new 150-ton mill to cost \$60,000. Require sludge and slime tables and general mill equipment. T. E. Forester is manager.

PFAEFFLE & KELLEY (Joplin)—To remodel its 150-ton concentrator. Need belts, slime tables, scales and cars. Wm. Pfaeffle is superintendent.

PIACHARD & CLEAR (Joplin)—Remodeling mill and placing new machinery. Require belts, boilers, cars and conveyors.

PLAYTER (Joplin)—To build 150-ton mill at Silver Fox mine near Monarch, Kan. Will purchase tables, drills and power equipment. George H. Playter is manager.

CAROLYN METAL (Joplin)—To build new 300-ton mill at estimated cost of \$100,000. Nels Darling is superintendent. To buy sludge and slime tables, power plant equipment and air compressors.

DOUTHAT-MIAMI (Joplin)—Installing 14 hand jigs at new shaft where strike has been made.

KLEIN & STERN (Joplin)—To begin erection August 1st of new 150-ton mill. Have not purchased equipment.

MIAMI YELLVILLE (Joplin)—To remodel mill and add new machinery. To purchase sludge tables, belts, engines and boilers.

SEALS & RADER (Joplin)—Building small mill at old New State mine at Commerce.

MONTANA

Beaverhead County

BANNACK (Bannack)—Practically closed down.

DELMONTE (Bannack)—Operating under lease.

PEARL SMITH (Dillon)—Mining and shipping graphite ore used for Government purposes.

PILARIS (Dillon)—Taken over by eastern interests. A. M. Anderson is in charge.

Jefferson County

MONTANA CONSOLIDATED (Basin)—To open up 400 and 500 levels of Comet mine.

Lincoln County

ROSE CONSOLIDATED (Libby)—To resume before Aug. 1, with indebtedness all paid by assessments. To mine tungsten, gold and copper.

Mineral County

INTERMOUNTAIN COPPER (Iron Mountain)—Shipped five carloads concentrates. Mill operating two shifts.

Silver Bow County

ANACONDA (Butte)—Has resumed operations at Tramway mine.

BOSTON & MONTANA (Butte)—To complete spur to Elkhorn properties from Oregon Short Line early this summer and push completion of 500-ton mill unit.

BUTTE & SUPERIOR (Butte)—U. S. Supreme Court has denied application for writ of certiorari by this company in its litigation with the Clark-Montana Realty Co., commonly known as the Elm Orlu-Black Rock case.

NEVADA

Esmeralda County

GOLDFIELD CONSOLIDATED (Goldfield)—Several leases given out and good returns are being secured.

Humboldt County

CONSOLIDATED SPANISH BELT (Belmont)—Tunnel in 1195 ft. passing through decomposed granite and soft shale and expects to cut Ernest vein soon.

INLAY (Oreana)—To reopen and resume milling.

NEVADA PACKARD (Rochester)—Milling 100 tons silver ore daily and mine development promising.

ROCHESTER COMBINED (Rochester)—To begin milling operations soon.

RYE PATCH (Rye Patch)—Shipping silver dump ore to northern California smeltery.

Lincoln County

PRINCE CONSOLIDATED (Pioche)—Flotation mill at Bullionville temporarily out of commission.

Mineral County

CANDELARIA (Belleville)—F. C. Beedle to soon finish treating accumulated tailings for recovery of quicksilver.

DREW (Mina)—Producing mercury at cinnabar mine 14 miles west of Mina.

LOUISIANA CONSOLIDATED (Mount Montgomery)—Milling 50 tons lead-silver daily from Tybo mine. Handicapped by high haulage costs.

SILVER DYKE (Sodaville)—Mining tungsten ore and shipping to mill at Toulon. Mill recovery is 85 per cent.

Nye County

GOLD MOUNTAIN DISTRICT is being actively developed. Gold Zone, Divide Extension, Dividend and other prospects are active. The electric-power line from Tonopah to Gold Mountain is being extended.

MANHATTAN CONSOLIDATED (Manhattan)—Drifting east and west on east orebody on fifth level. Ore of fair milling grade.

UNION AMALGAMATED (Manhattan)—Shaft at permanent water level. To continue foot-wall drift on 600 level. Sinking pump has been installed on water level.

WHITE CAPS (Manhattan)—To cut foot-wall vein of shaft orebody, which contains two parallel streaks of ore, one in hanging wall portion of limestone and one in the foot wall.

WILLIAM PATRICK (Manhattan)—To install small amalgamating plant to handle free milling ore.

AMERICAN ONYX (Manhattan)—Quarrying chalcedony deposit eight miles north and east of Manhattan.

DIVIDE (Tonopah)—Resumed shaft sinking and will soon reach 300-ft. level. Vein carries silver and molybdenum on two upper levels.

OKLAHOMA

Joplin District

CENTURY (Douthat)—To erect a 150-ton mill at cost of \$60,000. In the market for sludge and slime tables and crushers.

LUCKY SYNDICATE (Douthat)—Mill destroyed by fire to be rebuilt.

SINDEN (Douthat)—Has renewed operations. Repairs, following near destruction by fire, completed.

BUCKSHOT MINING (Miami)—To erect 150-ton mill at mine near Hockerville. To purchase tables, crushers, conveyors and power-plant equipment. Robert E. Brooke is superintendent.

INDIAN CHIEF (Miami)—Mill of 300-ton capacity to be erected this summer. To purchase sludge and slime tables, crushers, drills, engines and boilers. John L. Sullivan in charge.

JEFFERSON (Miami)—Has purchased machinery for new 300-ton concentrator to be erected on lease east of Picher. Shaft down 230 ft and 12 ft. in ore. E. S. Perry, of Miami, is manager.

KENTEX (Miami)—Completed well. Mill completed some weeks ago to be started at once.

MIAMI WONDER (Miami)—Began construction of 250-ton mill. Shaft down 208 ft. and drifting has developed good ore. A. V. Ellis, Miami, is vice president and superintendent.

ST. LOUIS LEAD & ZINC (Miami)—New mill to be started as soon as draining operations are finished.

TULSA-SAPULPA-MIAMI (Miami)—Completed drilling and sinking shaft on lease at Hockerville. J. P. Dunaway, Miami, is president and manager.

NEBO (Peoria)—Concentrator of 150-ton capacity to be built. To purchase jigs, tables, crushers and other mill and power-plant equipment. R. C. Croslin is superintendent.

PALATINE (Peoria)—To build 250-ton concentrator. Equipment not yet purchased. E. L. Warner is manager.

EAGLE-PICHER (Picher)—First mules used underground in Oklahoma field at Picher-Netta mine. Oklahoma law requires that mules used underground be taken above ground one day in every twelve.

AURORA (Quapaw)—Building 150-ton mill near Lincolnville. John W. Hale is manager.

LUCKY PAT (Quapaw)—Building mill on lease east of Lincolnville.

O. & T. OIL (Quapaw)—Sinking third shaft at old Katy mine and operating mill.

PIONEER (Quapaw)—Installed 150-hp. boiler. Shaft down 190 ft. Albert Spencer is superintendent.

LUCKY BILL (Tar River)—Sinking well for boiler and drinking water purposes.

OREGON

Grant County

TRI-STATE CHROME (Canyon City)—Mill has begun operations under direction R. E. M. Strickland.

Jackson County

RANIER MERCURY (Gold Hill)—Made initial shipment of 40 flasks from its 12-pipe furnace operation on the Utah and Burtleson groups. Chisholm group is also operating 12-pipe furnace on rich ore from new drift under old workings.

SOUTH DAKOTA

Custer County

SPOKANE (Custer)—Operating 100-ton concentrator on lead and silver ores.

Pennington County

BLUE LEAD (Hill City)—Shipping copper ore.

ELKHORN TUNGSTEN (Hill City)—Being unwatered and to develop. Shaft to be sunk deeper.

LUNA (Hill City)—Mills Brothers constructing small concentrator to be used on tungsten and tin ores.

UTAH

Juab County

TINTIC DISTRICTS SHIPMENTS for the week ended June 15 totaled 152 carloads.

TINTIC CENTRAL (Eureka)—Leased to F. W. Blackwell. Shaft now down 1075 feet.

CENTENNIAL-EUREKA (Eureka)—Exploration work continuing on 1900 level, just above water level.

CHIEF CONSOLIDATED (Eureka)—To prospect their holdings at northern and eastern ends of the district by diamond drilling.

EUREKA CROESUS (Eureka)—Opened up new orebody.

OLD SCRANTON (Eureka)—Carbonate iron ore low in silica shipped. Also recently shipped one carload of zinc ore.

RIDGE AND VALLEY (Eureka)—New silver-lead ore found on 1800 level.

SCRANTON (Eureka)—Iron ore of good average being shipped to smelteries, coming from DelMonte side of property. Car of zinc ore recently shipped by Scranton Leasing.

UTAH (Fish Springs)—Again being worked. Small mill treating dump ore of good grade.

IRON BLOSSOM (Silver City)—To prospect on 2200 level.

Salt Lake County

COLUMBUS-REXALL (Alta)—Lack of cars and teams prevents larger shipments to Wasatch.

MICHIGAN-UTAH (Alta)—Shipping silver-copper ore from Copper Prince tunnel. Patsy Marly Hill being driven through, and shipment expected within few weeks.

Tooele County

GARRISON MONSTER (Gold Hill)—Silver-lead mining temporarily suspended at this company's Dutch Mountain property, and attention given to development of promising showings of copper ore. Test shipments to smelter brought good returns.

WESTERN UTAH COPPER (Gold Hill)—Deeper work and thorough development to be undertaken.

WASHINGTON

Ferry County

MAMMOTH (Republic)—Group leased to John W. Lyoyd and William Monteith, who have begun development.

Stevens County

SILVER BELL (Loon Lake)—To begin shipping about July 1.

CANADA

British Columbia

FLORENCE SILVER (Ainsworth)—Mill has increased from 8 to 12-hour basis. Sufficient ore at smeltery and in transit to cancel indebtedness.

Ontario

ELK LAKE—Elk Lake-Gowganda road to be placed in good condition. Miller Lake-O'Brien is principal shipper, and several others contemplate shipments.

CASTLE (Gowganda)—Being developed by the Threthewey, of Cobalt.

DOME (Porcupine)—Disposing of stocks of supplies. Property is due for a shut-down of a couple of years.

WEST DOME (Porcupine)—Closed down on account of labor shortage.

HUDSON BAY (Cobalt)—Vein cut on second level shows rich ore.

MINING CORPORATION (Cobalt)—Taken option on water power on Montreal River near Fort Matachewan. Company has number of claims there and has recently taken an option on the Davidson property adjoining the Otisse.

NATIONAL (Cobalt)—Flotation mill treating tailings from Silver Cliff.

NIPISSING (Cobalt)—High-grade mill treated 195 tons of Nipissing and customs ore during May.

COLORADO DEVELOPMENT (Fort Matachewan)—Started to diamond drill Otisse property, on which it holds option.

MILLER INDEPENDENCE (Boston Creek)—New vein showing gold and gold tellurides was found toward north side of property some distance from present workings.

PATRICIA (Boston Creek)—Mill running. Main shaft down 200 feet.

The Market Report

SILVER AND STERLING EXCHANGE

June	Sterling Exchange	Silver		June	Sterling Exchange	Silver	
		New York, Cents	London, Pence			New York, Cents	London, Pence
20	4.7530	99½	48½	24	4.7530	99½	48½
21	4.7530	99½	48½	25	4.7530	99½	48½
22	4.7530	99½	48½	26	4.7530	99½	48½

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

June	Copper		Tin		Lead		Zinc
	Electrolytic	Spot	N. Y.	St. L.	N. Y.	St. L.	St. L.
20	*23½	†	7.82½	7.75	@8½	@8½	8½
21	*23½	†	7.82½	7.75	@8½	@8½	8½
22	*23½	†	7.82½	7.75	@8½	@8½	8½
24	*23½	†	7.82½	7.75	@8½	@8½	8½
25	*23½	†	7.90	7.75	@8½	@8½	8½
26	*23½	†	7.90	7.75	@8½	@8½	8½

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

† 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 quotations for electrolytic 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 20c. per 100 lb. above St. Louis.

LONDON

June	Copper			Tin		Lead		Zinc
	Spot	3 Mos.	Electrolytic	Spot	3 Mos.	Spot	Spot	Spot
21	110	110	125	329	329	29½	54	
22								
24	110	110	125	332	332	29½	54	
25	110	110	125	332	332	29½	54	
26	110	110	125	332	332	29½	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—June 26, 1918

Some large transactions in spelter, the general feeling that there is something in the air with respect to copper, and some mystification on the part of the public with respect to the situation in lead, were the features of interest in the metal markets this week.

Copper—It is in the air that the price for copper is going to be advanced in the near future, especially to compensate for the increase in freight rates. We think that there is justification for this feeling and that such an advance is likely soon to be announced. In the meanwhile, producers are uncertain about booking orders, and in general they are willing to book them only on the condition that they will be subject to the new price. In other words, they are willing to book an order at 23½c., subject to revision. If the price should be advanced on July 1 to 25c., for example, copper shipped previously to that time would be billed at 23½c., while subsequent shipments would be at 25c. It may be remarked that up to June 1 the price for copper was arranged by agreement between the War Industries Board and the producers. Since June 1 there has been no agreement, the producers not having assented to the continuation of the price of 23½c., which was promulgated by the War Industries Board. The question whether a new price will be retroactive to June 1 occasions considerable discussion. The general opinion is that it will be least awkward to cause a new price to prevail from the date of arrangement.

Copper Sheets are quoted at 33½c. per lb. for hot rolled, and 1c. higher for cold rolled. Copper wire is quoted at 27@27½c. f.o.b. mill, carload lots. Increases are due to advanced labor costs.

Tin—Very little business was done in this market. Arrivals have been fairly heavy, but stocks do not increase. Licenses for the shipment of Lamb & Flag have temporarily been held up. At the close of the week, Banca, spot, was quoted at 95@97c., and tin of 99% grade, at 92@93c., but supplies of any kind were very limited. Singapore quoted £337½ on June 20; £338½ on the 21st; £340 on the 24th; £342½ on the 25th; and £345½ on the 26th.

Lead—Producers advanced their price to 7.90c., New York, on June 25, the St. Louis price remaining at 7.75c. The advance in New York price was simply to correspond to the increase in the freight rate differential that became effective on that date. The actual increase in that differential will probably be a little more than 15c. per 100 lb., but nobody knows yet just what it will be, and it was deemed undesirable to overestimate it. Some further adjustment will probably be necessary. Business reported by producers this week was rather small, but the situation is very tight, producers being unable to supply any more lead than they are doing already.

Zinc—The Navy Department placed an order during the week for 1000 tons of Grade B and 500 tons of Grade C, which were taken at 9½c. and 8.36c., respectively, New York. The Ordnance Department of the Army placed an order for 9000 tons of Prime Western. Bids were opened on June 21, but the order was not definitely placed until June 24. The recent advance in the market is attributable to the prospect of large Government business, together with contraction in the monthly rate of production and reduction in the accumulation of unsold stocks. The consummation of the Government business, together with private business of considerable volume, caused the market to be very firm during the last week, but in the latter half it became dull, the volume of inquiries shrinking materially.

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

Aluminum—Price fixed at 33c. per lb. for lots of 50 tons or more, ingot, 98-99% grade. Price established June 1 and continues to Sept. 1.

Antimony—The market was dull and steady at about the same prices as in the previous week. We quote spot at 13½@13½c. We quote futures at 11½@12c., c.i.f., in bond.

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 minimum and \$1.75 maximum per lb.

Nickel—Market quotation is 40@45c. per pound.

Quicksilver—California virgin is strong around \$125. Mexican virgin is quoted nominally at \$118. San Francisco reports by telegraph \$113.50, steady.

Gold, Silver and Platinum

The general stock of money in the U. S. on June 1 totaled \$6,615,007,632; of this, \$3,043,879,782 was in gold coin and bullion, \$518,583,959 in standard silver dollars and \$231,646,325 in subsidiary silver. Money in circulation on June 1 was \$5,246,662,253.

Silver—No new features in the silver market have manifested themselves, with the exception that China exchanges have advanced to a point which makes it possible for banks to buy in San Francisco on the same basis as the Government. London remains at 48½d. and New York official is still quoted as 99½c. per oz. fine.

By mistake Sterling exchange on June 14 and 15 was incorrectly quoted in the "Journal" of June 22. The correct figure for those dates is 4.7550.

Mexican dollars at New York: June 20, 77; June 21, 77; June 22, 77; June 24, 77; June 25, 77; June 26, 77.

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

In our issue of June 22, through a typographical error, we published the price of palladium as \$125. This should be \$135 per oz., the fixed price.

Ore Markets

Joplin, Mo., June 22—Blende, per ton, high, \$76.44; basis 60% zinc, premium, \$75; Class B, \$55; prime western, \$45@50; calamine, per ton, 40% zinc, \$35@25. Average selling prices: Blende, \$47.75; calamine, \$34; all zinc ores, \$47.27.

Lead, high, \$96.40; basis 80% lead, \$95@90; average selling price, all grades of lead, \$90.06 per ton.

Shipments the week: Blende, 8314; calamine, 296; lead, 1296 tons. Value, all ores the week, \$523,750.

Sellers came to the conclusion that a higher price was due them, and pointedly declined to accept feelers sent out the early part of the week for a continuation of \$45 basis, and, holding firm, the buyers advanced the price to \$50 basis, though a few early sales were made on the \$45 base. The low production and eager demand assisted sellers in obtaining the raise. Cars were scarce, doubtless being diverted to points near the harvest fields.

Platteville, Wis., June 22—Blende, basis 60% zinc, highest price reported paid for premium grade was \$65.85 per ton; high lead blende product sold down to \$45 per ton; lead ore, basis 80% lead, \$85 per ton. Shipments reported for the week were 3073 tons blende, 159 tons galena and 539 tons sulphur ore. For the year to date the totals are 63,637 tons blende, 3172 tons galena and 25,858 tons sulphur ore. During the week 2927 tons blende was shipped to separating plants.

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. Tonnage is extremely difficult to obtain, and of the allotment that was scheduled to be delivered in April and May, only a small portion has come in. Domestic pyrite is selling at prices ranging from 25 to 30c. per unit, f.o.b. mine. Unchanged.

Tungsten Ore—The market remains steady, with prices ranging from \$19 to \$24 per unit, according to grade. High-grade ores free from impurities are quoted at from \$23 to \$24 per unit for 65% and 70% WO₃, respectively; low-grade ores containing impurities are quoted at \$19 to \$20 on the basis of 60% or over.

Chrome Ore—Unchanged at \$1.50 per unit, f.o.b., shipping point, basis 40 per cent.

Manganese Ore—Unchanged.

Molybdenum Ore—Situation is unchanged.

Iron Trade Review

PITTSBURGH—June 25

The decision of the War Industries Board announced yesterday, that iron and steel price limits as hitherto fixed should stand for another three months, through Sept. 30, with an advance in iron ore, conforms with the majority opinion here entertained. There were the usual arguments on the part of the producers that advances would be justified by changes in conditions, including wage advances and the heavy freight advances effective today; but, on the other hand, the Government feels that the producers are making large profits, and with the Government buying the major part of the output, the money spent in higher prices could not be recouped by excess-profits taxes unless the percentages were extremely high. As iron-ore prices are based at Lake Erie docks, and the freight advance is paid by ore producers from mine to upper Lake ports, the advance in iron ore represents a passing of the freight advance on to the ore buyer, the furnaceman, and this might appear inconsistent with the refusal to advance pig-iron prices and thus pass the ore advance and the freight advances on coke and limestone on to the consumer again, but the point is that the ore prices ruling are those established Nov. 23, 1916, when pig iron was considerably lower than at present. The ore freight advance is 30c. per net ton, ore prices being per gross ton, and the excess of the ore price advance, 45c., is perhaps due to the fact that ores more commonly run below the base iron content, the differentials being based on much lower rail and Lake rates than now obtain, so that the ore shipper pays freight on more tons of ore than he is paid for on the basis of iron content.

Nearly all the merchant pig iron and steel products produced is going out on war orders or against the preference list in peace industries, prescribed June 6. Producers estimate, however, that not more than 10% of the existing demand is left out, having neither priority orders or preference, and thus the rigid distribution of material now obtaining adversely affects only a small proportion of the consumers, and really is not nearly as drastic as appears on the surface.

Pig Iron—There continues to be considerable demand for basic iron, and many allocations of orders to merchant furnaces are being made by the War Industries Board, private sales being infrequent. Prices remain: Bessemer, \$35.20; basic, \$32; No. 2 foundry, \$33; malleable, \$33.50; forge, \$32, f. o. b. furnace. The freight from Valley furnaces to Pittsburgh increases today from \$1.10 to \$1.40, having been 95c. prior to May 22.

Steel Products—The more important prices, just reaffirmed for another three months, are: Billets, \$47.50; small billets, \$51; sheet bars, \$51; slabs, \$50, f. o. b. Pittsburgh or Youngstown; rods, \$57, f. o. b. Pittsburgh; Bars, 2.90c.; shapes, 3c.; plates, 3.15c.; blue annealed sheets, 10 gage, 4.25c.; black sheets, 28 gage, 5c.; galvanized sheets, 28 gage, 6.25c.; all f. o. b. Pittsburgh. Originally bars, shapes and plates were set to be based Pittsburgh or Chicago, but the establishment of Chicago as a separate basing point, a procedure that started the steel trade last September, has now been rescinded.

Ferromanganese—The ferromanganese market is only fairly active, but is steady at \$250, delivered, for 70%, with \$4 a unit for higher manganese contents. Spiegeleisen for prompt shipment is scarce, and is reported to have brought \$75 and higher in small lots, the regular market remaining quotable at \$70, furnace, for 16 to 18%.

Connellsville—The 15,000 or 20,000 tons a month of coke that will be released about Aug. 1 when the Youngstown Sheet and Tube Co. completes its additional 102 by-product ovens has been sold for the remainder of the year to other consumers, at the Government price. The few contracts expiring June 30 have in general been renewed between the same parties, most of them having already been at the Government price. A fair tonnage of spot coke is picked up each week by representatives of furnace interests. Scarcely any coke brokerage business being done, as the broker can secure his margin only from the producer, and the producer has no occasion to pay a margin. For the last eight or nine weeks production in the Connellsville and lower Connellsville region has been steady at about 341,000 tons a week. Prices remain: Furnace, \$6; foundry, 72-hour selected, \$7; crushed, over 1-in., \$7.30, per net ton at ovens.

STOCK QUOTATIONS

Table with columns: N. Y. EXCH.†, June 25, BOSTON EXCH.* June 25. Lists various stocks like Alaska Gold M., Adventure, Ahmeek, etc.

N. Y. CURB† June 25

Table listing various commodities and stocks under N. Y. CURB† June 25, including Big Ledge, Butte & N. Y., Butte Detroit, etc.

BOSTON CURB* June 24

Table listing various stocks under BOSTON CURB* June 24, including Alaska Mines Corp., Boston Fly, Boston & Mont., etc.

SAN FRAN.* June 25

Table listing various stocks under SAN FRAN.* June 25, including Alta, Andes, Best & Belcher, Caledonia, etc.

SALT LAKE* June 24

Table listing various stocks under SALT LAKE* June 24, including Bannack, Cardiff, Colorado Mining, etc.

TORONTO* June 24

Table listing various stocks under TORONTO* June 24, including Adanac, Bailey, Beaver Con., etc.

STOCK QUOTATIONS—Continued

Table with columns: COLO. SPRINGS June 25, LONDON Apr. 15. Lists stocks like Cresson Con., Doctor Jack Pot., Elkon Con., etc.

MONTHLY AVERAGE PRICES OF METALS

Table showing monthly average prices for Silver in New York and London from 1916 to 1918.

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

Table showing monthly average prices for Copper in New York and London from 1917 to 1918, categorized by Electrolytic, Standard, and Electrolytic.

Table showing monthly average prices for Tin in New York and London from 1917 to 1918.

Table showing monthly average prices for Lead in New York, St. Louis, and London from 1917 to 1918.

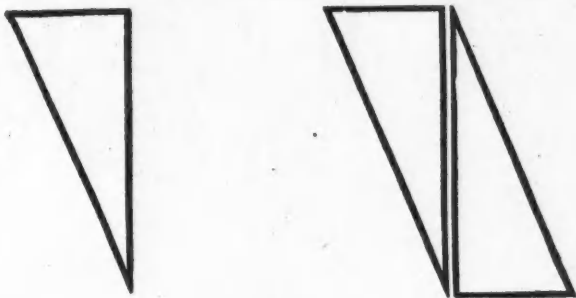
Table showing monthly average prices for Spelter in New York, St. Louis, and London from 1917 to 1918.

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

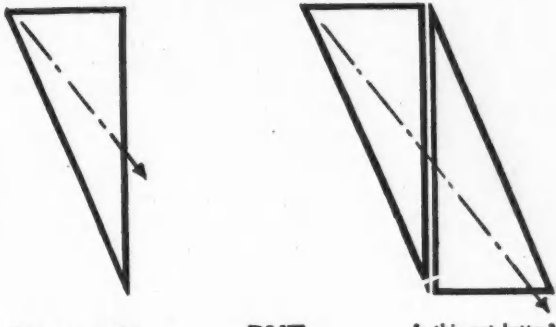
Table showing monthly average prices for Pig Iron in Bessemer, Basic, and No. 2 Foundry from 1917 to 1918.

† As reported by W. P. Snyder & Co.

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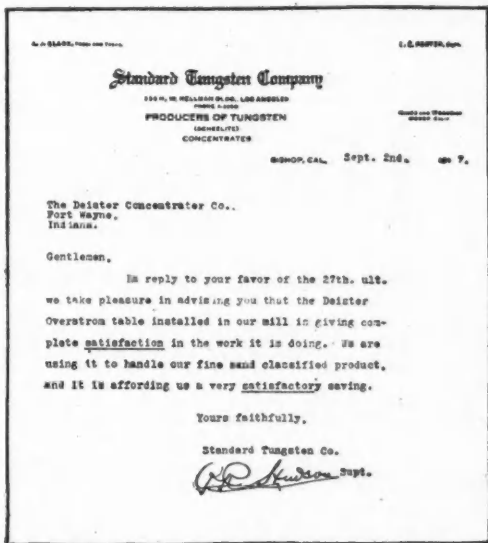
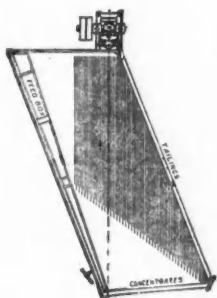
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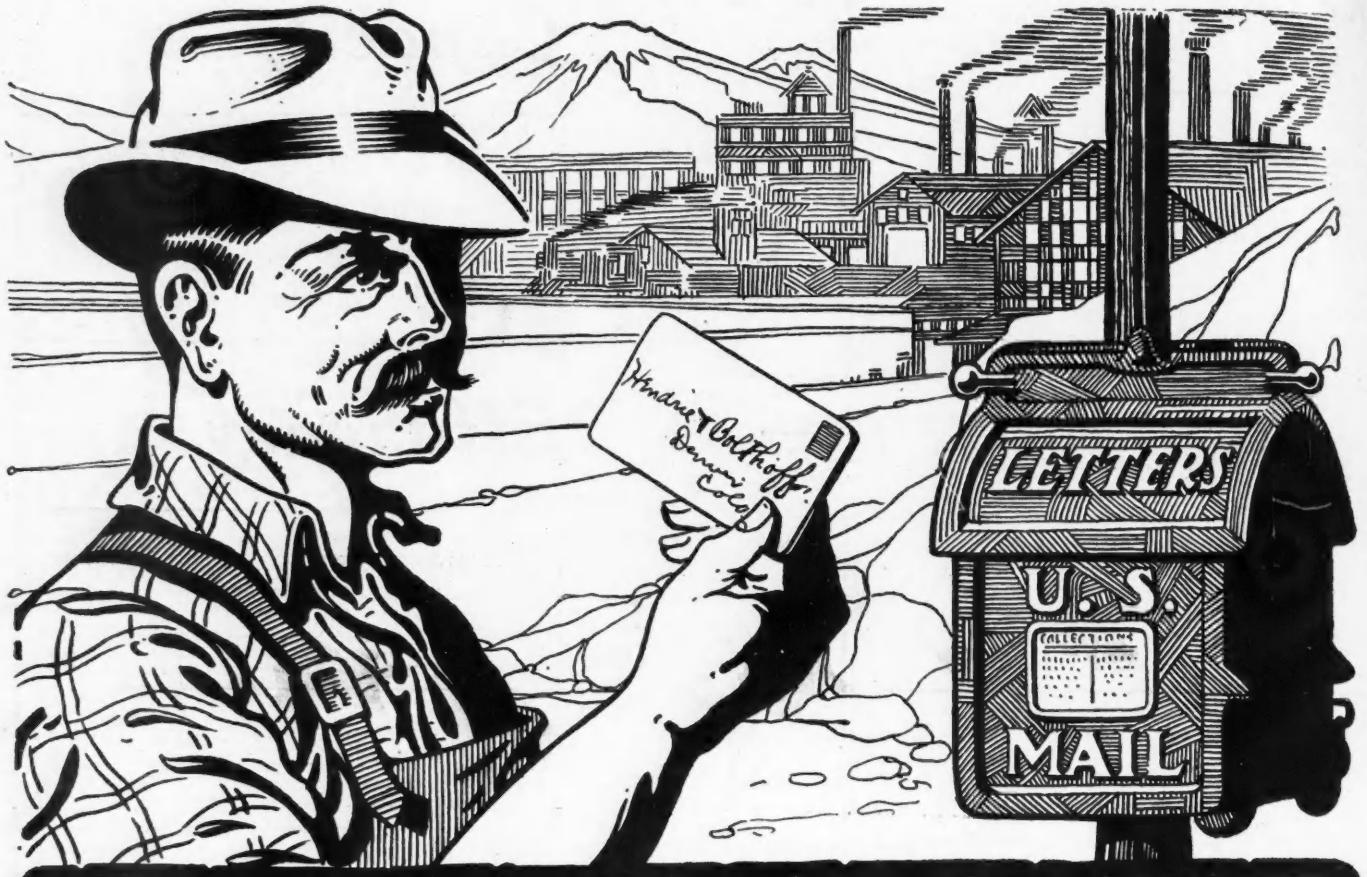
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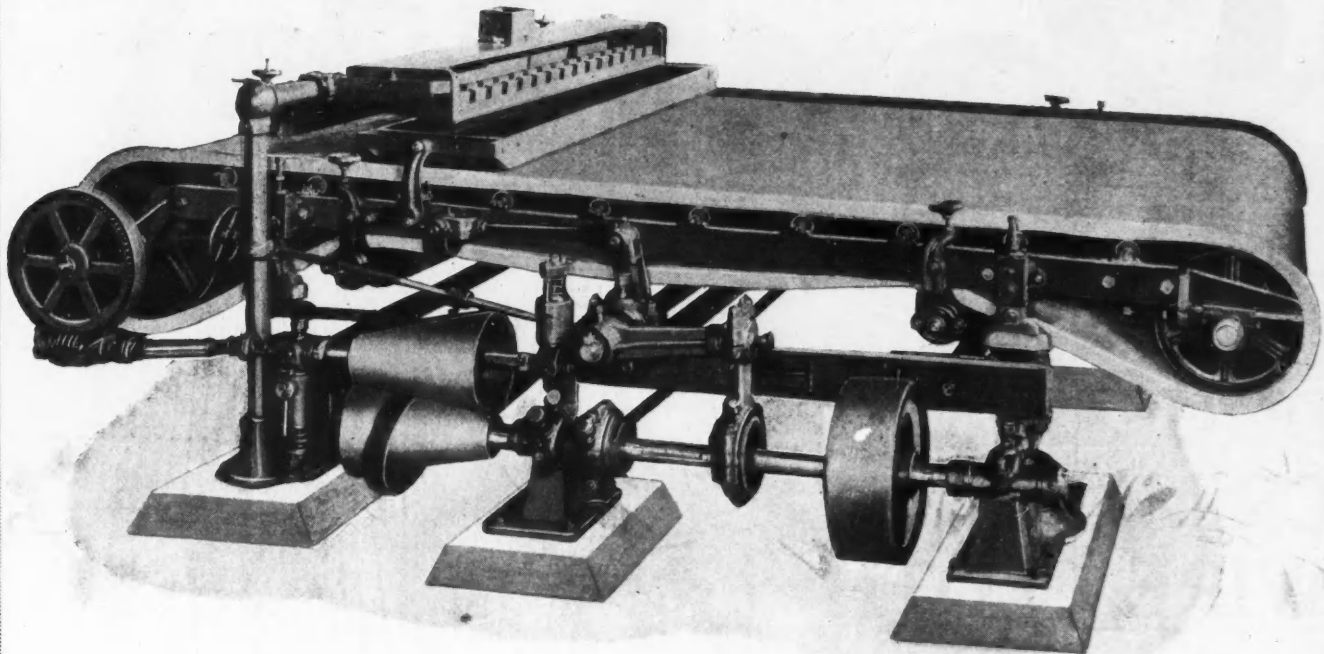
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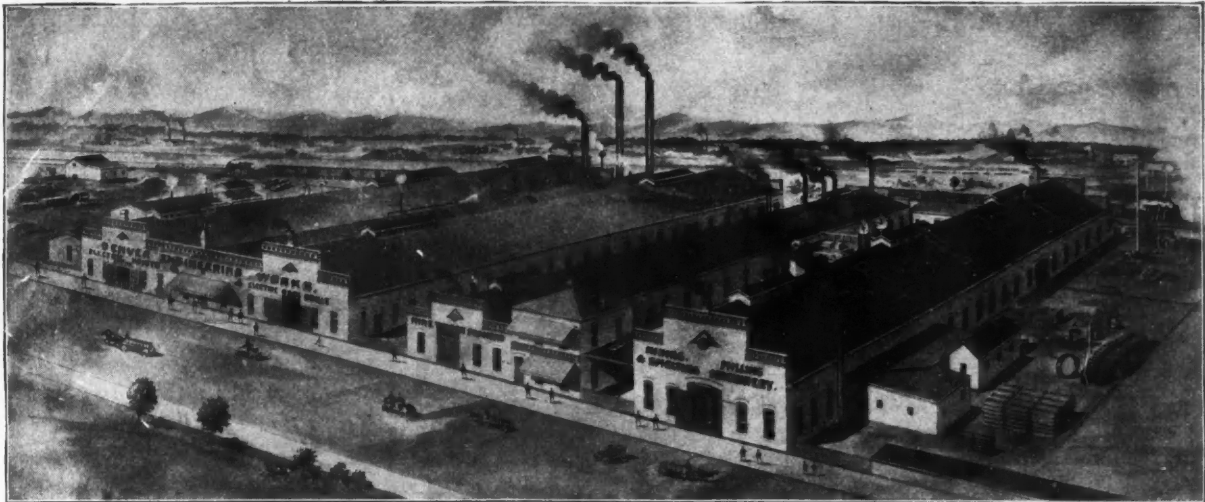
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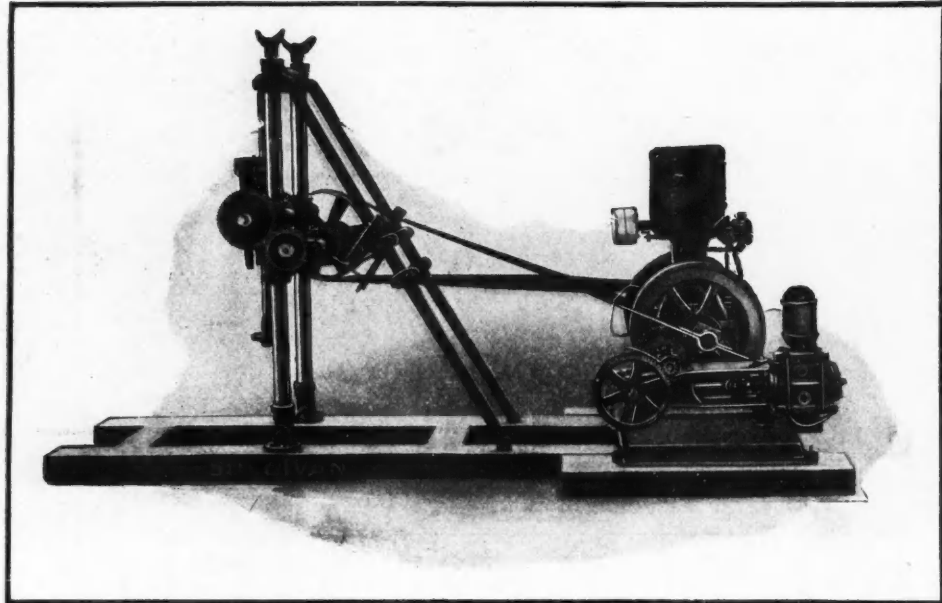
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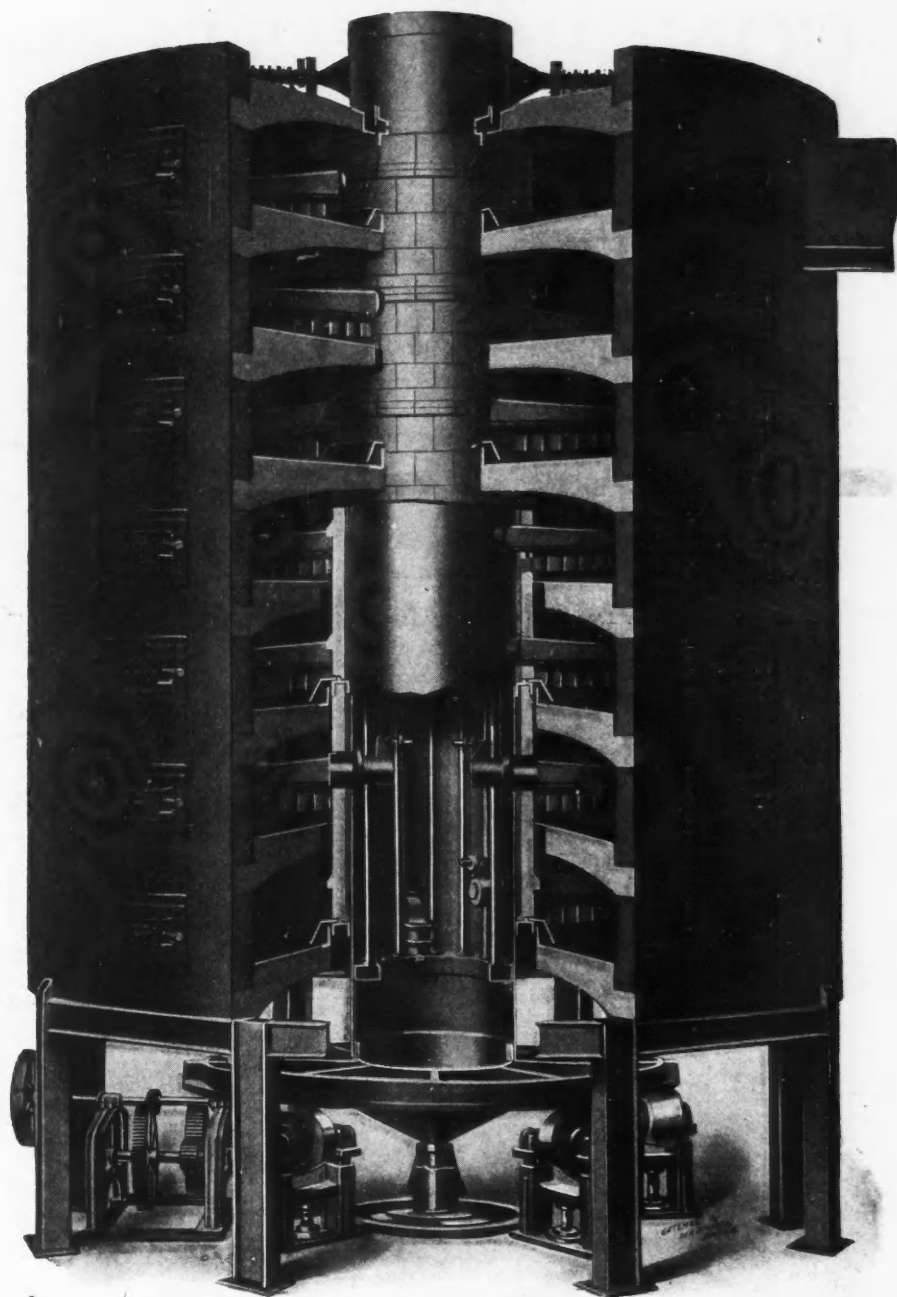
New York
 Paris
 Petrograd
 Pittsburgh
 Salt Lake City

San Francisco
 Spokane
 St. Louis
 Sydney, Aus.

Toronto
 Turin, Italy
 Vancouver
 Wallace, Idaho

The Wedge Mechanical Furnace

Patented



Roasting Pyrrhotite Ore Economically

A PYRRHOTITE and chalcopyrite ore, containing nickel, with a sulphur content of about 24% is being roasted in Wedge Furnaces WITHOUT THE USE OF FUEL.

We are continually developing roasting furnaces for different problems, which are showing economy over other types of furnaces heretofore used.

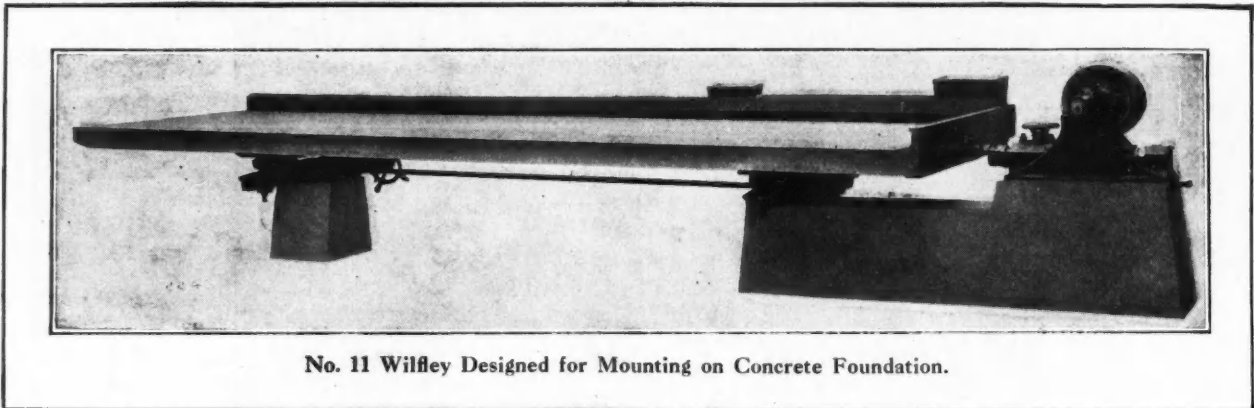
Write us in detail regarding your roasting requirements.

Wedge Mechanical Furnace Company

Greenwich Point, Philadelphia, Pa.

The WILFLEY Concentrating Table With CONCRETE Foundations!

Another Improvement Added to the Famous Pioneer
Concentrating Table



No. 11 Wilfley Designed for Mounting on Concrete Foundation.

As an aid in the conservation of steel the No. 11 Wilfley has been designed for mounting on concrete foundations.

Shipping weight only 2000 lbs.

The new Wilfley maintains the old Wilfley principles and the same Wilfley efficiency both in mechanical construction and metallurgical operation.

Note the extreme simplicity of the under-structure as shown below.

Only a Wilfley Table could carry such improvements without radical changes in design. Where concrete is available the savings in purchase of the No. 11 Wilfley are threefold.

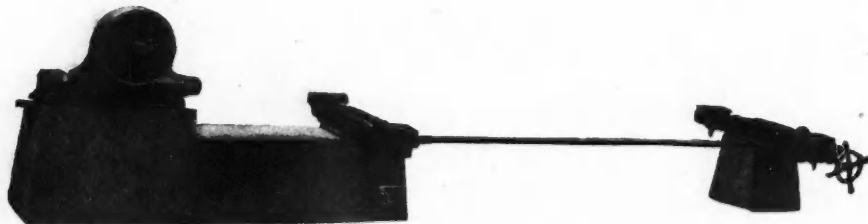
First—Saving in first cost.

Second—Saving in shipping charges.

Third—Saving in erection charges.

The Wilfley always leads—others follow.

No. 5, No. 6, No. 9, No. 10 Wilfleys are also available for prompt shipment.



Manufactured and sold only by

THE MINE & SMELTER SUPPLY COMPANY

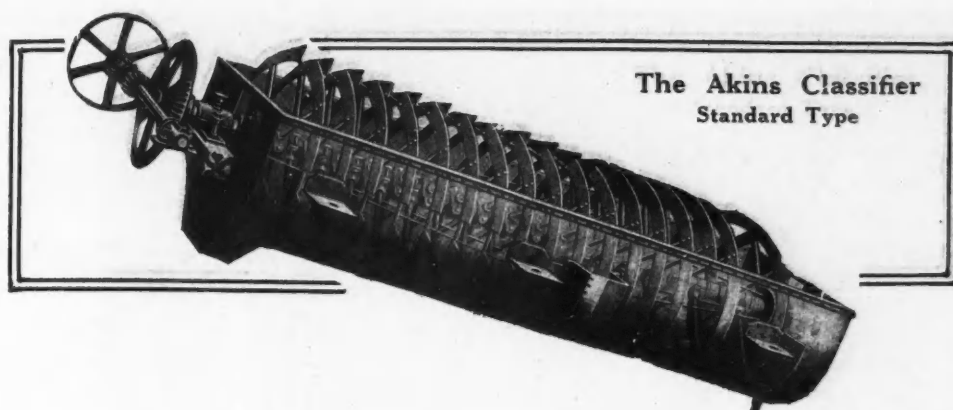
A Service Station Within Reach of You

Denver

Salt Lake City

El Paso

New York Office: 42 Broadway



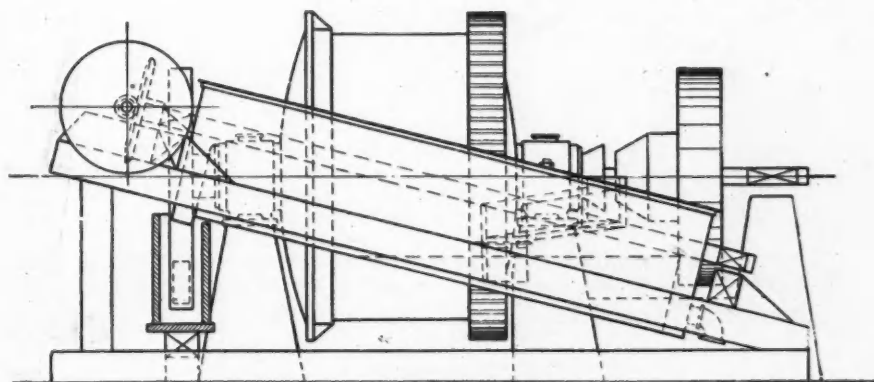
The Akins Classifier
Standard Type

Successful Ball Mill Operation and Close Classification are inseparably linked together

The ball or tube mill cannot begin to handle its full capacity if a large part of the product, already sufficiently reduced, is returned for regrinding. This is certain to occur unless close classification is provided for. Further, to regrind the product that is already in the right shape to pass on for treatment on table or by flotation, is not only to choke capacity and increase costs, but also to produce excess slimes and decrease extraction of values. An Akins Classifier, in closed circuit with ball or tube mill, can almost be said to be the most important part of the mill.

The Akins Classifier Gives Close Classification

Bulletin 24-C tells just how and why. Send for a copy.



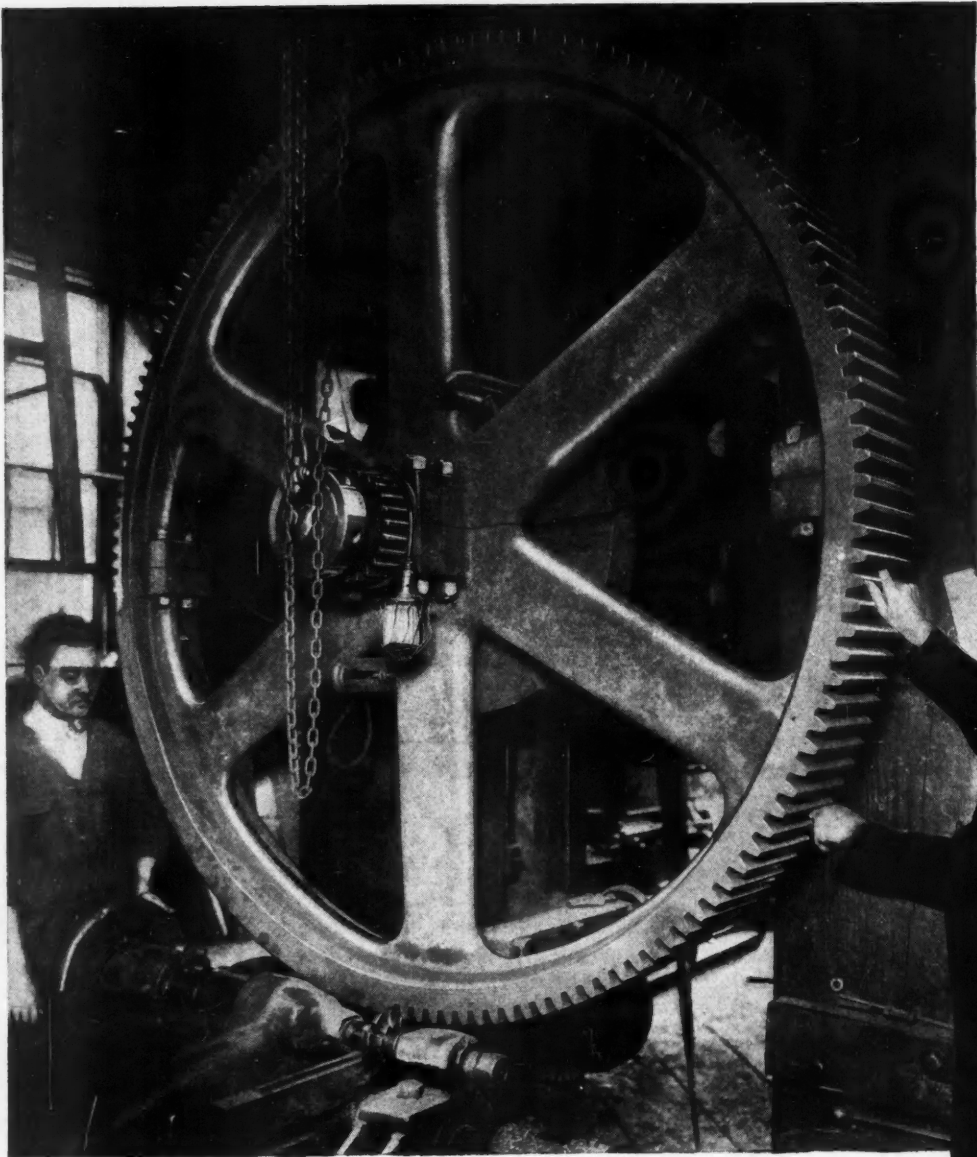
Akins Classifier in Closed Circuit with Ball Mill

COLORADO IRON WORKS CO.

Ore Milling Machinery and Smelting Equipment since 1860

New York Office: 30 Church St.

DENVER, COLO.



Real Gear Service for Mining Plants

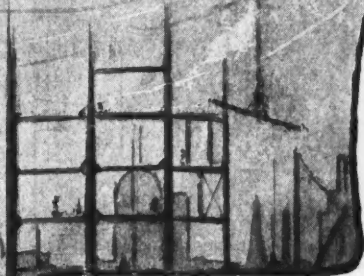
How would you like to own a gear making plant—all the convenience and comforts of home, with no taxes and no worries? That's what happens when you place an order for Gears Philadelphia. For when Phillie Gear makes your gears, for all practical purposes you own the Phillie Gear plant, to the last man and the last machine needed to put your order through in the shortest time possible. And no matter with what speed the gear is turned out, it is absolutely guaranteed for quality and workmanship.

This is gear service supreme.

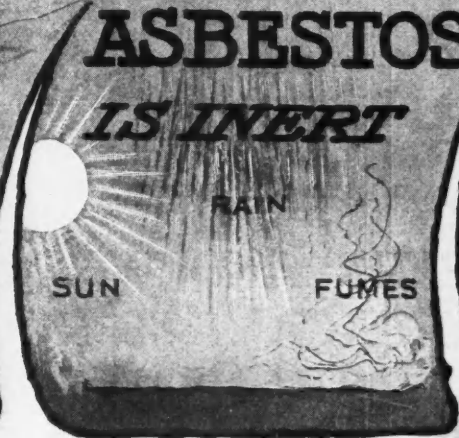
Philadelphia  Works Philadelphia 1120-1128 Vine St.

You know that-

STEEL
IS STRONG



ASBESTOS
IS INERT



ASPHALT
IS WATERPROOF



Therefore when **STEEL, ASBESTOS and ASPHALT** are combined, as is done in **Asbestos Protected Metal** you have a product with remarkable strength and durability

And apart from this very natural assumption, what has Asbestos Protected Metal proven in service?

It has proven that sulphurous gases, acid and alkali fumes and dampness (even salt water dampness) will not rust it.

It has proven superior to the weather's merciless and perpetual alternations—sunshine and storm, dryness and moisture, intense heat and intense cold.

It has proven itself a most effective fire-retardant. It has proven that it does not require painting.

APM is not only low in first cost, but it involves practically no maintenance or depreciation costs. It **LASTS**—because of materials naturally strong and protective. Furnished in standard gauges and sizes, red and black.

The man interested in enclosing a single, small factory building, or the man with the roofing and siding problems of a great industrial plant, will both find facts of interest in Bulletin 5511.

Aspromet  **Company**
Pittsburgh U.S.A.
(FIRST NATIONAL BANK BUILDING)

APM is used to cover this sea coast power plant.



Pacific Gas and Electric Company
Oakland, California

HEAVY
WATERPROOFING
ENVELOPE

ASBESTOS
(on all sides)

STEEL



87-A-280



"Leyner-Ingersoll" Drills
Bulletin 4120



Leyner Sharpener
Bulletin 4122

WHENEVER AND WHEREVER YOU EXCAVATE ROCK YOU NEED AN INGERSOLL-RAND DRILL

Ingersoll-Rand Rock Drills have borne the brunt of the work on practically every big project from the days of the first introduction of machine drills—and on the great aggregate of little jobs as well. For, large or small undertaking, the merit of the drilling equipment plays an important part in the cost of the work.

Ingersoll-Rand Rock Drills of the present day combine the perfection of design and refined methods and standards of manufacture evolved by a wealth of experience. Your choice of an I-R Drill is backed by the judgment of many thousands of satisfied users.

There are types for every grade of work from open-cut excavation and tunnel driving to road building or trench digging.

Ask for the Bulletins.

INGERSOLL-RAND COMPANY

11 Broadway, New York

165 Q. Victoria St., London

Offices the World Over

"Stopehamers"
Bulletin 4036



"Jackhamers"
Bulletin 4321



28-RD

The Slogan of the Cameron—"Character: The Grandest Thing"

SMALL DETAILS BECOME BIG

The smallest detail in a Pump becomes big and troublesome if it is skimmed over in manufacture. The great point about

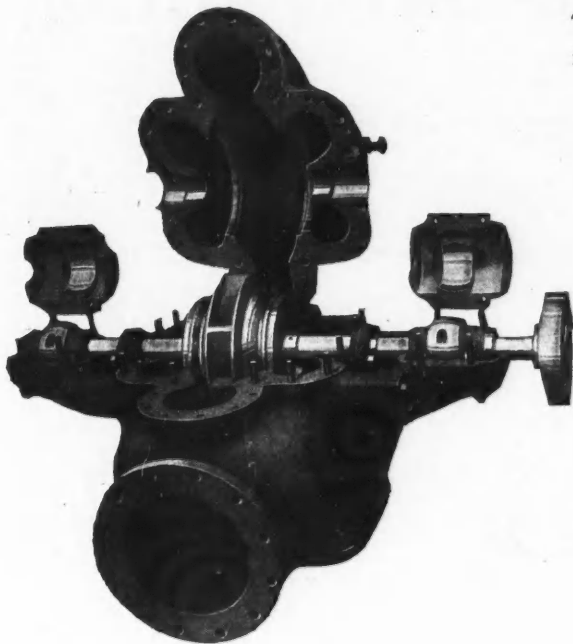
CAMERON CENTRIFUGALS

and why they last so long and have such low up-keeps is that every detail down to the smallest gets the greatest care in manufacture.

Examine the design and construction of the Cameron Class "DV" Centrifugal Pump, shown in the illustration. Note how every part is carefully finished to secure the greatest durability and efficiency.

Cameron Centrifugals make good on the hardest job as well as the easiest—and that's why they deserve your attention.

Get the Whole Story—Bulletin No. 7150.



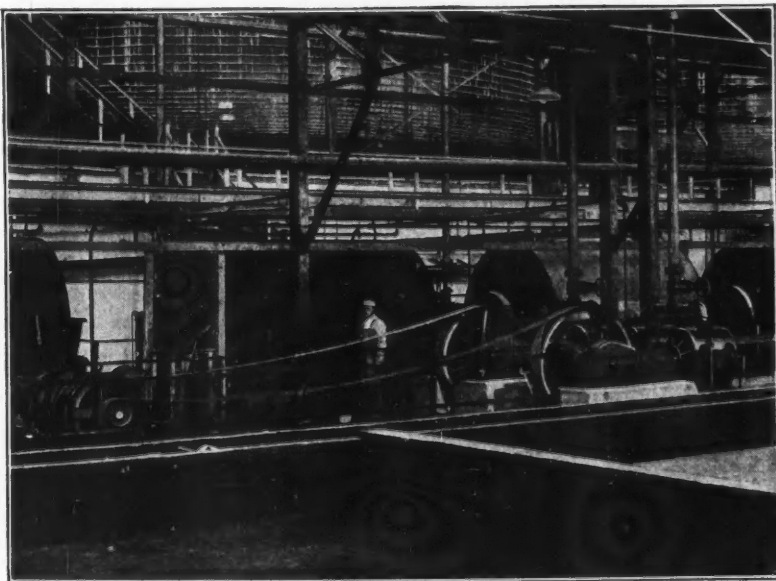
A. S. Cameron Steam Pump Works

11 Broadway, New York

Offices the World Over

31-V

INGERSOLL-RAND VACUUM PUMPS



Ask for the Bulletins.

One sure means of securing permanent satisfaction in the maintenance of vacuum on your filtration units is to install Ingersoll-Rand Vacuum Pumps.

These machines, built to the same high standard as air compressors of the same make, are not only supremely reliable but equally economical.

In them you obtain all the advantages of dust and dirt proof construction, automatic lubrication, noiseless air valves and efficient electric motor or piston valve steam engine drive.

Built in all capacities and for all vacua to 29.5 inches—smaller machines of straight line type, larger units of duplex construction.

INGERSOLL-RAND COMPANY

NEW YORK

LONDON

33-VC

RUBBER BELTING OF SATISFACTION

FOR

ELEVATING - - CONVEYING - - TRANSMISSION

In every field of enterprise, where machinery and equipment are brought into service, the demand for efficiency in production was never greater than today.

With our Conveyor, Elevator and Transmission Belting you may attain the highest efficiency and combine it with the greatest economy. The best is always the most economical, and the most satisfactory. It has been proved and may be proved again by using

FOR CONVEYORS

Giant, Relio or Supremo Brands

FOR ELEVATORS

Silvertown or Fortune Brands

FOR TRANSMISSION

Matchless, Rainbow, Four Ace or Giant Brands

All of these brands are marked with the seal, the mark of quality, of the world's largest rubber manufacturer.



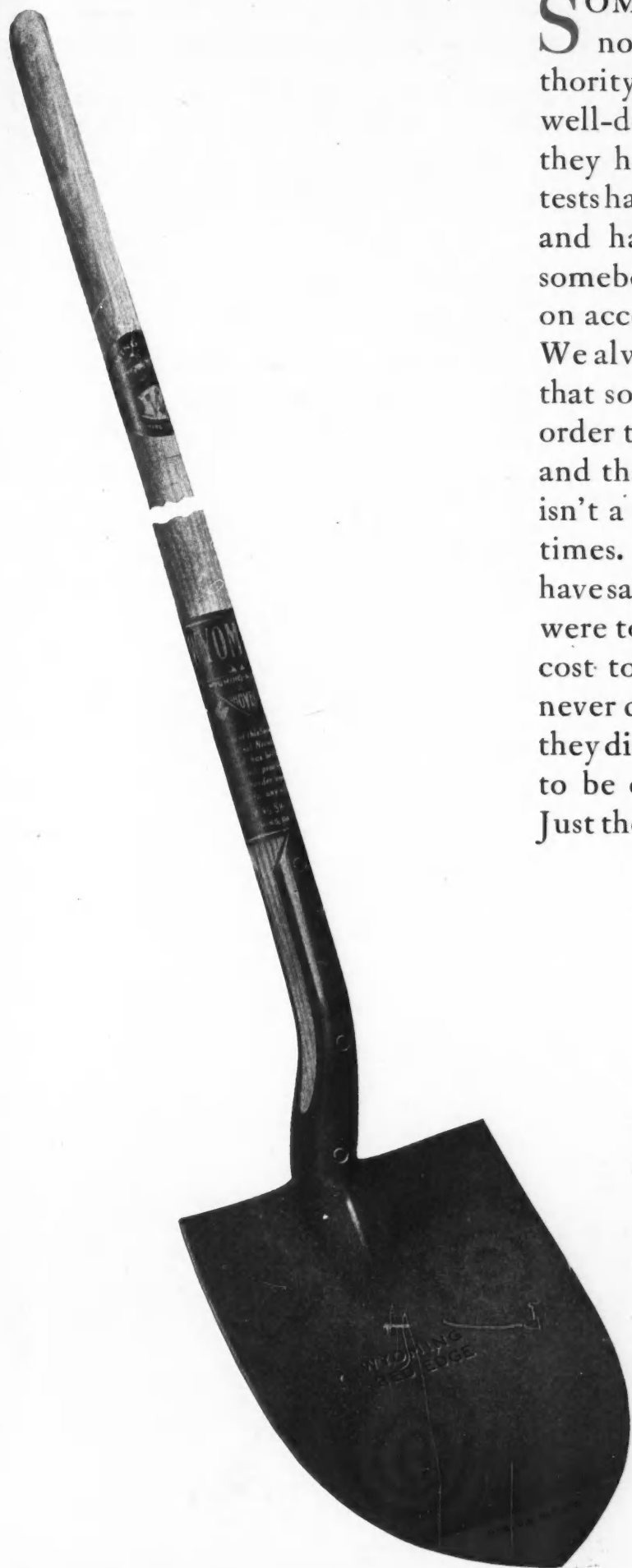
United States Rubber Company

MECHANICAL GOODS DIVISION

1790 BROADWAY

NEW YORK

SOME of our Salesmen complain every now and then of somebody in authority who sprags the wheels of their well-developed campaign. That after they have secured trial orders and the tests have shown results that are gilt edged and have absolutely proven economy, somebody upstairs refuses to say "yes," on account of a slightly higher first cost. We always say that we can't help them—that somebody has to be the pessimist in order to make the world average up well and that for certain purposes a pessimist isn't a bad person to have around sometimes. Of course pessimists and skeptics have said in the past that Tungsten Lamps were too expensive and Steel freight cars cost too much and Auto Trucks would never displace horses, etc., etc., but really they didn't mean it, they were only trying to be conservative—generally at least. Just the other day we received a telegram





from a large Company notifying us that they had adopted Red Edge Shovels as Standard and wanted a hundred and fifty dozen at once. We had been trying to get that business for four years and they made us run five tests and the results were the same in each test. The first was absolute proof—the other four tests were for the skeptics.

When the skeptics and pessimists finally give in they do it thoroughly.

As we have something really worth while, we can afford to wait and business that takes time to get is business that sticks.

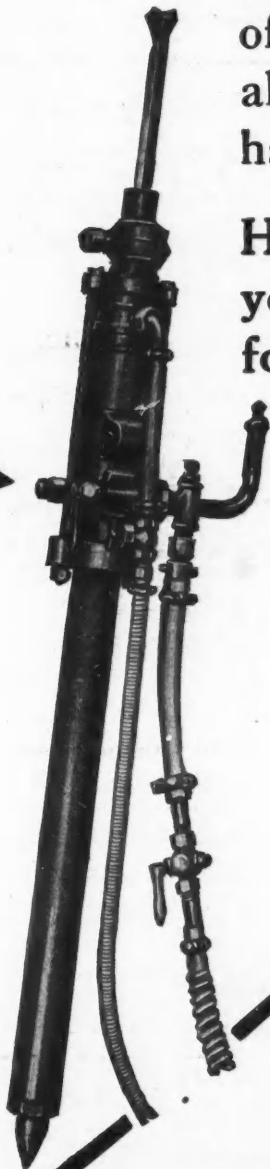
THE WYOMING SHOVEL WORKS
WYOMING, PENNA., U. S. A.



THE NEW "WATER WAUGHS"

have won the approval of the machine men in all mines where they have been introduced.

Here's the "wet" stoper you've been looking for.



If you've got the sort of ground that makes sharp cuttings and menaces the health of your drill men, here are the drills that will end your dust evil. The Model 71 or 72 Waugh Stoper is the ideal machine for drilling in such rock. These drills are free from the bad features of the water tube type of Stoper and are designed so they protect the working parts from injury by the water and cuttings. The water enters the drill at the chuck end and is not carried through the machine in a water tube. They possess the simplicity of design and sturdy construction characteristic of the other types of Waugh Stopers and are easily rotated, high speed drillers. The simple substitution of a chuck end and tappet will change them into "dry" stopers.

THE Denver Rock Drill Manufacturing Co.

DENVER, COLO.

225 Rialto Bldg., San Francisco, Calif.
301 San Francisco St., El Paso, Texas
105-106 Maynard Bldg., Seattle, Wash.
393 Calle Carabaya, Lima, Peru

113 W. 2nd South St., Salt Lake City, Utah
Houghton, Mich. Joplin, Mo.
34 Queen St., Melbourne, Australia

30 Church St., New York City
401 Title Insurance Bldg., Los Angeles, Cal.
51 W. Granite St., Butte, Mont.
Southern Life Bldg., Johannesburg, So. Africa

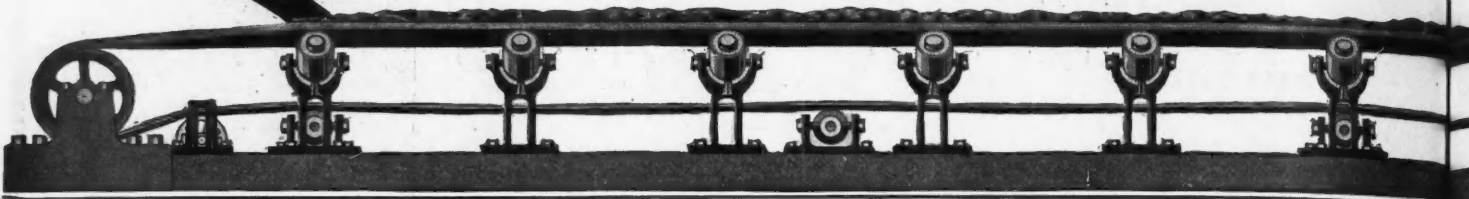
42 Scott St., Toronto, Ont.

CANADIAN ROCK DRILL COMPANY, Ltd., Selling Agents:
Cobalt, Ont. 614 Baker St., Nelson, B. C.

912 Pender St., W. Vancouver, B. C.

E60

IMPROVING



A DEPENDABLE conveyor that operates continuously, with an appreciable reduction in power, with a minimum amount of attention, and a minimum expense for maintenance is your idea of a 100% conveyor. You can have a conveyor answering these specifications by equipping it with Hyatt Roller Bearings.

At the present time, three of the largest conveyor manufacturers are furnishing Hyatt Roller Bearing equipped conveyors and almost all the other manufacturers are prepared to supply them.

The advantages that are gained by the use of Hyatt Roller Bearings on the head and tail shafts and in the idlers of your conveying system are:

1. You can use a belt with less than the customary number of plies—for Hyatt Roller Bearings eliminate at least 50% of the friction of the idlers thereby reducing belt tension.
2. A longer conveyor will be possible, for the decreased tension permits the use of longer single belts and sometimes makes unnecessary an additional conveyor.



Hyatt
Roller
Bearing
showing
arrangement
of helical
rollers in
steel cage.

HYATT BEARINGS *for*

the CONVEYOR

3. A conveyor that would have required 100 H.P. if fitted with plain bearings, required only 65 H.P. when equipped with Hyatt Roller Bearings. Consider the value of a 35% power saving in terms of dollars per year.

4. Hyatt Roller Bearings eliminate wear in the bore of an idler pulley and turn so easily that the belt does not slide over the face of the pulley. This means an important decrease in the cost of idler replacements.

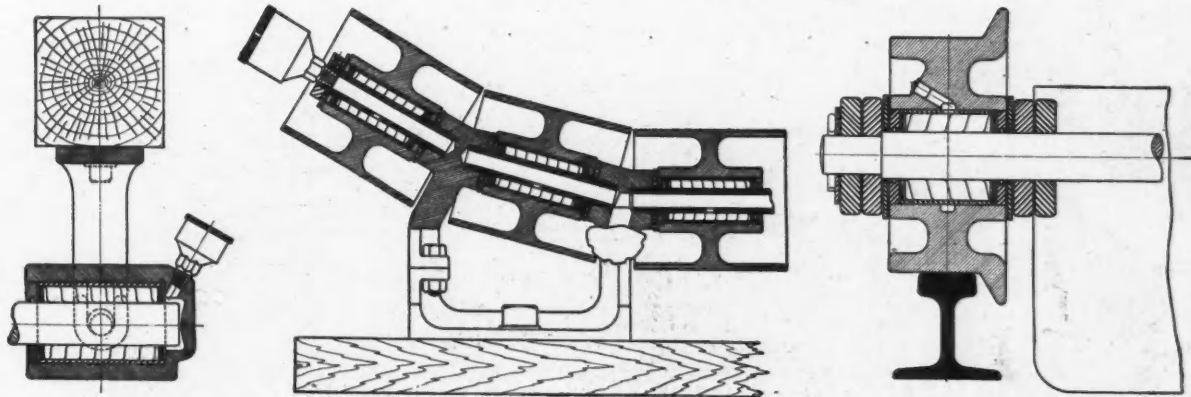
5. Hyatt Roller Bearing equipped conveyors operate from three to six months on one charge of lubricant. This economy in lubricant and the saving in time and labor of applying it is an important advantage.

All of these advantages combine to make Hyatt Roller Bearing equipped conveyors **DEPENDABLE** and dependability is unquestionably the one big requisite of an efficient conveyor system.

You will find our Conveyor Bulletin of value to you if you are a present or prospective user of conveyor systems. It contains complete information relative to the application of Hyatt Roller Bearings to Belt, Bucket and Gravity conveyors. Make sure that we send you a copy at once.

HYATT ROLLER BEARING CO., Metropolitan Tower, New York

Manufacturers of Bearings for Steel Mill Cars and Roller Tables, Trolleys, Cranes, Hoists, Machine Tools, Line Shafts, Concrete Machinery, all kinds of Trucks and Cars, Textile Machinery, Etc.



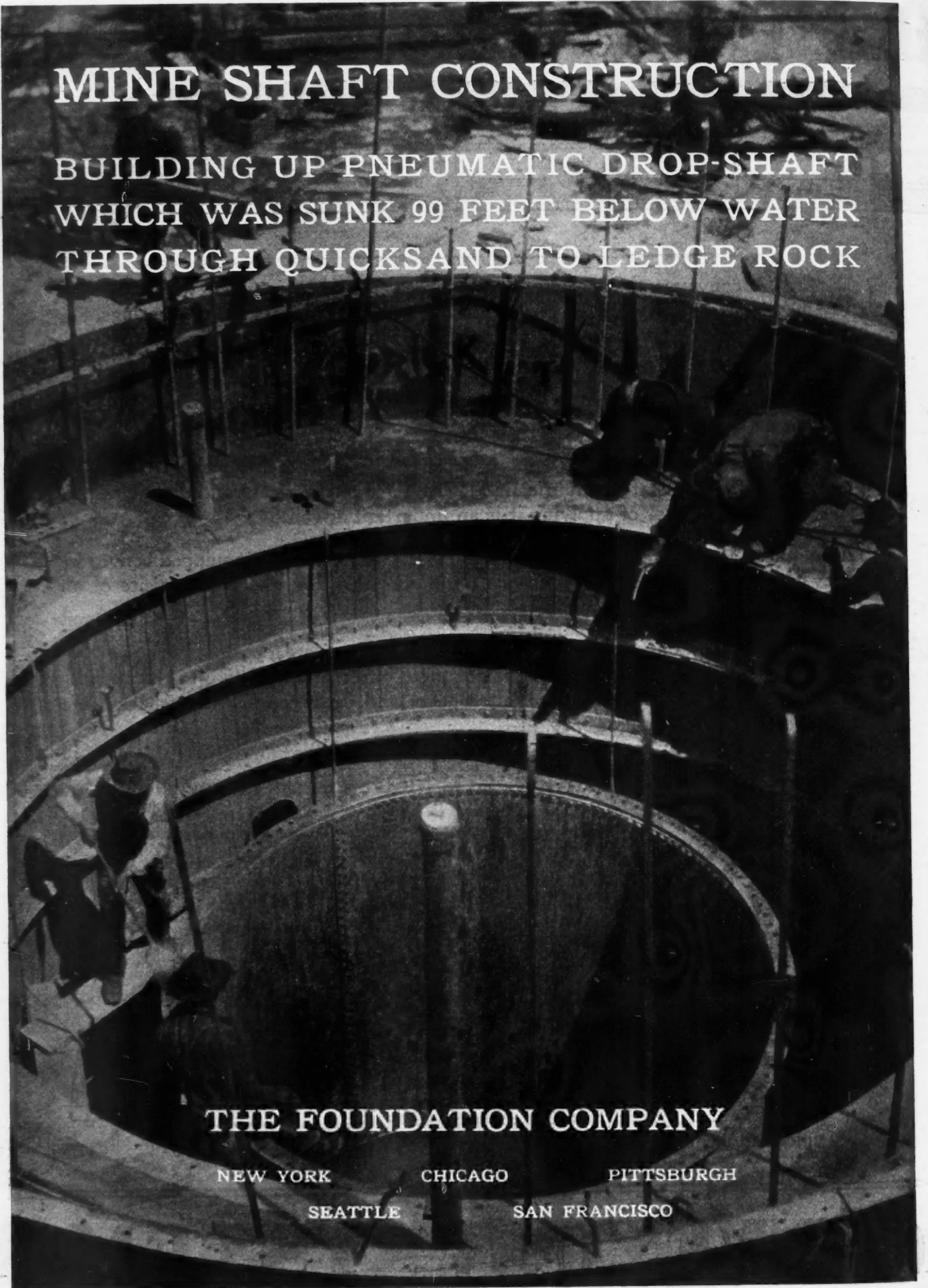
Typical applications of Hyatt Roller Bearings in Conveying Machinery.

1002

CONVEYING SYSTEMS

MINE SHAFT CONSTRUCTION

BUILDING UP PNEUMATIC DROP-SHAFT
WHICH WAS SUNK 99 FEET BELOW WATER
THROUGH QUICKSAND TO LEDGE ROCK



THE FOUNDATION COMPANY

NEW YORK

CHICAGO

PITTSBURGH

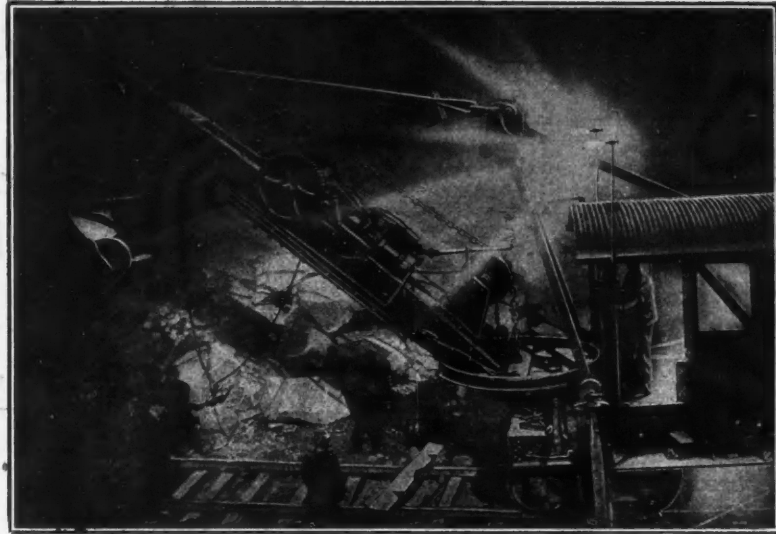
SEATTLE

SAN FRANCISCO

MILBURN

"The Light That Never Fails"

*The Best Known:
Our No. 8.*



Hyde-McFarlin-Burke Co. wrote to us as follows:

"We have been using your Milburn Acetylene Lights during the past few years on the grade elimination work for the Lackawanna R.R. at Madison, Chatham, South Orange and Orange, N. J. We have been

Thoroughly Satisfied

with the results obtained from the use of these lights."

Naturally! Each one gave over 8000 candlepower for more than 12 hours on one charge of 8 lbs. of ordinary Carbide—the kind bought anywhere—and did it without let-up, night after night, without any special attention other than the recharging with carbide.

The NEW Carbide Holder is the reason. It prevents over- or after-generation. You can't over-charge it and the action is absolutely automatic. Try one on your job. Booklet 26 tells more about them.

CUT-WELD TORCH



An Oxy-Acetylene torch with tips for cutting and tips for welding. A strong, simple, double-duty torch that has performed with uniform success in rigid tests held by the Stone & Webster Corp., the U. S. Signal Corps, the U. S. Quartermaster's Dept., and other important bodies. Write for Circular 36.

GENERATORS—COMPRESSORS—TORCHES

THE ALEXANDER MILBURN COMPANY

BALTIMORE, U. S. A.

NEW YORK:
51 E. 42nd Street

CHICAGO:
1012 Kimball Bldg.

BOSTON:
79 Milk Street

PITTSBURGH:
406 Bessemer Bldg.

WASHINGTON:
711 13th Street, N. W.

Agents Everywhere

EFFICIENCY

in your

ASSAY OFFICE

Are You Getting It?

No part of the equipment
is of more importance
than the

FURNACE

therefore we recommend

THE CASE OIL-FIRED MUFFLE TYPE ASSAY FURANCE

Because
it will
SAVE

FUEL
TIME
LABOR
DELAYS

AND INSURE
ACCURATE

RESULTS

THE DENVER FIRE CLAY CO.
DENVER Established 1876 COLORADO

Of Interest to Mine Superintendents

Superla Oils

assure you the highest
degree of lubrication.

Their adoption by leading
industrial works of the
world is proof of their
power-saving qualities.

A Superla Brand for Every Use

Superla Cylinder Oil
Superla Engine Oil
Superla Dynamo Oil
Superla Turbine Oil
Superla Machine Oil
Superla Transformer Oil
Superla Diesel Cylinder Oil
Superla Soluble Oil

You will effect a great
saving for your plant by
using the Superla Brands
of lubricating oils.

STANDARD OIL CO.

(INDIANA)

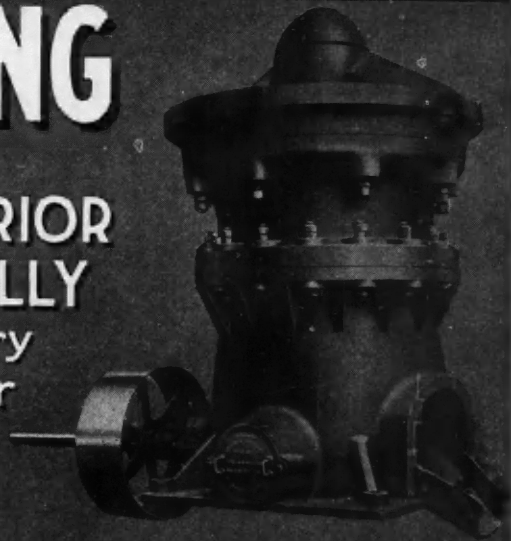
Chicago

U. S. A.

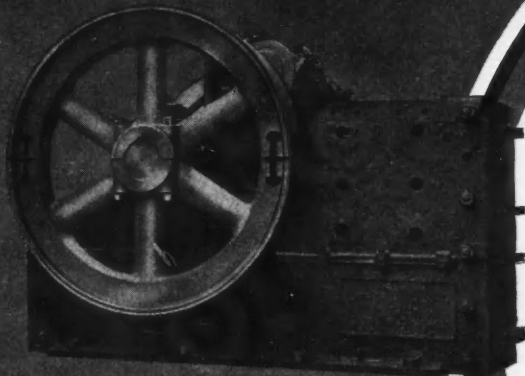
POWER & MINING

Crushing
and
Grinding
Equipment

SUPERIOR
M^CCULLY
Gyratory
Crusher



SUPERIOR
Jaw Crusher



Get the Facts

about these record-breaking machines

SUPERIOR McCULLY GYRATORY CRUSHERS.
OUR NEW DESIGN (Patented)—The Last Word in Gyratory Crusher Construction. Life of "Eccentric and Gears" Lengthened "200%," Because All "Dust and Grit" is Absolutely Excluded and "Cut Gears" run "Quietly in Oil," Main Shaft 50% Stronger than any Gyratory of Corresponding Opening, Area of Eccentric, 75% Greater than any Machine of Equal Size.

SUPERIOR JAW CRUSHERS—We were the Pioneer Builders of Large Jaw Crushers—Have More Large Machines in Operation than all other Manufacturers Combined—Repeat Orders for 84 x 60-in. Machines from Chile Copper Co.; Chino Copper Co.; Hardaway Co.; Luossavaara Kurunavaara Aktiebolag.

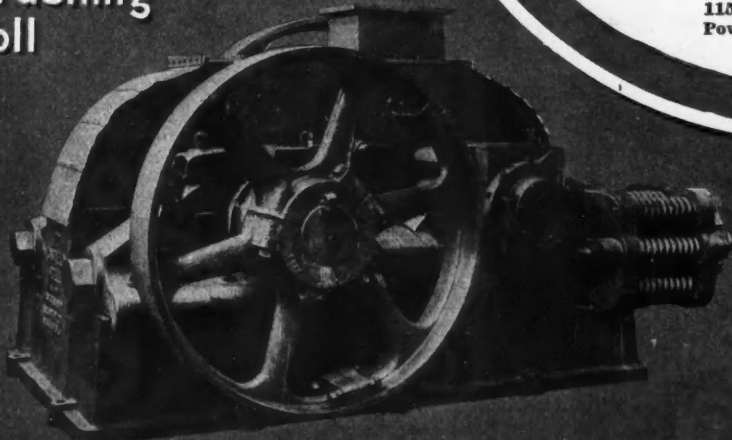
GARFIELD CRUSHING ROLLS—Manufactured in a wide range of sizes, to meet the requirements of discriminating engineers, who demand an exceptionally efficient and worthy design. Most sizes of Garfield Rolls so constructed as to permit the use of oversize roll shells. A wide range of standard designs, and also several special types equipped with heavy, flywheel type pulleys.

Send for the Bulletins, They're Free.

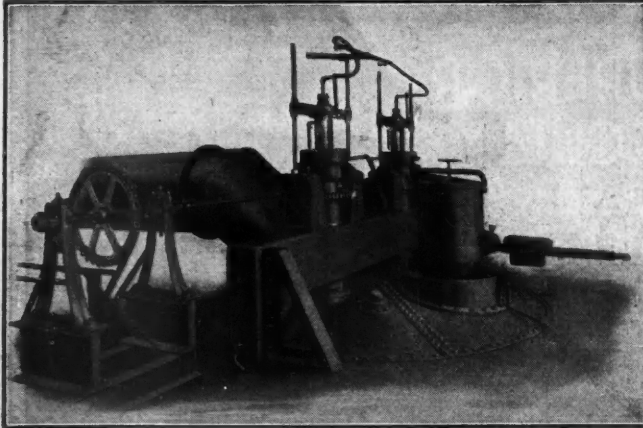
WORTHINGTON PUMP AND MACHINERY CORPORATION

115 Broadway, New York
Power and Mining Works,
Cudahy, Wis.
M468.8

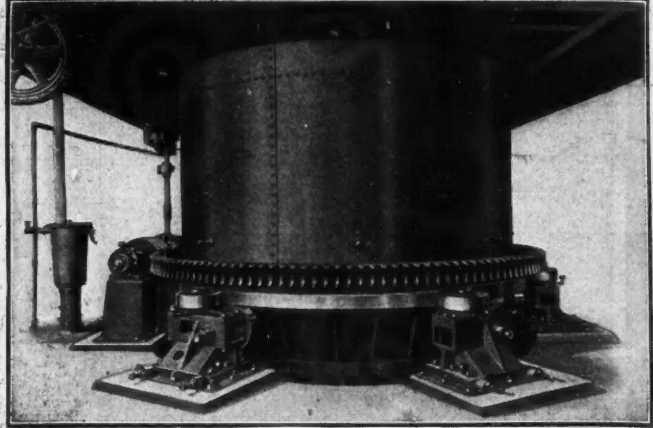
GARFIELD
Crushing
Roll



Continuous Gasification Without Hand Poking or Clinker Formation



Stationary Section showing Stirring Gear.



Revolving Section showing Worm Gear Drive.

WOOD Mechanically Operated GAS PRODUCERS

Produce a continuous gas supply with from 26 to 28% CO content. Unexcelled for operation in connection with zinc smelting and Roasting Furnaces. In use by American Zinc and Chemical Co., Grasselli Chemical Co., American Zinc, Lead and Smelting Co. Highly economical. Low steam and water consumption. Write for complete information now.

R. D. WOOD & COMPANY

PHILADELPHIA, PENNA.

Makers of Hydraulic Machinery, Gas Holders, Centrifugal Pumps, Cast Iron Pipe, Fittings, Valves and Special Castings.

HARDSOEG

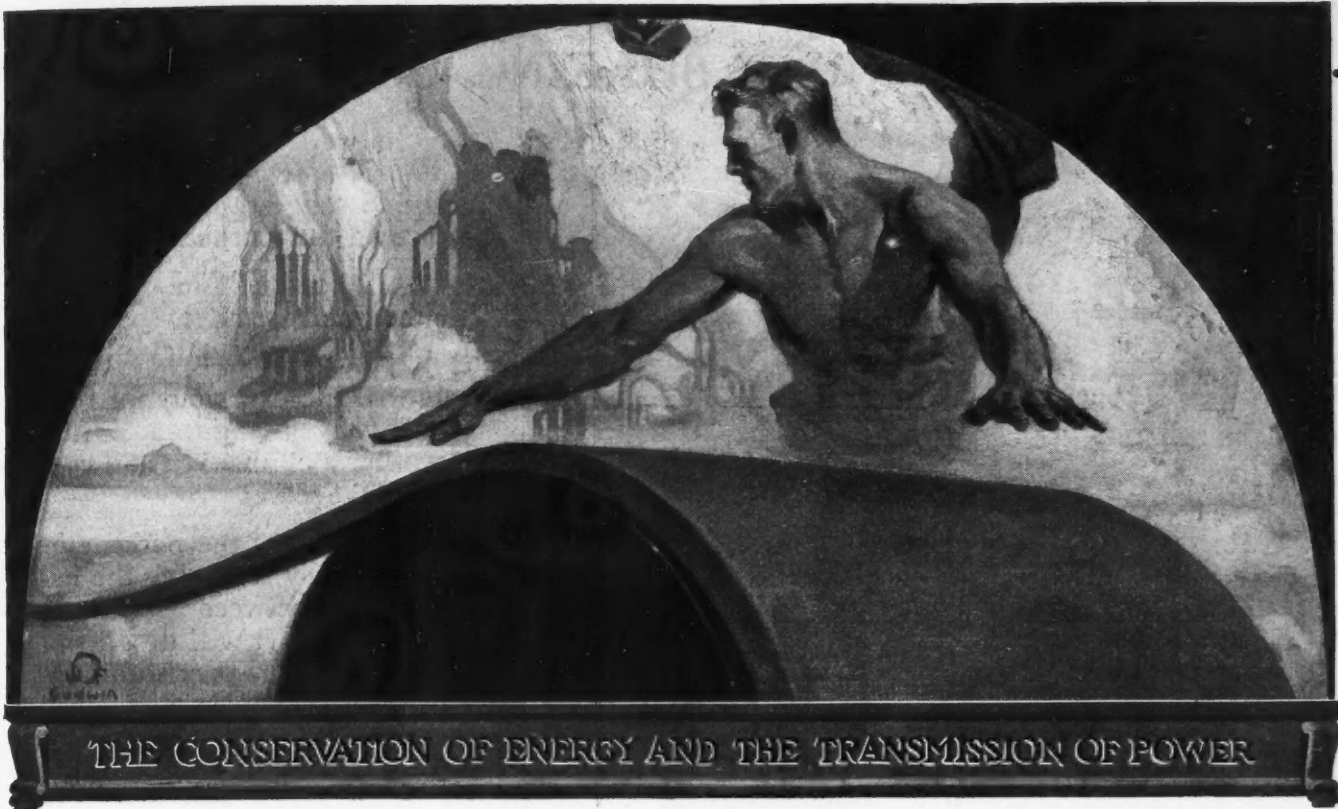
Hammer Drill No. 67 W.

This is strictly a one-man drill. It is Self-Rotating, Valveless and equally adaptable to either Drifting or Sinking. It has the low air consumption feature common to all Hardsocg drills, and owing to few wearing parts gives little trouble and is economical to maintain. Being a hard rock drill the adjustable shell, which permits of a great saving of time in the necessarily frequent changes of steel, is a valuable feature.

You'll be interested in Bulletin 61 which gives full details.



HARDSOEG WONDER DRILL CO.
OTTUMWA, IOWA



What the Mines Tell You About These Belts

Of the \$100,000,000 expended each year for belting, the mining industry pays most.

Belts, to it, are even a more formidable factor in production costs than they are to mills and factories.

What the mines do to reduce these costs can well be done by others. In some mining companies scrutiny of belt-expense extends to maintaining officials expressly charged with the duty of reducing it.

It is significant that such companies are among the largest purchasers of Goodyear belts.

Their accurate cost accounting shows that these belts best cut the year's belting bill.

It is also significant that the min-

ing industry's belt experts buy on the Goodyear plan of plant analysis.

They have Goodyear men make a survey of every drive, conveyor and elevator to specify the proper Goodyear belt for each.

The entire set of specifications constitutes a complete analysis of the plant's belting needs.

Goodyear men have already made thousands of such analyses.

They cover many important mills and factories in every national industry.

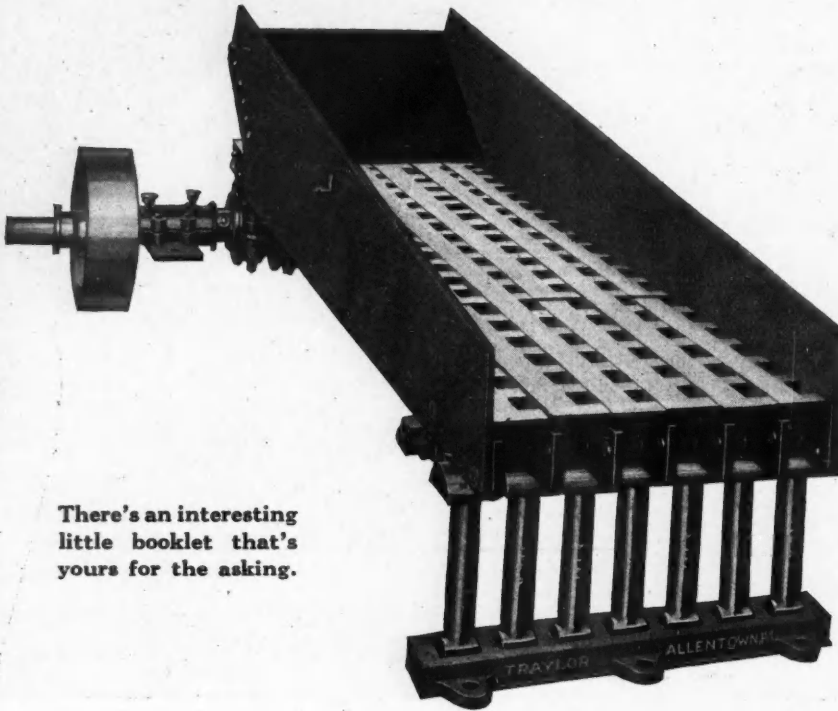
Everywhere they are the means of effecting considerable savings.

They can do it for your plant also.

The Goodyear Tire & Rubber Co., Akron, O.

BELTING · PACKING  HOSE · VALVES
GOODYEAR
 AKRON

THE SHERIDAN SHAKING GRIZZLEY



There's an interesting little booklet that's yours for the asking.

The Simplest, Most Efficient and Strongest Screening device on the market.

It will handle 25-in. or larger cubes and remove the fines from an earthy, talcy ore.

It will increase your mill capacity by giving your initial crusher a clean, even and continuous feed.

It will reduce the percentage of slimes by removing the undersize between crushing operations. It will do all this and more at a very slight expense for power and head room.

TRAYLOR ENGINEERING & MANUFACTURING CO.
ALLENTOWN, PA.

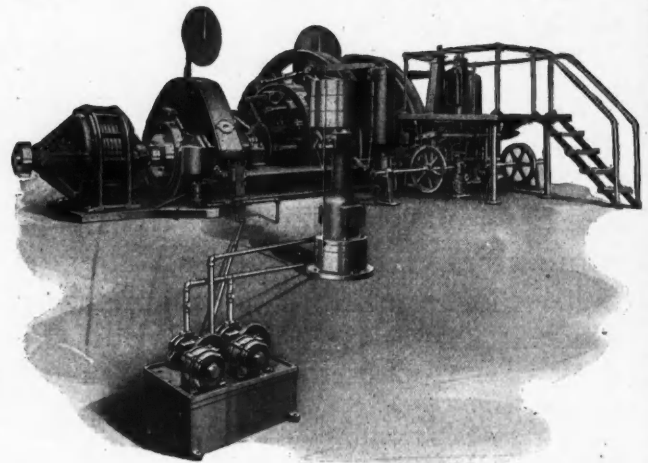
New York Office, 30 Church St.

Chicago Office, 1414 Fisher Building

The photograph shows a large Ottumwa Electric Hoist

built for the
Eagle & Blue Bell Mining Co.
Salt Lake City, Utah

The reels are 12 ft. in diameter and hold 2500 ft. of flat rope. Each reel is driven with axial plate clutch operated by thrust cylinder by means of oil under pressure. The brakes are of the post type gravity applied and released by oil acting in thrust cylinder. The brakes are interlocked with the clutches and so arranged that the clutch can not be thrown out only when the brake is set and the clutch is thrown in before the brake can be



released. The gears are run in oil-tight gear case. The hoist is equipped with overwinding device which will apply the emergency brakes in case of overwind, overspeed or failure of current supply to the hoist.

Let us quote you on your next hoist.

Ottumwa Iron Works, Ottumwa, Iowa

LARGE POSSIBILITIES OF REDUCED TRANSMISSION COSTS ARE OPEN TO THOSE WHO WILL INVESTIGATE MORSE DRIVES—MADE RIGHT, PROVIDE MAXIMUM DURABILITY AND EFFICIENCY.

Positive as Gears. Flexible as a Belt

Deliver full power and speed and deliver RIGHT ALONG

THE LARGEST MANUFACTURERS AND STOCK OF SILENT CHAIN DRIVES IN THE WORLD. CONSIDER THE ADVANTAGE OF THIS AND OUR PROMPT DELIVERIES. THESE ARE VITAL FACTORS OF

MORSE ENGINEERING SERVICE

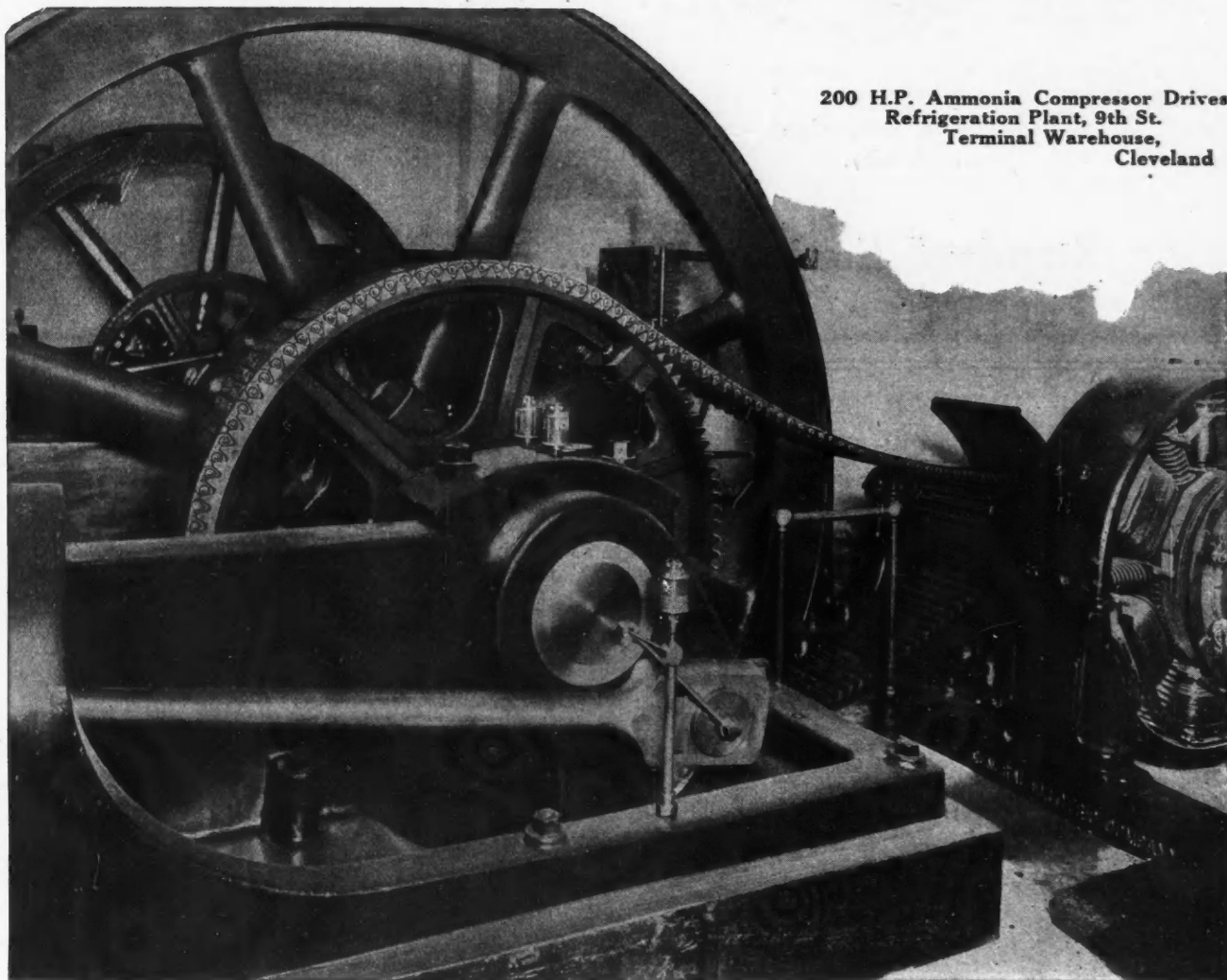
Our engineers, specialists in the art of designing chain drives, are conveniently located at addresses below, and will gladly call at your request and assist in solving any power transmission problem without obligation.

We are always glad to furnish special information and welcome inquiries. Feel free to write us at any time.

THE MORE SEVERE THE DUTY, THE MORE NEED OF "MORSE"—THE PERFECT, DURABLE, POSITIVE TRANSMISSION, WITH 99 PER CENT. EFFICIENCY.

Morse Drives have great mechanical strength. Made of the best material available and with the perfection of modern cost manufacturing methods, assuring 100 per cent. overloads.

LOSS OF SPEED WITH HIGHER PRODUCTION COSTS AND SHUT DOWNS ARE EXPENSIVE. FAULTY BELT TRANSMISSION IS A BIG COST ITEM.



200 H.P. Ammonia Compressor Drives
Refrigeration Plant, 9th St.
Terminal Warehouse,
Cleveland

MORSE CHAIN CO. LARGEST MANUFACTURERS OF SILENT CHAINS IN THE WORLD Ithaca, N. Y.

ADDRESS NEAREST OFFICE



BOSTON, MASS. 141 Milk St. CHICAGO, ILL. Merchants L & T. Bldg. CLEVELAND, OHIO Engineers Bldg. DETROIT, MICH. 1003 Woodward Ave. GREENSBORO, N. C. 805 Ashboro St.



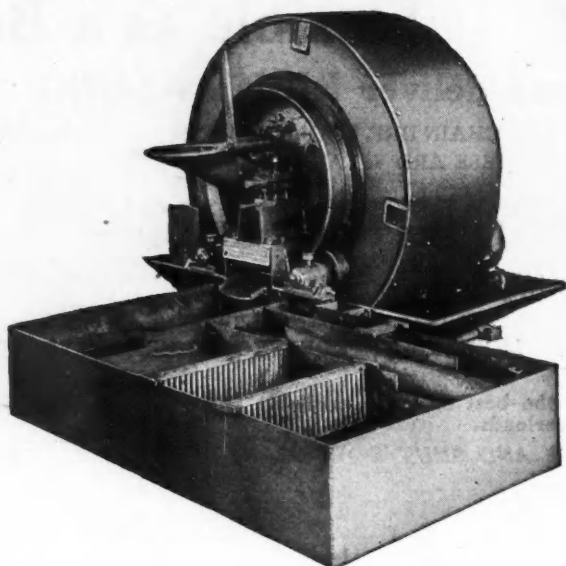
ATLANTA, GA. Earl F. Scott, M.E. Candler Bldg. NEW YORK CITY 50 Church St. PITTSBURGH, PA. Westinghouse Bldg. SAN FRANCISCO, CAL. Monadnock Bldg. JONES & GLASSCO, REG'D Montreal, St. Nicholas Bldg. TORONTO, Traders' Bank Bldg.

KANSAS CITY, MO. Morse Engineering Co. R. A. Long Bldg.

MINNEAPOLIS, MINN. Strong-Scott Mfg. Co. 413 Third St., S.

ST. LOUIS, MO. Morse Engineering Co. Chemical Bldg.

LICENSEES FOR EUROPE The Westinghouse Brake Co., Ltd. 82 York Road, King's Cross, London, N.



Bulletin E will give
you details.

Wonderful—But True

A revolution is brewing in the mining industry—a new machine has come on the market, a machine that *crushes, pulverizes and concentrates* at one operation.

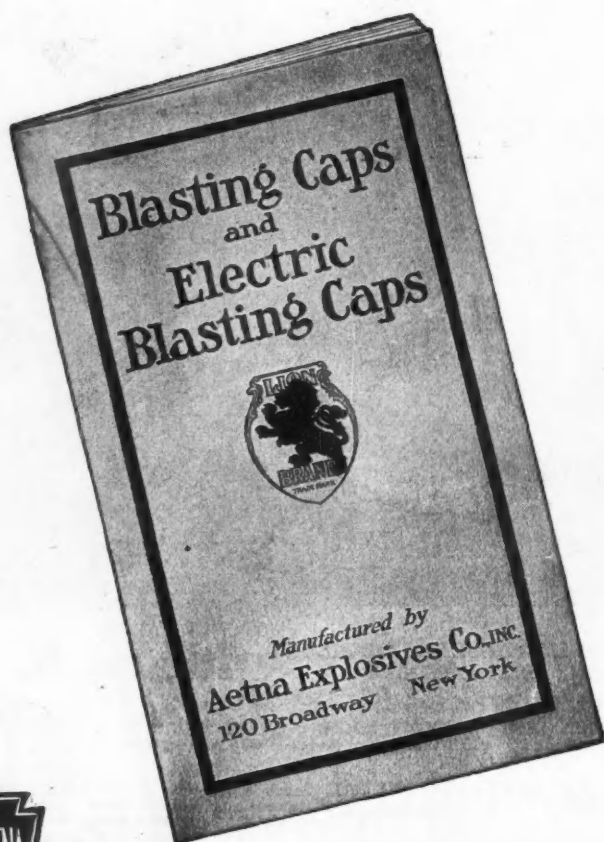
It is the

STANDARD MILL

The Standard Mill operates by the wet process, it takes ore from a primary crushing unit, either gyratory or jaw, anything that will crush to 2½ in., and grinds and pulverizes to 200 mesh.

The Standard Mill takes the pulp which it produces and concentrates it as it is produced, automatically ridding itself of the gangue; making possible the handling of ore from primary crusher to tables with only one intermediate operation.

Standard Equipment Co., New Haven, Conn.



Just off the Press

This booklet on "Lion" Brand Blasting Caps tells about their use; their composition; their strengths; their calibres; their dependable charges, and why dependable; the advantages of using strong Detonators; precautions for handling and storage, etc.

Too frequently the Dynamite—of any manufacture—is blamed when mis-fires occur, where an examination of the Detonator used would probably show that it did not explode completely, or with sufficient strength to detonate the Dynamite. These mis-fires are costly and dangerous.

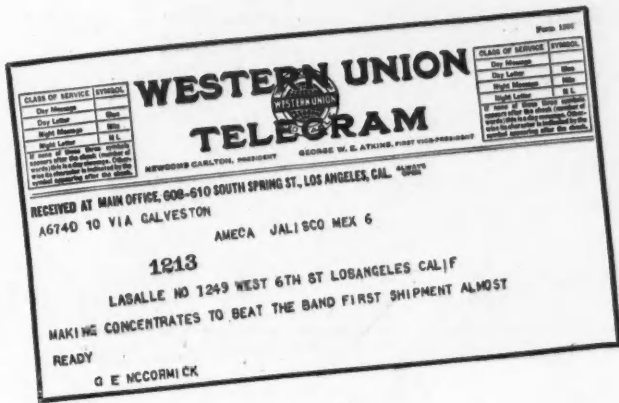
Surely you want to avoid mis-fires—

"Lion" Brand Caps, charged with FULMINATE OF MERCURY, cost no more—

Then write for this free booklet (size 3½ in. x 6 in.)—read it carefully—and use "Lion" Blasting Caps or "Lion" Electric Blasting Caps.

Aetna Explosives Co., Inc.

High Explosives For All Blasting Purposes.
120 Broadway Dept. B New York, N. Y.



*The
General Manager
Telegraphed the
President*

Without Grief or Disappointment

At a well-known Mexico copper property, the concentrating of the ores is done entirely by flotation, and K & K Flotation Machines are used exclusively.

None of the usual grief and disappointment incident to starting up a new mill was experienced at this plant, and the General Manager telegraphed the President.

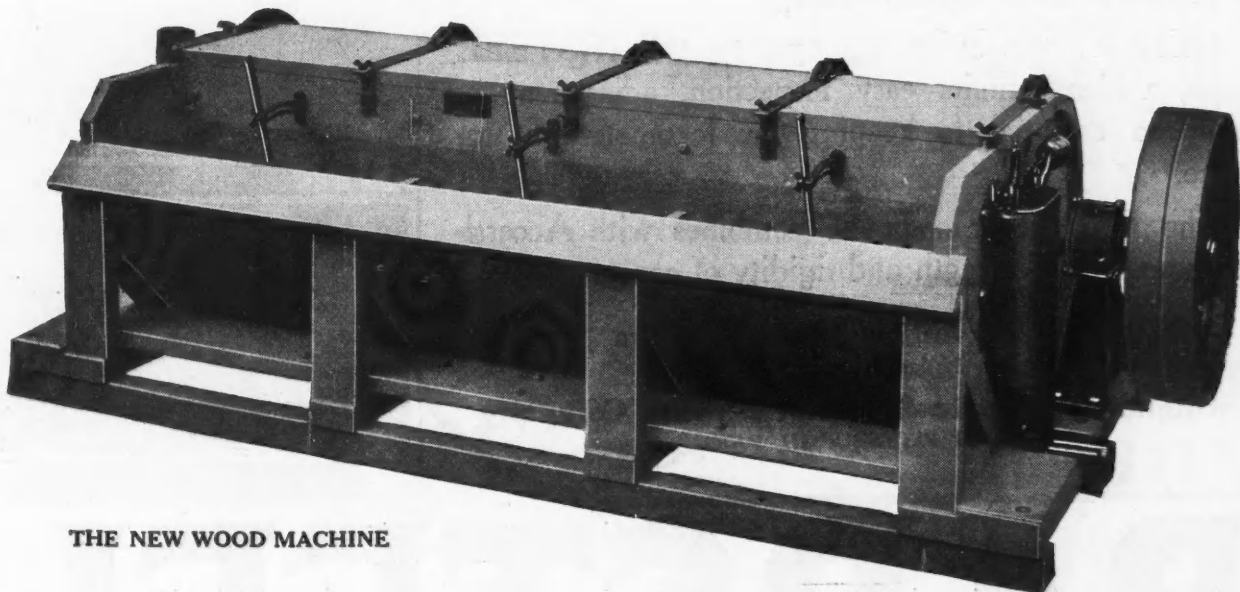
The reason you should consider K & K Flotation machines for your operation is that they will duplicate the best work of other type flotation apparatus continuously and without loss of efficiency AT LESS COST.

In more than one instance K & K Flotation Machines have turned flotation failures into successful operations.

The thorough aeration of the flotation pulp is the most important factor to successful flotation.

Investigate the K & K way,
and you will see the reason.

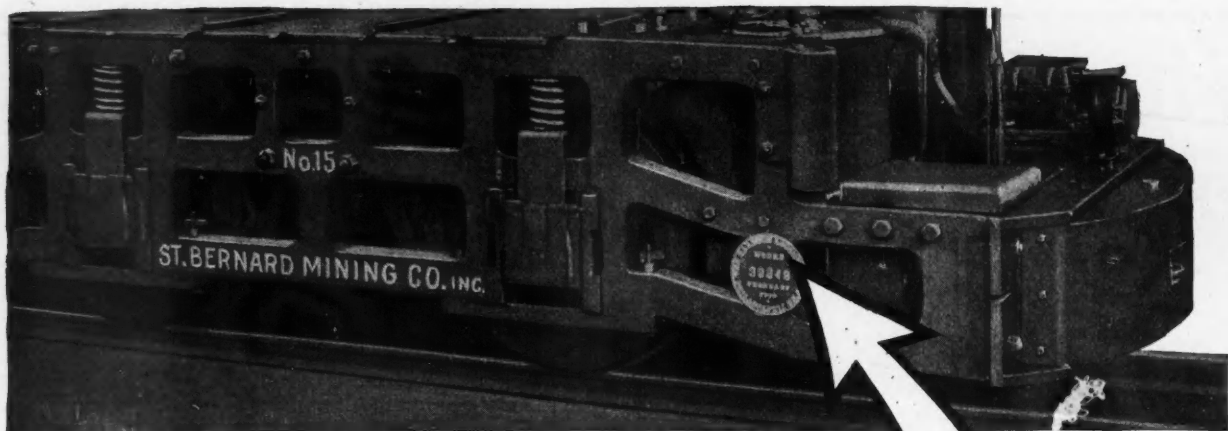
THE K. & K. FLOTATION MACHINE



THE NEW WOOD MACHINE

Southwestern Engineering Company, Incorporated

106 West Third Street, Los Angeles, California



Strength and Accessibility

Before the Open-Frame BARSTEEL Mine Locomotive came into being, strength was obtained at a sacrifice in accessibility.

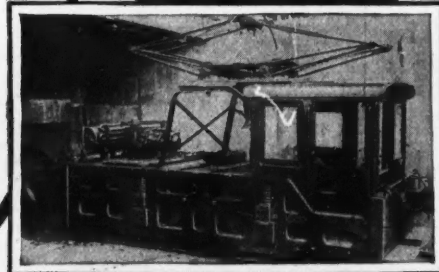
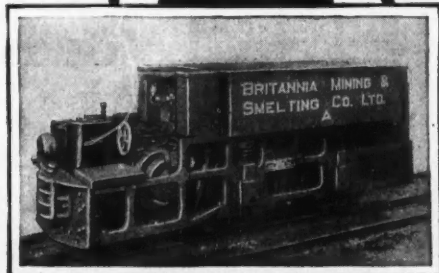
The closed, box-type frame made inspection, adjustment, lubrication and repair a difficult task; and, following the path of least resistance, the operator turned a deaf ear to minor troubles. Naturally they developed into serious defects—ultimately taking the locomotive out of service and crippling haulage.

HENCE, we build the open-type BARSTEEL Frame, which permits easy inspection, adjustment or repair—so essential to keeping the locomotive fit for service.

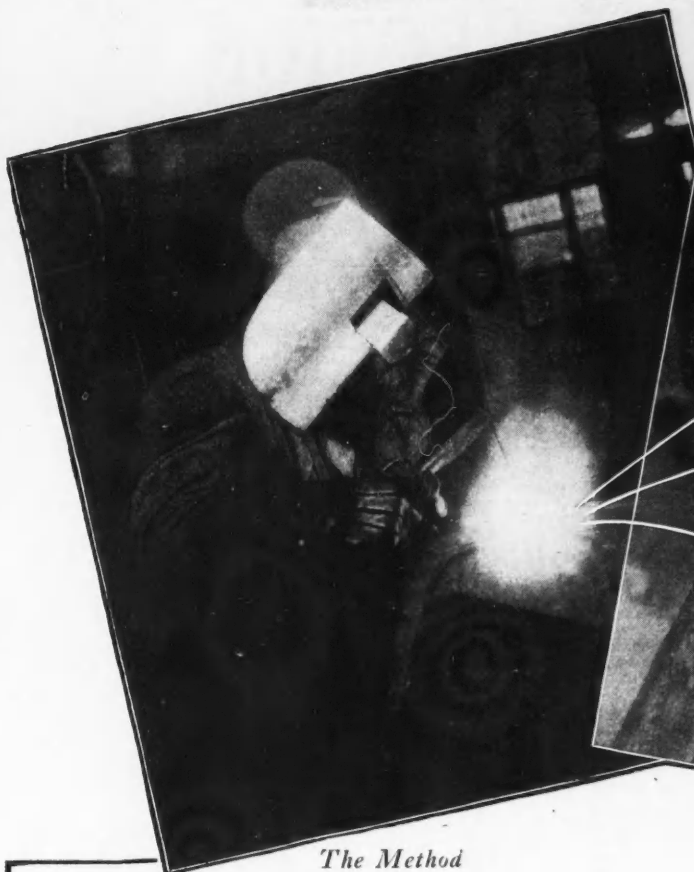
The BARSTEEL Frame combines with Accessibility unequalled strength and rigidity of construction.

The Baldwin Locomotive Works
Philadelphia, Pa.

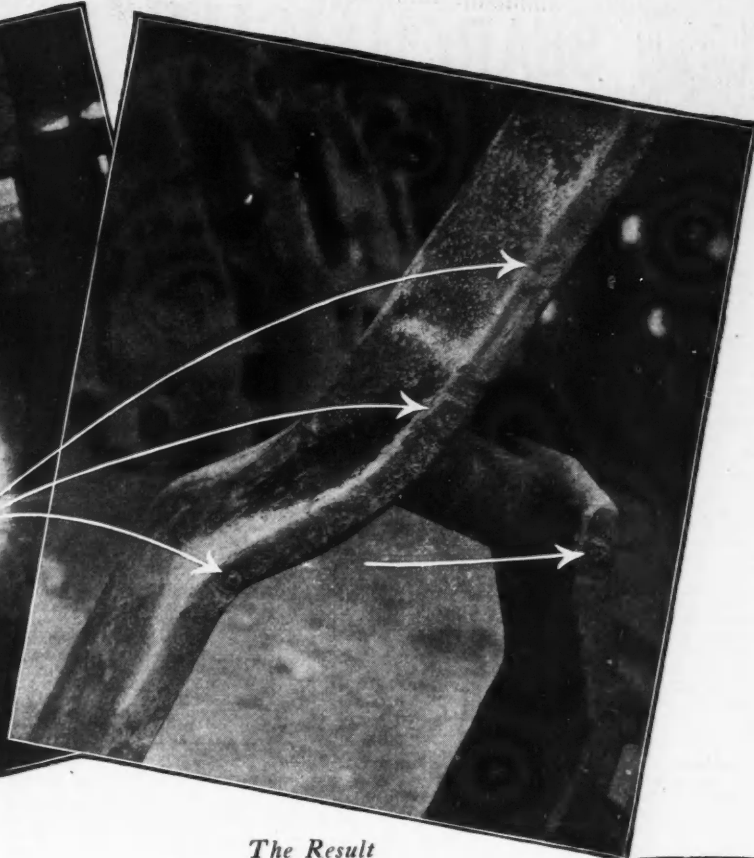
Westinghouse Electric & Manufacturing Company
EAST PITTSBURGH, PA.



BARSTEEL



The Method



The Result

Reclamation of Iron Castings by Arc Welding is Very Successful

Reclaiming 98% of all the defective castings they attempt is the remarkable accomplishment of the Spencer Heater Company, Scranton, Pa. Castings repaired by the G-E Arc Welding process are as good as those that are cast perfect.

The skill and organization required for this work has been gradually built up by the Spencer Heater Company which was a pioneer in the use of cast iron electrodes.

Casting reclamation is but part of the valuable and varied work done by the G-E Arc Welding Equipments at the Spencer Heater Company.

To save time and money, build up worn or broken ferrous parts with G-E Arc Welding Outfits.

General Electric Company

Atlanta, Ga.
Baltimore, Md.
Birmingham, Ala.
Boston, Mass.
Buffalo, N. Y.
Butte, Mont.
Charleston, W. Va.
Charlotte, N. C.
Chattanooga, Tenn.
Chicago, Ill.
Cincinnati, Ohio
Cleveland, Ohio

Columbus, Ohio
*Dallas, Tex.
Dayton, Ohio
Denver, Colo.
Detroit, Mich.
Des Moines, Iowa
Duluth, Minn.
Elmira, N. Y.
Erie, Pa.
*El Paso, Tex.
Fort Wayne, Ind.
Hartford, Conn.

General Office: Schenectady, N. Y.

ADDRESS NEAREST CITY

*Houston, Tex.
Indianapolis, Ind.
Jacksonville, Fla.
Joplin, Mo.
Kansas City, Mo.
Knoxville, Tenn.



Los Angeles, Cal.
Louisville, Ky.
Memphis, Tenn.
Milwaukee, Wis.
Minneapolis, Minn.
Nashville, Tenn.

New Haven, Conn.
New Orleans, La.
New York, N. Y.
Niagara Falls, N. Y.
*Oklahoma City, Okla.
Omaha, Neb.
Philadelphia, Pa.
Pittsburgh, Pa.
Portland, Ore.
Providence, R. I.
Richmond, Va.
Rochester, N. Y.

St. Louis, Mo.
Salt Lake City, Utah
Schenectady, N. Y.
Seattle, Wash.
Spokane, Wash.
Springfield, Mass.
San Francisco, Cal.
Syracuse, N. Y.
Toledo, Ohio
Washington, D. C.
Youngstown, Ohio

*Southwest General Electric Company For Canadian Business refer to Canadian General Electric Company, Ltd., Toronto, Ont.
General Foreign Sales Offices: Schenectady, N. Y.; 120 Broadway, New York City; 83 Cannon St., London, E. C., England.

SEARCHLIGHT SECTION

POSITIONS VACANT

WINCHMEN wanted for gold dredging property in South America, can use several good men. Single men acquainted with river dredging in tropical countries preferred. Transportation paid; two years contract; in replying state fully experience and monthly salary expected. P-95, Eng. & Min. Journal.

AN A-1 DRAFTSMAN wanted for general mine field and railroad work, also an experienced mining engineer for precise underground surveying by a large Arizona copper company. P-116, Eng. & Min. Journal, Chicago.

ASSAYER wanted by large manufacturing plant, vicinity of New York. State age, training, experience, salary desired. References required. P-110, Eng. & Min. Journal.

THREE shift bosses wanted for washery and jig concentration on manganese ore. Permanent work in excellent location, close to large cities, where cost of living is far below present-day standards. Must be familiar with jigs and hard workers. Six dollars eight hour shifts. Give references first letter. P-139, Eng. & Min. Journal, Phila.

NINE (9) jig men on manganese ore wanted. Permanent work in excellent location (close to large cities) where cost of living is far below present-day standards. Five dollars eight-hour shifts. Give references first letter. Traveling expenses to right man. P-140, Eng. & Min. Journal, Phila.

STEAM shovel superintendent wanted. Capable selecting his own equipment and running same at top efficiency. Permanent position on manganese open cut mine in excellent location where cost of living is far below present-day standards. Give references and state salary requirements in first letter. P-141, Eng. & Min. Journal, Phila.

PAYMASTERS, Time Inspectors, Timekeepers, Warehouse Clerks and Accountants wanted for work in South America, three-year contracts, expenses to and from property and salary while traveling paid by the Company. P-136, Eng. & Min. Journal.

OFFICE Engineers, Engineers for construction work, Junior Engineers, mining and construction, Transitmen, Levelmen, Rodmen, Draftsmen and Designers wanted for work in South America, three year contracts, expenses to and from property and salary while traveling paid by the company. P-137, Eng. & Min. Journal.

Employers' Clearing House

Established 1911 El Paso, Texas.
Technical men, practical mine or mill men, office men. Competent mining man of technical and practical training in charge of mining department. Men using Spanish a specialty. Wire, cable or write us your needs.

Mills Building, El Paso, Texas

Correspondents Wanted

We are interested in securing correspondents in mining centers who can send us news in their spare time of new mines to be opened, equipment to be purchased, etc.

Write giving full details of present work to

L. V. Fletcher
McGraw-Hill Co., Inc.
10th Ave. at 38th St., New York, N. Y.

Get your Wants
into
the Searchlight

ADVERTISING RATES

Ads Set in Uniform Style

(Solid, in one paragraph, without display.)
THREE CENTS A WORD, minimum charge 50 cents an insertion, payable in advance, less 10 per cent if one payment is made in advance for four continuous insertions—for advertisements under:

Positions Wanted	Vacation Work Wanted
Evening Work Wanted	Salesman Wants Connections

FIVE CENTS A WORD, minimum charge \$1.50 an insertion, for advertisement under:

Agencies Wanted	Positions Vacant
Agents Wanted	Partner Wanted
Business Opportunities	Representations Wanted
Desk Room for Rent	Salesmen Wanted
Educational	Patents for Sale
Employment Agencies	Plants for Sale
Desk Room Wanted	Sub-Contracts Wanted
Foreign Business	Work Wanted

Miscellaneous for Sale, for Rent or Want Ads.

THIRTY CENTS A LINE, minimum five lines, for all undisplayed advertisements set with a paragraph for each item or tabulated.

THREE DOLLARS AND SIXTY CENTS AN INCH for advertisements for bids (Official Proposals).

Ads Set in Display Type

(Individual space, within border rules.)

Space for these advertisements is sold by the inch. Each page contains 27 inches. The rate per inch is based on the total number of inches to be used—that is, the number of inches the advertisement is to occupy multiplied by the number of insertions it is to receive. For instance, a 2-inch advertisement in 2 issues earns the 4-inch rate of \$2.90 an inch. A 1-inch space in 4 issues, or a 4-inch space in one issue, also earn the 4-inch rate.

SCHEDULE OF RATES

1 to 3 in., \$3.00 an in.	15 to 26 in., \$2.70 an in.
4 to 7 in., 2.90 an in.	27 to 49 in., 2.60 an in.
8 to 14 in., 2.50 an in.	50 to 99 in., 2.55 an in.

Rates for larger space furnished on request.

INFORMATION

ALLOW FIVE WORDS for the address, if replies are to a box number in care of any of our offices. There is no extra charge for forwarding replies.

IN REPLYING TO ADS, do not enclose original testimonials or anything that you may want returned. State your experience and qualifications in as concise and neat a manner as possible and enclose copies of your testimonials.

BE CAREFUL TO PUT ON ENVELOPE, when answering any "blind" ad, the box number in the ad, the name of the paper, and also the local address of office to which reply is sent:

36th St., at 10th Ave.,	New York
1570 Old Colony Bldg.,	Chicago
657 Leader-News Bldg.,	Cleveland
935 Real Estate Trust Bldg.,	Philadelphia
501 Ria to Bldg.,	San Francisco

WHEN ADVERTISING MACHINERY, use your own name and address—or a local address of some kind—so that the readers can wire direct and get quick replies. We advise also that you state in your advertisement the present location of plant that is offered for sale, or point of delivery provided you are in the market for equipment.

TO SIGN YOUR NAME and address to your advertisement begets the confidence of the reader and facilitate receiving replies. You can however, obviate delay in receiving answers by signing your ad only with initials (your own or others), care of your home, your office or a post-office box number in your city.

For quick and satisfactory results
tell the reader everything that
he will want to know

EMPLOYMENT AGENCIES

TEMPORARY free registration. Applications accepted at present without registration charge from graduates mining, metallurgy, available \$150 or lower. Positions negotiated up to \$6500 per year. Desirable positions secured promptly. Wanted immediately—Superintendent sulphur mine and retorts, \$200; mill electrician, Mexico, \$200; mill electrician, Colorado, \$175; copper chemist, southwest, \$150; vanadium chemist, \$150; mill mechanical draftsmen, domestic and foreign, \$175 to \$250; several openings recent mining graduates, \$125 up. Apply Business-Men's Clearing House, Denver, Colorado.

CORRESPONDENCE SERVICE

THE undersigned provides a confidential service designed to locate openings, through correspondence, for men earning not less than \$2500 and up to \$25,000; all lines. Not an employment agency, but a constructive, initiative service, covering individual negotiations. Established 1910. Complete privacy assured; present connections in no way jeopardized. Send name and address only for explanatory details. R. W. Bixby, W-64-66 Niagara St., Buffalo, N. Y.

POSITIONS WANTED

OIL and coal geologist. Owing to cancellation of foreign engagements, experienced oil and coal geologist will accept assignments during the summer and autumn months, Eastern or Western fields. Address: William F. Jones, Geological Department, Mass. Institute of Technology, Cambridge, Mass.

MINING engineer, technical graduate, wants position as superintendent or manager. Experienced in iron mining. Competent to make plans for open pit, milling or underground mining. PW-115, Eng. & Min. Journ., Chicago.

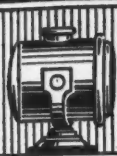
MANAGER of Silver Lead Mines and Mill will be open for a position about July 15th. Had 18 years experience. Know the game technically and practically. Now located in Mexico, will consider salary and working interest in a property of merits. PW-128, Eng. & Min. Journal, San Francisco.

MANAGER or general superintendent desires position with large interests. Graduate of University of Penna. and Boston School of Technology as mechanical and mining engineer, competent executive, good organizer, 15 years experience in Penna., Alabama and Texas. Thoroughly familiar with lay-out, installation and operating mechanical equipments and concentration work. Now at head of half million dollar concern in Texas, but do not like country. PW-129, Eng. & Min. Journal, Philadelphia.

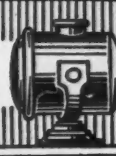
**NEED A
Superintendent?**

Assayer, Engineer
Master Mechanic,
Electrician?
Wire or Write
**Business Men's
Clearing House,**
Denver, Colo.





SEARCHLIGHT SECTION



POSITIONS WANTED

CHIEF electrician; mining or industrial; technical; 17 years practical experience; excellent record in cost reduction. References. PW-119, Eng. & Min. Journal.

SUPERINTENDENT or manager, open for engagement, age 44. Technical education and twenty years' experience in western states and South America mostly in the copper industry. Claim to understand every phase of the work in connection with mining and milling, including layout and construction of plant. Refer to former employers. PW-122, Eng. & Min. Journal, Chicago.

MINING engineer with over twenty years' varied experience, desires position as mine manager or superintendent. Immediately available. New York interview. PW-123, Eng. & Min. Journal.

MANAGER or superintendent, technical graduate, American, age 34, married, wishes position with live growing company. Thirteen years' experience in mining and milling copper, silver, lead and zinc ores in United States and Mexico; past 10 years in full charge of operations. Personally familiar with mining and milling operations and methods of many of largest companies in United States and Canada. Fluent Spanish. PW-125, Eng. & Min. Journal, Chicago.

ENGINEER—Electrical and mechanical. Eleven years' experience U. S. and Europe. Mfg. plant, sales, electric furnace and Central Station. Desires position where ability and ingenuity will count. Now employed but available on short notice. Excellent references, executive ability. Any location. PW-138, Eng. & Min. Journal, Chicago.

MINING engineer open for engagement with reliable company. Fifteen years' experience in examination, milling, cyanidation, mine development and management. Speak Spanish, good organizer. New York interview. PW-127, Eng. & Min. Journal.

POSITIONS WANTED

FIELD engineer, acquainted with good properties in Canada, seeks engagement with company wishing to secure desirable mining properties. PW-126, Eng. & Min. Journal.

MANAGER, Superintendent or assistant.—Graduate M. E. experienced in foundry, cement mill, machine shop, construction, power generation and transmission, and Cottrell electrical precipitation. Middle West preferred. PW-135, Eng. & Min. Journal, Phila.

ENGINEER as manager or superintendent. Seventeen years' experience development and operation gold, silver and copper mines. Ten in Mexico. PW-134, Eng. & Min. Journal, San Francisco.

MISCELLANEOUS

Mineral Specimens

I buy choice mineral specimens, crystallized specimens of any mineral, crystallized golds particularly. At \$28.50 I sell handsome mineral collection 110 specimens containing nice specimen of every important ore, size one to three inches. Send for pamphlet. G. S. Scott, 20 Nassau St., New York.

WANTED

Used Carbon (Black Diamonds) and Bortz and fragments wanted; will pay highest prices. S. Dessau's Son, 180 Broadway, New York, N. Y.

Large Quartz Crystals

WANTED to purchase. Must be transparent and free from flaws. G. S. Scott, 20 Nassau Street, New York.

Maurice S. Dessau, 6 Maiden Lane, N. Y. will pay highest prices for carbon (black diamonds) and Bortz fragments, also large and small used stones. Payment made return mail for merchandise purchased.

THE AMERICAN MINERALOGIST

A Monthly Magazine, containing in convenient form all discoveries and data essential to the students of this science, including descriptions of minerals, collections, accounts of trips, reviews of books, proceedings of societies, and abstracts of the literature. See Eng. & Min. Journal, May 11 1918, p. 895.

Price: Single copies 15c., annual subscription \$1.50
Harry W. Trudell, Business Manager
41 N. Queen St., Lancaster, Pa.; or,
2030 E. Madison St., Philadelphia

POTASH TAILINGS

We own approximately 8,000,000 tons of Tailings that will average approximately 10% K₂O. They are crushed to minus 100, are located at Colorado Springs, Colo. Lime beds on the property. These tailings are from Cripple Creek ore. An opportunity for anyone having a process for obtaining the Potash from Silicates. Will sell outright or lease to responsible parties.

The Morse Bros. Mchry. & Supply Co.
Denver, Colo.

WANTED

2 or 3—17-A

Mining Machines

250 V. 42-in. gauge, Jeffrey make.

What have you?

DUQUESNE
Electric & Mfg. Co.

Write, wire or phone our nearest office, Pittsburgh, Pa., or 230 S. La Salle St., Chicago, Ill.

Simpson—San Francisco used machinery

A Large Stock—Prompt Delivery. Also New Machine Tools Carried in Stock
Write—Wire—Call

A. H. SIMPSON CO., 634 Stevenson St., San Francisco, Cal.

WANTED

4000 to 6000 Feet of Second
Hand Double Strength

Wrought Iron or Steel Pipe

6-inch to 10-inch

UTAH FUEL CO., Salt Lake City, Utah

P. O. Box 1386

We are in the market for Western ores and mines of Manganese, Molybdenum,

Tungsten, Vanadium and Chromium.

Submit analysis, estimates of quantities available engineers' reports and maps. Blank forms supplied on application.

L. F. S. H., 629 Citizens' National Bank Bldg.
Los Angeles, Calif.

SILVER MINING PROPERTY

FOR SALE
In Austin, Nevada, consisting of approximately 1200 acres, over half of which are patented. Last owned by Austin-Manhattan Consolidated Mining Co. Includes old mines of the MANHATTAN SILVER MINING CO., with record production of over TWENTY MILLION DOLLARS. None of the old mines are deep.

WM. A. MARSHALL
Resident Agent Austin, Nevada

MICA MICA MICA MICA MICA

Can ship clean, scrap mica in carload lots. Can contract for all you need.

L. B. MAUPIN
Baggs, Wyo.

SEARCHLIGHT SECTION

AUCTION SALE of valuable Graphite Property Near Buckingham Province of Quebec, Canada

The undersigned will offer for sale by public auction at W. A. Cole's Auction Rooms, No. 63 Sparks Street, in the City of Ottawa, Canada, at 2:30 o'clock in the afternoon, of the **Tenth day of September, 1918**

the property known as the "Walker Graphite Mine" in the Township of Buckingham, comprising about 1250 acres of land, held in fee simple. The property is situated about six miles from the Town of Buckingham, on the Canadian Pacific Railway between Montreal and Ottawa, and less than ten miles from the landing on the Ottawa River. The quantity of ore is practically inexhaustible and the mining facilities are exceptional.

The buildings consist of refinery, engine and boiler house, manager's dwelling, foreman's dwelling, and other buildings. The lands are well timbered and contain ample supplies for mine purposes and fuel. The right to cut basswood until the 1st day of March, 1919, has been sold.

A large quantity of machinery, plant and tools on the property will also be sold as a separate lot. Both sales will be subject to reserved bids.

Applications to inspect the property may be made to Mr. Sam. Devine, Buckingham, Quebec, Canada, and further particulars may be obtained from

M. J. GORMAN, Vendor's Solicitor,
Union Bank Building, Ottawa, Canada.
W. A. COLE, Auctioneer.

Do you receive our stock sheet monthly?

We have a complete stock of

MOTORS

both A.C. and D.C.—ranging from 1 to 200 hp.

*Wire Us—Write Us—Phone Us—
We are at your service.*

DUQUESNE
Electric & Mfg. Co.

Write, wire or phone our nearest office, Pittsburgh, Pa., or 230 S. La Salle St., Chicago, Ill.

FOR SALE

Immediate Delivery

One 3-drum Lidgerwood

HOISTING ENGINE

Nos. 19883 x 19884, cylinder 12 in. x 12 in. Stevenson link reverse, 3 main drums, 50-in. diameter, 60 cable grooves in each, double-cone clutch. Single drum, 20-in. diameter, 10-in. face, keyed to Niggerhead, 12-in. x 14-in. Wire or write

STEWART SAND CO.

615 American Bank Bldg., Kansas City, Mo.

FOR SALE

200-ton Cyanide Mill and Hoisting and Sur- face Plant of

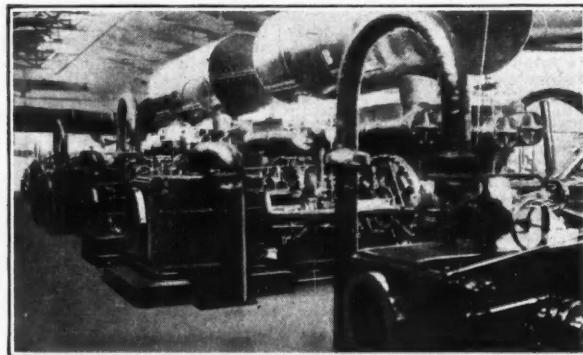
Nevada Hills Mining Co., Fairview, Nevada

Most complete plant in state of Nevada. Consists of structural steel buildings, full cyanide equipment, electric hoist, large compressor plant, electrical equipment, boarding house, cottages and full set of surface buildings. To anyone in a position to purchase plant complete as it stands, we can offer an exceptional bargain.

Write or wire

Nevada Engineering & Supply Co.

Reno, Nevada



BLOWING ENGINE

FOR SALE

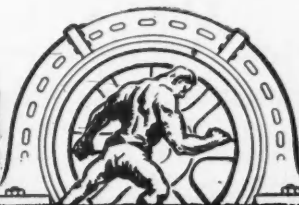
Owing to the change from steam to electrical equipment, Nordberg, Corliss Cross-compound steamsi, ngle-stage, duplex air. Air pressure 60 oz., displacement 20,200 cu. ft. per minute.

TENNESSEE COPPER COMPANY

61 BROADWAY, NEW YORK CITY

SEARCHLIGHT SECTION

MAC GOVERN & COMPANY INCORPORATED



POWER MACHINERY

HOISTS—Electric Driven

- 2—Mead-Morrison electric hoists, double drum, drums 30-in. dia. x 24-in. face x 3-in. flange, with 40 H.P. Westinghouse motors, 500 volts D.C. variable speed, 510 R.P.M.
- 1—Maine electric hoist, double drum, drums 12-in. dia. x 24-in. face x 6-in. flange, direct geared to 37 H.P. PMaine, 60-cycle motor.
- 2—Maine electric hoists, 2-drum, drums 18 x 32 in., flanges 7 in., 5 operating lever, ratchet operating lever, etc., direct connected to 75 H.P. Maine slip ring motors, 3 phase, 69 cycle, 220 volts, 865 R.P.M.
- 2—Lidgerwood electric mine hoists, single drum, drums 30-in. dia. x 24-in. face x 4-in. flanges, direct geared to General Electric motors, type IQC, form M, 60 cycle, 220 volts, slip ring 830 R.P.M.
- 7—Lidgerwood electric mine hoists, single drum, drums 30-in. dia. x 24-in. face x 4-in. flanges, direct geared to 52 H.P. Westinghouse type 10-K series wound motors, 220 volt, direct current, 700 R.P.M.
- 1—Maine double drum hoist, drums 12-in. dia. x 24-in. face x 6-in. flange, capacity 3000 lb. on a single line at rope speed of 250 ft. per min., dir. con. to 37-hp., 440 volt, 60-cycle motor, 1200-r.p.m.

HOISTS—Belt Conveyor Coal Hoist

- 1—Belt conveyor coal hoist, 20-in. belt, 90-ft. centers over coal hoppers, driven by 15 H.P. Crocker-Wheeler motor, 230 volts D.C., 800 R.P.M.

AIR COMPRESSORS—Electric Driven

- 1—Christianson, type D-4, 50 cu. ft. air per min., with 10 H.P. motor, 550 volts direct current, 1100 R.P.M.

HOISTS—Steam Driven

- 2—Flory, 8 1/2 x 10 in., double cylinder, double drum, drums 27 x 30 in., capacity, 3000 lb. on a single line.
- 1—Lidgerwood, 7 x 10-in., double drum, double cylinder, 2 niggerheads, drums 14-in. dia. x 26-in. face x 6-in. flange, approximately 20 H.P.
- 1—Lidgerwood, 7 x 10-in., double drum, double cylinder, 2 niggerheads drums 16-in. dia. x 18-in. face x 7-in. flange, approximately 20 H.P.

- 1—Lambert, 7 x 10-in., double drum, double cylinder, 2 niggerheads, drums 14-in. dia. x 22-in. face x 6-in. flange, approximately 20 H.P.
- 1—Orten & Steinbrenner, 7 x 10-in., double cylinder, drum 14-in. dia. x 21-in. face x 6-in. flange, approximately 20 H.P.
- 1—Lambert 6 1/2 x 10-in. single cylinder, single drum steam hoist, with 18-hp. boiler.
- 1—Lidgerwood, 5 x 8-in., single drum, double cylinder, drum 14-in. dia. x 21-in. face x 6-in. flange, approximately 8 H.P.

AIR COMPRESSORS—Belt Driven

- 1—Laidlaw-Dunn-Gordon, 18 x 12 x 12 in., duplex, 2-stage, 525 cu.ft. free air per min., 100 lb. pressure.
- 1—Hall 13 x 8 x 9 in., cross compound, class K, 2-stage duplex, 182 cu.ft. free air per min. at 135 R.P.M.

AIR COMPRESSORS—Steam Driven

- 1—Rand cross compound, 2 stage, H.P. side 22 x 24 x 48 in., L.P. side 40 x 39 x 48 in., complete with intercooler, etc., capacity 4000 cu.ft. air per min.
- 1—Ingersoll-Sargent cross compound, H.P. side 22 x 22 1/2 x 42 in., L.P. side 40 x 36 1/2 x 42 in., complete with intercooler, etc., capacity 2626 cu.ft. air per min.
- 1—Ingersoll-Rand, class A-1, 20 x 22 1/2 x 24, 1000 cu.ft. air per min., at 85 to 100 lb. pressure.
- 1—Clayton duplex, 2-stage, 10 x 18 and 10 x 10-in., 175-r.p.m., capacity 425-cu.ft.
- 1—Ingersoll-Rand, 6 x 10 x 6 in., type NF-1, 114 cu.ft. air per min.
- 2—508-hp. Babcock & Wilcox, 200-lb. pressure.
- 1—400-hp. Babcock & Wilcox, 160-lb. pressure.
- 4—360-hp. Erie City, 160-lb. pressure.
- 14—290-hp. Babcock & Wilcox, 160-lb. pressure.
- 2—283-hp. Aultman & Taylor, 160-lb. pressure.
- 2—283-hp. Babcock & Wilcox, 160-lb. pressure.
- 3—243-hp. Heine, 160-lb. pressure.
- 2—240-hp. Stirling, 140-lb. pressure.

We have on hand all classes of Power Machinery.

MacGovern & Company, Inc., 114 Liberty Street, New York, N. Y.

Rails

- 150 tons—12-lb. with splices. **New.**
- 100 tons—16-lb. with splices. **New.**
- 150 tons—20-lb. with splices. **New.**
- 50 tons—25-lb. with splices. **New.**
- 200 tons—25-lb. with splices. **Relay.**
- 500 tons—40-lb. with splices. **New.**

Locomotives—

STEAM

- 1—30-ton Davenport S.T., 4 ft. 8 1/2 in. gage, 150-lb. steam. **First-Class.**
- 1—26-ton Davenport S.T., 4 ft. 8 1/2 in. gage, 150-lb. steam. **First-Class.**
- 14—36-in. gage 9 x 14 Saddle Tank. Steam 140-lb. **First-Class.**
- 2—24-in. gage 7 x 12 Saddle Tank. Steam 150-lb. **First-Class.**

GASOLINE

- 1—5-ton 30-in. gage Whitcomb Gasoline. **First-Class.**

Dump Cars

- 38—End dump quarry, 36-cu.ft., 36-in. gage.
- 10—1 1/2-yd. Atlas All Steel "v" shape, 36-in. gage.
- 30—10-ton All Steel Hopper Bottom, 24-in. gage.

Generator Unit

- 1—75-kw. Westinghouse Generator, 250 volts, D. C., direct connected to 14 x 14 Payne Automatic Engine, complete with switchboard panel. **Excellent.**

ZELNICKER IN ST. LOUIS
Get Bulletin 237—78 Bargain pages

A FEW RARE BARGAINS

OPEN STEEL TANK

Quantity	Size	Capacity Gals.	Weight		Each Sides Bot. In. In.
			Lbs.	In.	
13	40x 8 ft., 8 in.	82,000	16,500		5/16
4	34x11 ft.	75,000	23,100		5/16
17	34x16 ft.	108,000	28,440		5/16

These tanks duty free into Mexico. Perfect condition.

AERIAL TRAMWAY

Gravity tram, one mile span, buckets, etc. Excellent condition.

STAMP MILLS

20 stamp mill, 1050 lb. stamps, with timbers, 30, stamp mill, new, with steel framing. Both complete in every respect.

DIRECT CURRENT GENERATORS

- 2—70 Kw. Westinghouse 250/500 Volt, 3 Wire Brand New. Snaps.

STRUCTURAL STEEL ORE BIN

12x12x50 capacity, 350 tons, marked for re-erection. Send for blueprints and photos. Same as New.

Tell Us What You Need

SOUTHWESTERN WRECKING COMPANY, El Paso, Texas

POWER UNITS

Immediate Shipment
A FEW SPECIALS

- 2—350 Kw. Westinghouse 25-Cyc., 3-Ph., 410-440-Volt, Revolving Field Alternators, Dir. Conn. to Cross Compound Allis-Chalmers Heavy Duty Double Eccentric, Double Ported Valve Gear Engines. Practically new.
- 1—350 Kw. Westinghouse 25-Cyc., 3-Ph., 6600-Volt, Revolving Field Alternator, Dir. Conn. to Heavy Duty Erie Ball Automatic Engine.
- 1—600 Kw. General Electric 125-250-Volt Unit, consisting of G. E. Generators and Tandem Compound Heavy Duty Russell 4-valve Engine.
- 2—500 hp. B. & W. Steel Header Water Tube Boilers with B. & W. Chain Grate Stokers, A No. 1 condition. Minimum allowance 175 lb. reerection.
- 3—500 hp. Edgemoor 200 lb. working pressure Water Tube Boilers with Chain Grate Stokers. Practically new.

Submit your requirements.

We can assist.

PAUL STEWART & CO., First National Bank Bldg., Cincinnati, Ohio

SEARCHLIGHT SECTION

Second Hand Machinery

Ready to Ship

Write us your requirements. Our lists are never complete—we cannot make them complete—but we can fill any requirements.

SPECIAL

200-kw. Hydro-Electric Plant, complete, consisting of:
 1—200-kw. General Electric Generator, 3-phase, 60-cycle, 2300-volt, 720-r.p.m., coupled direct to a Victor-Francis Water Turbine, designed to operate on 110-lb. pressure.
 3—75-kv.a. Step-up Transformers, 2300 to 16,500-volt.
 3—75-kv.a. Step-down Transformers, 16,500 to 2300-volt.
 16—Mile Transmission Line No. 6 M.H.D. Bare Wire.
 7700 ft. of 36-in. Wood Stove Pipe Line.
 1—500-kw. Westinghouse Parsons Turbine, 3-phase, 60-cycle, 440-volt, with Alberger surface condenser, vacuum pumps, circulating pumps, piping, etc.

BELT DRIVEN COMPRESSORS

1400-ft. 13 x 22 x 36 Reidler, used at Camp Bird Mine; excellent condition.
 1130-ft. 24 x 14 x 18 Franklin cross compound.
 909 ft. 20 x 12½ x 20 Sullivan.
 513 ft. 15 x 9 x 12 Ingersoll-Rand-Imperial.
 481 ft. 16 x 10 x 18 Leyner.
 196 ft. 10 x 12 Ingersoll-Rand, Type 11.
 115 ft. 9 x 8 Ingersoll-Rand, Class ER-1.
 348 ft. 16½ x 10 Ingersoll-Rand, 25-lb. pressure.

STEAM DRIVEN COMPRESSORS

909 ft. 18 x 20 x 13½ x 20 Norwalk, compound.
 648 ft. 16 x 18 x 11 x 22 Leyner, compound.
 558 ft. 16 x 16 x 10½ x 16 Norwalk, compound.
 519 ft. 12 x 18 x 12 x 12 Ingersoll, compound.
 482 ft. 21½ x 11 x 16 x 10 x 18 Leyner, compound.
 439 ft. 18 x 11 x 18½ x 10½ x 10 Ingersoll, compound.
 427 ft. 14½ x 16 x 10 x 17 Leyner, compound.
 391 ft. 14 x 14 x 22 Rand St. Line.
 314 ft. 12 x 13½ x 8½ x 16 Leyner, compound.
 150 ft. 10 x 10 x 10 Smith-Valle.

POWER MINE PUMPS

2½ x 9 Aldrich Quintuplex, 50 gal., 1000 ft., direct connected to 20-hp., 3-60-440 motor.
 8 x 12 Gould Triplex, double acting, 150 lb. pressure, 608 gal.
 10 x 12 Deane Horizontal double acting, 150 lb. pressure, 1125 gal.
 6-in. Wheeler, two-stage centrifugal, 1200 g.p.m., 200 ft.
 4-in. Worthington turbine, direct connected to 20-hp., 3-60-440 motor, 400 gal., 150 ft.

STEAM PUMPS OUTSIDE PACKED

26 and 15 x 8 x 24 Knowles Compound Duplex.
 24 and 14 x 7 x 24 Knowles Compound Duplex.
 9 x 5 x 10 Buffalo, Duplex.
 10 x 7 x 10 Worthington Duplex.
 7 x 4 x 8 Cameron, Single.
 7 x 4 x 8 Snow, Duplex.
 7 x 4 x 8 Advance, Duplex.
 6 x 3 x 6 Fairbanks-Morse, Duplex.

General Service Pumps

8 and 12 x 10½ x 12 Knowles Compound Duplex.
 16 x 10½ x 10 Worthington Duplex.
 14 x 8 x 12 Snow Duplex.
 16 x 8 x 20 Hooker, Simplex.
 16 x 8 x 12 Knowles, Simplex.
 12 x 7 x 12 Snow, Duplex.
 10 x 7 x 10 Worthington Duplex.
 8 x 8 x 12 Fairbanks-Morse, Duplex.
 2—10 x 6 x 10 Snow, Duplex.
 1—8 x 6 x 10 Snow, Duplex.
 1—7½ x 4½ x 10 Deane, Duplex.
 1—7 x 6 x 8 Snow, Duplex.
 2—7 x 4 x 8 Prescott, Duplex.
 2—7 x 4 x 8 Buffalo, Duplex.
 1—7 x 4 x 8 Snow, Duplex.
 3—6 x 5½ x 6 Snow, Duplex.
 1—6 x 5½ x 6 Fairbanks-Morse, Duplex.
 1—6 x 5½ x 6 Worthington, Duplex.
 2—6 x 4 x 6 Snow, Duplex.
 1—6 x 4 x 6 Deane, Duplex.
 1—5½ x 3½ x 5 Worthington, Duplex.

The Morse Bros. Machinery & Supply Co.
 1732 Wazee Street, Denver, Colo.

Electric Mine Locomotives

2—6-ton Jeffrey, 24-in. gauge, Type D.M., Class 30, Form H. Equipped with 2-MH, 64 motors, 250 volts D.C. Extra armatures and repair parts.

Immediate Shipment.

ARTHUR S. PARTRIDGE
 Federal Reserve Bank Bldg., St. Louis

Immediate Deliveries and Pre-War Time Prices on ANYTHING AND EVERYTHING IN THE MACHINERY AND EQUIPMENT LINE
Wire, Write or Telephone

BOGUE SUPPLY COMPANY
 210 Felt Bldg., Salt Lake City, Utah
 Was. 2448-1005 M. J. McGill, Mgr.

NEW ADVERTISEMENTS

for the

SEARCHLIGHT SECTION

can be received until 10 a.m. Monday for Saturday's issue.

90 H.P. GAS ENGINE

1—90 H.P. Western distillate engine, equipped to burn tops; with friction clutch and Bosch Magneto; installed less than year ago, used less than 60 days; equal to new in every respect. Immediate delivery Central Arizona point; with this can furnish either compressor or generator making complete power plant.

Southwestern Wreckin Co., El Paso, Texas

FOR SALE—Electric Motors

We make a specialty of, and have the largest stock of SECOND HAND electric MOTORS and GENERATORS in America, and buy and sell, rent, exchange and repair electrical machinery of all kinds.

GREGORY
 ELECTRICAL
 CHICAGO, ILL.

16th and Lincoln Streets, Chicago

Subject to Prior Sale we offer the following:

Second-Hand Mining Machinery for Sale

Six 8-ton Morgan Gardner Type F, 250-volt, 34 in. and 36 in. track gauge Locomotives for inspection at Ehrenfeld, Winburne and Munson, Pa.

10-ton Goodman Type 11A, 250-volt, 36 in. track gauge Locomotive, for inspection at Patton, Pa.

7-ton Milwaukee Locomotive of Manufacturing Company gasoline Locomotive, 36 in. gauge and spare parts for inspection at Gipsy, Pa.

Morgan-Gardner Type D, 250-volt, 36 in. gauge, 7½-ft. cutter, Bar-Mining Machine, for inspection at Amsbry, Pa.

Jeaneville boiler feed Pump, 5 by 8 outside packed, 4 in. suction, 3 in. discharge, 1½ in. live steam, 2 in. exhaust, for inspection at Arcadia, Pa.

Nagle Engine, 16 x 22 slide valve, throttling governor with shaft and outboard pillow block and band wheel, 96 in. by 20 in., 175 hp., at 150 r.p.m., with 100 lb. steam at throttle, 4½ in. live steam, 6 in. exhaust, for inspection at Cresson, Pa.

PENNSYLVANIA COAL & COKE CORPORATION, Cresson, Cambria County, Pennsylvania

USED COPPER CABLE

	Ga.	Strands	Cir. Mills
2700 Ft.	6	1	26,000
5000 Ft.	14	7	28,000
1000 Ft.	3	1	52,000
1600 Ft.	11	7	59,000
150 Ft.	2	1	66,000
1000 Ft.	10	1	72,000
400 Ft.	9	7	94,000
1300 Ft.	8	7	115,000
1100 Ft.	000	1	167,000
2000 Ft.	10	19	197,000
10,000 Ft.	11	37	300,000

RAILS: RELAYING A-1

100 Tons 56 lb. with angle bars, switch points, switches, etc., at \$60 f.o.b. Bedford, Ind.

STEEL DUMP CARS

20—10 ton ATLAS, Bottom Dump, Standard Gauge.

TURBINES

1000 kw., CURTIS, Vertical, 25 cy. 3 Ph. 480 V., 160 lb. pressure.
 800 kw., CURTIS, Vertical, 25 cy. 3 Ph. 480 V., 160 lb. pressure.

BOILERS

2—300 hp. CAHALL, Vertical Water Tube.
 4—250 hp. GEARY, Water Tube.
 1—375 hp. O'BRIEN, Heine, Water Tube.

PIPE

1000 Ft. 12 in. Flanged C. I. Pipe.
 1000 Ft. 14 in. " "
 1000 Ft. 16 in. " "
 with valves, tees, ells, etc.

Large quantity shaft hangers, pillow blocks, shafting, couplings, pulleys, safety collars, etc. PRICE, 4c. per lb.

CONVEYORS: Belt, Bucket and Screw, with troughs, all sizes. PRICE, 4c. per lb.

WRITE FOR OUR COMPLETE LIST.

D. M. OSBORNE MACHINERY CO.
 221 St. Clair Ave., N. E., Cleveland, Ohio.

The SEARCHLIGHT SECTION

of the McGraw-Hill Engineering Publications

Complete Service

A business paper that gives **complete** service to an industry, does so in three ways:

1

Its text pages furnish reliable information of up-to-the-minute progress and practice in the work of an industry.

2

Its advertising of manufacturers keeps readers informed of new and standard material, equipment and machinery.

3

Its Classified Advertising catalogs the current needs and special opportunities of an industry through the announcements of Employment and Business Opportunities, Second-Hand Equipment, Wanted and For Sale, etc.

What "Searchlight" Is

Recognizing fully both the special and associated value of all Classified advertisements, such announcements are grouped in one part of each McGraw-Hill paper called the "Searchlight" Section. The special appropriateness of this name centers in the fact that the thousands of copies of each paper carrying this advertising are synonymous with the rays of a searchlight. They search out for advertisers the prospective employers, employees, buyers or sellers with whom they can do business.

Special Circulation

And in the same sense that a searchlight typifies highly concentrated light so does the subscription list of each McGraw-Hill paper represent highly concentrated circulation as compared with the diffused circulation of newspapers and magazines.

Interested Readers

Each of the ten McGraw-Hill engineering publications is the representative business paper of the industry it serves. The men responsible as owners or managing executives for successful operation or maximum and efficient production and the ambitious and progressive "live wire" workers in these industries read these papers as a necessary part of their business equipment.

"Searchlight" Ads

When you want to do business with these men, the most direct and inexpensive means of getting your message before them is through their business paper. And when you are seeking or offering Employment, Second-hand Equipment or Business Opportunities, the advertising finds its logical place in the "Searchlight" Section—the nationally recognized center for such advertising.

And Then—Results

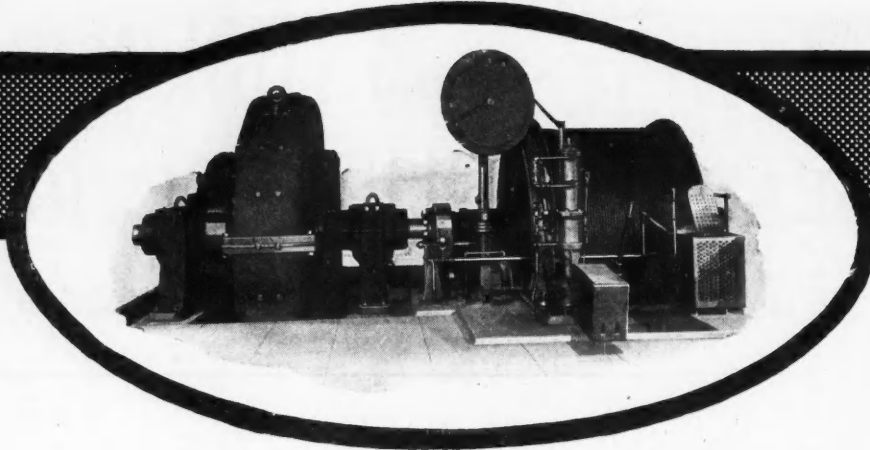
And that this advertising serves its purpose and accomplishes the desired results is evident from thousands of letters received from satisfied advertisers as well as from the fact that most of our copy is new in each issue—convincing evidence of the quick returns invariably received by "Searchlight" advertisers.

One McGraw-Hill paper carries 30 to 40 pages of this advertising each issue; two others 20 to 25; others 6 to 10. Naturally, the volume of this advertising from some industries is greater than from others but in each McGraw-Hill paper the "Searchlight" Section is the accepted means of communicating with the men of that industry.

To Serve You

When you want effective and inexpensive advertising in any of the ten fields covered by these papers, the "Searchlight" Section offers you an invaluable service for advertising.

Agencies Wanted	Machinery Wanted
Agents Wanted	New Industries Wanted
Auction Notices	Partners Wanted
Books and Periodicals	Patent Attorneys
Buildings for Sale	Patents for Sale
Business Opportunities	Plants for Sale
Civil Service Opportunities	Positions Vacant
Contracts Wanted	Positions Wanted
Desk Room for Rent	Property for Sale
Desk Room Wanted	Receivers' Sales
Educational	Representatives Wanted
Employment Agencies	Salesmen Want Connections
Evening Work Wanted	Salesmen Wanted
Foreign Business	Specialties
For Exchange	Tutoring
For Rent	Vacation Work Wanted
Franchises	Water Front Property
Industrial Sites	Work Wanted
Labor Bureaus	Miscellaneous for Sale,
Machine Shops	for Rent or Want Ads.



This first motion hoist built for Cleveland Cliffs Iron Mining Company, lifts a balanced load of five tons of ore from a depth of 1000 feet at a speed of 1500 feet per minute. The drum is 8-foot diameter by 66-inch face and is fitted with an 8-foot air-operated band brake. The hoist is provided with an indicator and safety stop.

W-S-M Electric Mine Hoists

The manufacture of hoists has been a specialty of this Company for many years. In our hoist construction there are combined with good and carefully selected materials an engineering and manufacturing excellence, developed under the guidance of high ideals, but tempered and made practical by long and diversified experience.

A W-S-M Hoist is not the lowest-priced hoist you can buy. In fact it is perhaps the highest-priced hoist built. But superior service, safety, economy of operation, reliability and long life more than offset the additional first cost.

Write for Bulletin D 5, "Electric Mine Hoists."

THE WELLMAN-SEEVER-MORGAN CO.
CLEVELAND, OHIO, U.S.A.
NEW YORK DENVER SEATTLE



NATIONAL Tanks are giving unequalled service in America's largest institutions, including the United States Government. For the past twenty years they have stood for the best in workmanship, the best material, and the best in service. Does the indorsement of NATIONAL Tanks from leaders in every line mean anything to you? If so, let us figure on your next order.

**NATIONAL TANK & PIPE COMPANY
PORTLAND, OREGON**

A GOOD COMPARISON

Look For



The Name

¶ Because "NATIONAL" Pipe serves industry and civilization in numberless ways, it has been likened to a "NATIONAL" SERVANT.

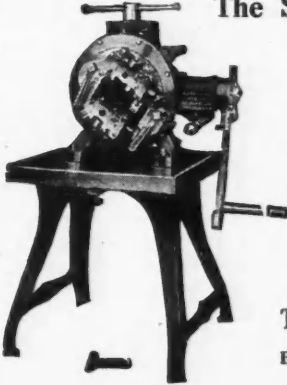
¶ A full page announcement featuring this idea will appear next week.

¶ Make a point of reading this announcement: it will be illustrated in a unique manner.

NATIONAL TUBE COMPANY, Pittsburgh, Pa.

ROOT Spiral Riveted Pipe—
Pipe Specialists for 48 Years.
ABENDROTH & ROOT MANUFACTURING COMPANY
 Works: Newburgh, N. Y. New York Office: 233 Broadway

The Same Dependable Dies

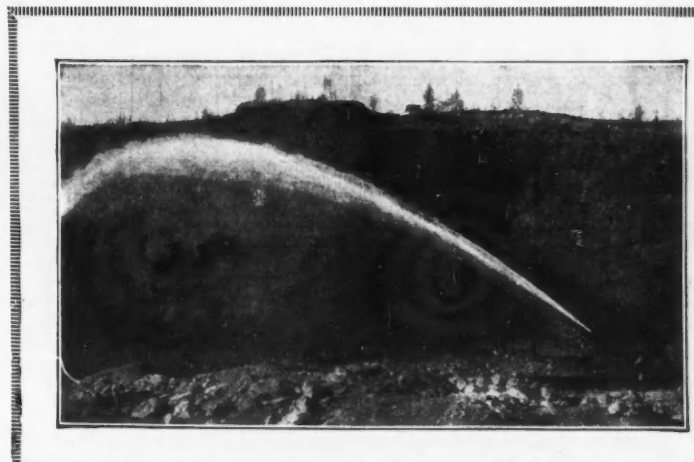


that have for a quarter of a century given such satisfaction in Genuine

ARMSTRONG

Stocks are used in the Nos. 0 and 00 Armstrong Pipe Threading and Cutting-Off Machines. All dealers carry them. Send for complete catalog including prices of repair parts on these perfect machines.

The Armstrong M'fg Co.
 324 Knowlton Street
BRIDGEPORT CONN.
 New York—248 Canal Street



Hydraulic Mining—Yukon Gold Co.
 Water supplied through TAYLOR SPIRAL RIVETED PIPE

New York, Jan, 16, 1911.

"Gentlemen: We beg to acknowledge yours of Jan. 9th, making inquiry as to our experience with your Spiral Riveted Pipe. Our first use of Spiral Riveted Pipe was in connection with our hydraulic mining operations as distributing lines from our main ditch system. The pipe was given severe service and proved entirely satisfactory. We are now using it in diameters up to 42 inches and heads up to 530 feet. We have found the pipe easy to lay and handle, strong for its weight and generally satisfactory.

Very truly yours,
 (Signed) Yukon Gold Co.
 O. B. Perry, Gen. Mgr."

Catalog and Special Prices on request.

AMERICAN SPIRAL PIPE WORKS, Chicago, Ill.



Americore
RUBBER COVERED WIRE
INTERIOR WIRING
ALL SIZES AND VOLTAGES

AWARDED
GRAND PRIZE
INTERNATIONAL EXPOSITION

Every coil examined and labeled under the direction of the underwriters' laboratories. Ignition wire for autos, motor boats and aeroplanes. Send for booklet fully describing.

American Steel & Wire Company
Chicago New York Cleveland Pittsburgh Worcester Denver

Export Representative: U. S. Steel Products Co., New York
Pacific Coast Representative: U. S. Steel Products Co.,
San Francisco Los Angeles Portland Seattle



WATERBURY WIRE ROPE

For Every Purpose
Standard Wire Rope, Armored Wire Rope (Gore Patent) and Fibrelad Wire Rope. A complete line with quality predominant. Catalog.

WATERBURY COMPANY
63 Park Row, New York
Chicago, New Orleans, Dallas, San Francisco, 2238-W

A. Leschen & Sons Rope Co.
WIRE ROPE
FOR
MINE HOISTING AND HAULING
AERIAL WIRE ROPE TRAMWAYS
St. Louis, U. S. A.

Manufacturers of "HERCULES" (Red Strand) Wire Rope

BRANCH STORES
New York-Chicago
Denver-Salt Lake City
San Francisco



"CRESCENT" WIRE ROPE

All desirable types and sizes for power transmission, hoisting, hauling, conveying, cableways, guy wires, etc. Let us quote you.

Geo. C. Moon Co.
Wire Rope for all purposes
Garwood, New Jersey

NEW YORK: 124 White St.
CLEVELAND: Rockefeller Bldg.

ROEBLING WIRE ROPE

FOR METAL MINING
JOHN A. ROEBLING'S SONS CO., Trenton, N. J.



Specify Goods Bearing This Trade Mark

It stands for the best in Electric Railway and Mine Haulage material.


ELECTRIC SERVICE SUPPLIES CO.
Philadelphia New York Chicago

SINTERING FINE ORES
FOR BLAST FURNACES
Dwight & Lloyd Sintering Company, Inc.
(Successor to Dwight & Lloyd Metallurgical Company)
Columbia Building: 29 Broadway, New York
Cable Address: Sinterer-New York

DORR CLASSIFIERS THICKENERS AGITATORS

THE DORR COMPANY ENGINEERS

DENVER 1009 17th Street
NEW YORK 17 Battery Place
LONDON 16 South Street



Are You Wasting Time with a wrench that slips off the nut?

Use the "FAVORITE" reversible ratchet WRENCH

It grips the nut on all sides.
Greene, Tweed & Co.
109 Duane St., N. Y. C.

When you want

Men

Put your advertising for them on the same basis as other publicity.

If you want competent and efficient assistants, experienced in the field served by this journal, you will naturally find such men among our readers—which include the keenest and most progressive men in the industry.

Get in touch with a number of these men and select the one that is best suited for your needs.

Only \$1.50 for 30 words



Protecting Cribbing—Hercules Mining Co.

Did You Read the Hercules Article?

It tells how this mining company used the CEMENT-GUN extensively in its recent improvements—how it fire- and weather-proofed cribbing, helped in the construction of a 190,000-gal. reservoir and rendered it *tight*, built the walls and roof of a three-story hall and clubhouse and the walls of ore bins, constructed a 60-ft. tank. And all this at *far* less cost than the hand plastering method.

But it's the **quality**, more than the saving in cost, that has won for the CEMENT-GUN such wide success—*quality*, for the cement and sand are mixed dry, hydrated at the nozzle, and shot into place by *compressed air*. How it penetrates *every* crevice, bonds like a steel weld, and builds up *strong, tough and durable*.

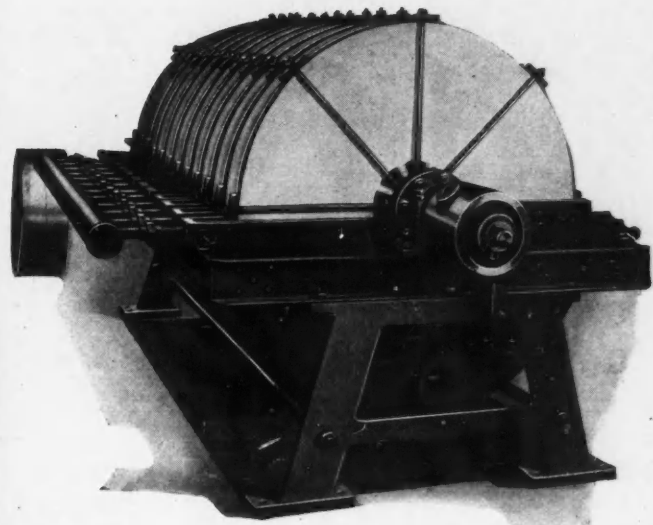
It's an *interesting* story, particularly to *mining men*. Our latest bulletins are at your service. *Where shall we address them?*



Cement-Gun Co., Inc.

South 10th and Mill Sts.
Allentown, Pa.

New York Office, 30 Church St. Chicago Office, 1414 Fisher Bldg. John A. Traylor, Newhouse Bldg., Salt Lake City, Utah. Taylor Engineering Co., 538 Central Bldg., Seattle, Wash. Taylor Engineering Co., Vancouver, B. C. R. E. Cleaton & Co., 20 St. Nicholas St., Montreal, Can. General Supply Co. of Canada, Ltd., Winnipeg, Can.



A Step Forward in Filtration Economy

Seeing the sludge entering the container tank—the filtrate leaving with almost sparkling clarity—and the cake discharging practically bone-dry—all being done continuously and automatically with little or no attention, proves that this filter is a decided step forward in filtration economy. The

American Continuous Suction Filter

requires but little floor space and little headroom. It is extremely convenient and accessible and has over double the capacity of other vacuum filters per unit of space occupied. Leaf segments are interchangeable and easily removed and filter cloths are renewed in a few minutes.

Laboratory Facilities. We maintain a thoroughly equipped laboratory where we are prepared to make tests on samples submitted to enable us to make recommendations as to the most efficient size and type filter to meet your requirements.

Ask for new Descriptive Catalogue, No. 102.

UNITED FILTERS

CORPORATION

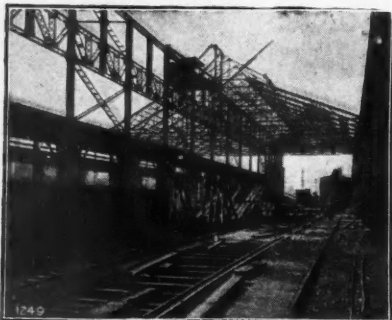
Sweetland and Kelly Pressure Filters—American Continuous Suction Filter—Sweetland's Patent Metallic Filter Cloth

Sperry Bldg., Brooklyn, N. Y. Peoples Gas Bldg., Chicago, Ill. Nevada Bank Bldg., San Francisco, Cal. Felt Bldg., Salt Lake City, Utah.

AMERICAN BRIDGE COMPANY

HUDSON TERMINAL-30 CHURCH STREET, NEW YORK

Manufacturers of Steel Structures of all classes particularly **BRIDGES AND BUILDINGS**



Open Hearth Furnace Building,
Edgar Thompson Steel Works

SALES OFFICES

NEW YORK, N. Y., 30 Church Street	St. Louis, Mo., Third Nat'l Bank Bldg.
Philadelphia, Pa. . . Widener Building	Denver, Colo., First Nat'l Bank Building
Boston, Mass. . . John Hancock Bldg.	Salt Lake City, Utah, Walker Bank Bldg.
Baltimore, Md., Continental Trust Bldg.	Duluth, Minn. Wolvin Building
PITTSBURGH, PA. . . Frick Building	Minneapolis, Minn., 7th Ave & 2nd St., S. E.
Buffalo, N. Y. . Marine National Bank	
Cincinnati, Ohio. Union Trust Building	Pacific Coast Representative:
Atlanta, Ga. . . . Candler Building	U. S. Steel Products Co. Pacific Coast Dept.
Cleveland, Ohio . . Guardian Building	SAN FRANCISCO, CAL., Rialto Building
Detroit, Mich., Beecher Ave. & M. C. R. R.	Portland, Ore. Selling Building
CHICAGO, ILL., 208 South La Salle St.	Seattle, Wash., 4th Ave. So. Cor. Conn. St.

Export Representative:

United States Steel Products Co., 30 Church St., N. Y.

The New Herreshoff

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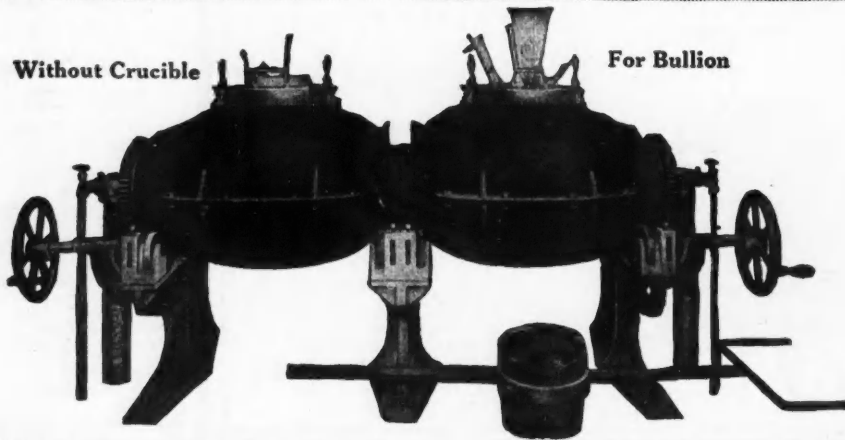
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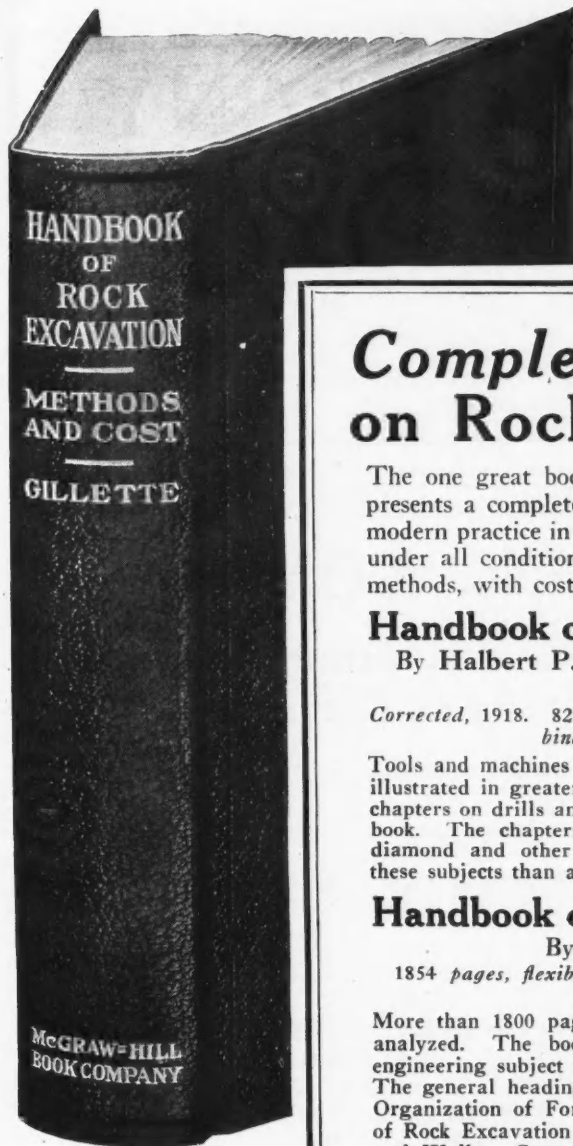
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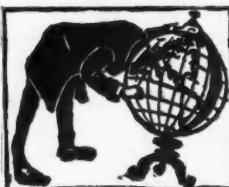
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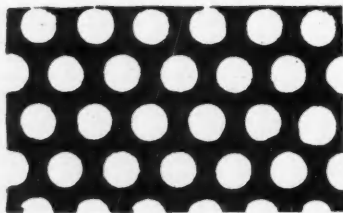
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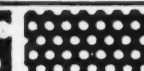
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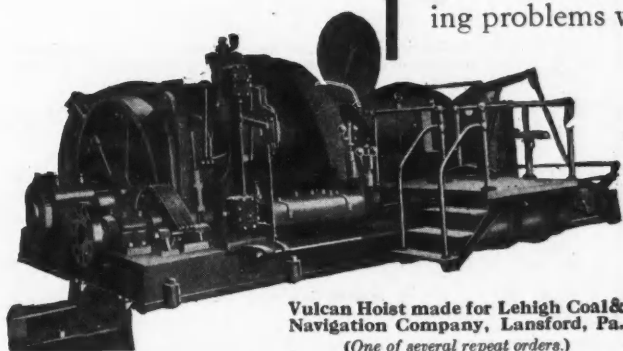
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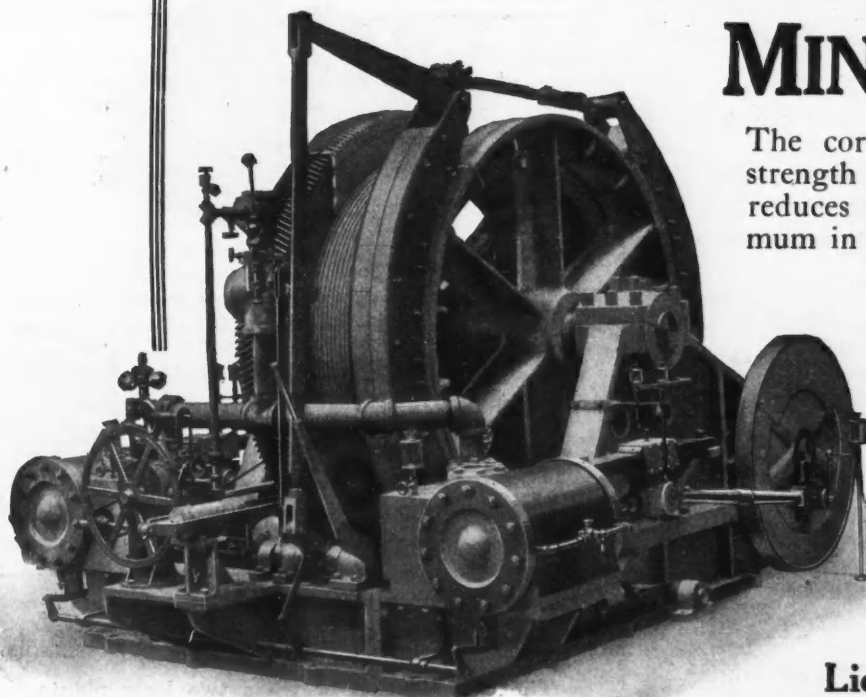
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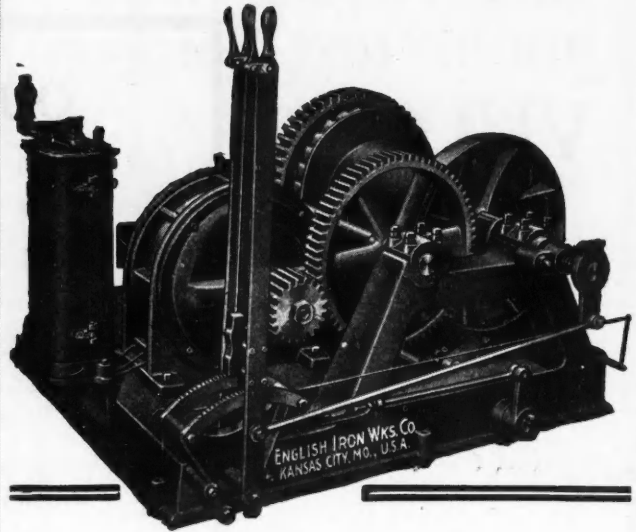
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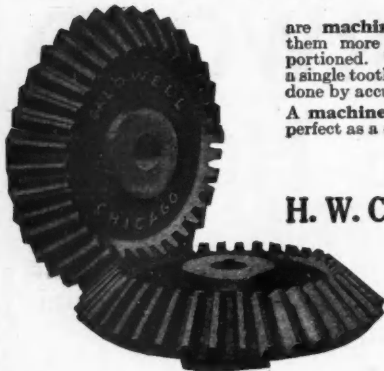
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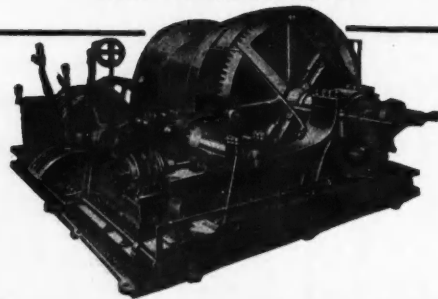
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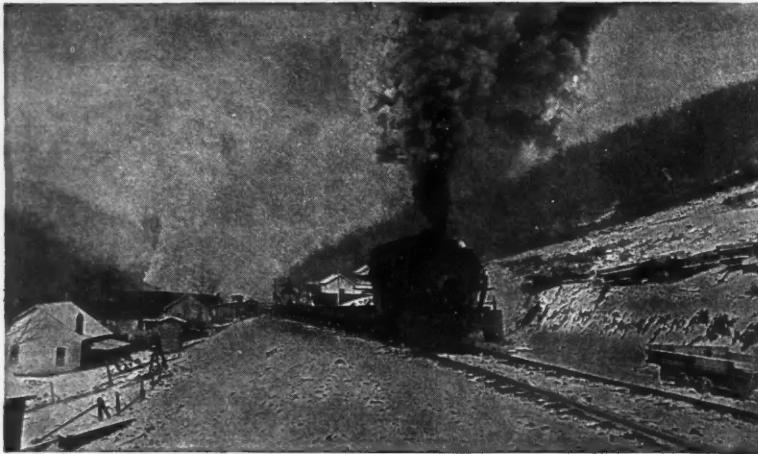
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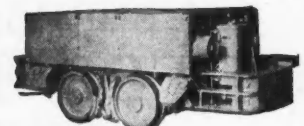
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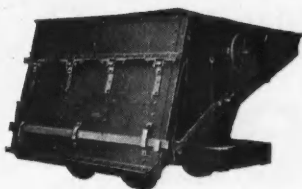


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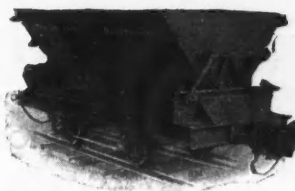
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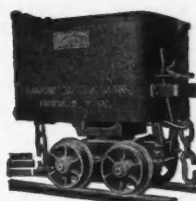
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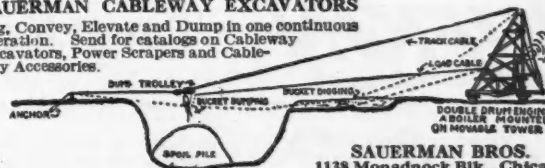
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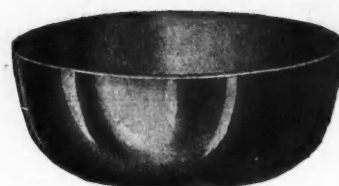
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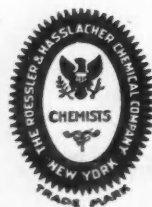
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- Miller, Hugo W.**, Mining Engineer and Assayer. Mine Examinations, Ores and Bullion Bought. Nogales, Ariz.
- Mills, Edwin W.**, Mining Engineer. 75 Yamashita-cho, Yokohama, Japan. Cable: Edmills. Usual Codes.
- Minard, Frederick H.**, Mining Engineer. Trinity Bldg. 111 Broadway, New York. Cable: "Fred-nard." New York. Cable: Bedford-McNeill.
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- Miranda M. J. Edward**, Mining Engineer. Informes-Planos. Muestras Administraciones minas on Chile. Chile Ovalle—Casilla 68. Cable—Edomir.
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- Mudd, Seeley W.**, Mining Engineer. 1208 W. I. Hollingsworth Bldg., Los Angeles, Calif. Code: Bedford-McNeill.
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- Munroe, H. S.**, Mining Engineer. Kimberly, Nev.
- Murphy, Chas. J.**, Min. Engr. Reports, Surveys, Plans, Estimates, Specifications, Design and Supervision. 22 N.S. Bk. Bldg., St. Catharines, Ont.
- Murias, E. R. Suarez**, Mining Engineer and Geologist. Examinations and reports. Bank of Nova Scotia Bldg., Havana, Cuba.
- Myers, Desaix B.**, Mining Engineer. 321 Story Bldg., Los Angeles, Calif.
- N**
- Nahl, Arthur C.**, Consulting Engineer. Care of Rocholl Ruffo & Co., La Paz, Baja California, Mexico.
- Neel, Carr B.**, Consulting Engineer. Box 253, Menlo Park, Calif.
- Nevius, J. Nelson**, Mining Engineer. 809 So. Los Robles Ave., Pasadena, Cal.
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- O'Keefe, Edward C.**, Metallurgy and Ore Dressing Tests. Flat River, Mo.
- P**
- Packard, George A.**, Metallurgist and Mining Engineer. 50 Congress St., Boston, Mass. Cable Address: "Geopack." Boston.
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- Pierce & Skogmark, Inc.**, Consulting and Metallurgical Engineers. 35 Nassau St., New York.
- Plate, H. Robinson**, Mining Engineer. Examination and Management. Temporary address: Sheepranch, Calif.
- Pollon & Poirier, Howard Pollon, C. H. Poirier**, Mining Engineers. 63 Wall St., New York.
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- R**
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- Radon, F. B.**, Mining Engineer. Supt. Turret Copper Mining and Reduction Co. Examinations of gravel deposits for dredgers a specialty. Turret, Colo., or Thatcher Bldg., Pueblo, Colo.
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- Rogers, Mayer & Ball, Allen H. Rogers, Lucius W. Mayer, Sydney H. Ball**, Mining Engrs. 42 Broadway, N. Y. 201 Devonshire St., Boston, Mass. Cable: "Alhasters."
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- Schmidt, Henry C.**, Examination and Management. Calle Hidalgo No. 117, Monterrey, N. L., Mexico.
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- Sears, Stanley C.**, Mining Engineer. Consultation. Examination and Management. 705 Walker Bank Bldg., Salt Lake City, Utah. Usual Codes.
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- Wahl, H. R., Mechanical Engineer. Design and Construction of Crushing, Milling and Mining Plants. 36 W. Randolph St., Chicago, Ill.
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- Ward, William F., Mining Engineer. 2564 West 32nd Ave., Denver, Colo., and Puerto Andes, Columbia, So. America.
- Ward, Howard R., Consulting Engineer. Address c/o American International Corporation, 120 Broadway, New York City.
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- Weed, Walter Harvey, Mining Geologist and Engineer. Examinations. Editor, The Mines and Copper Handbook. 29 Broadway, New York. Cable: "Minexam."
- Weekes, Frederic R., Mining Engineer. 42 Broadway, New York.
- Welch, Max J., Designing and Supervising Engineer of Construction. 1210 Hollingsworth Bldg., Los Angeles, Calif.
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- Wheeler, H. A., Mining Engineer. Reports on Oil and Mining Properties. 408 Locust St., St. Louis, Mo. Cable: "Wah," St. Louis.
- White, Rush J., Mining Engineer. Shoshone Bldg., Wallace, Idaho.
- Whitman, Alfred R., Mining Geologist. 43 Exchange Place, N. Y.
- Wilding, James, Mine Valuation. Copper and Lead Smelting. Concentration by Flotation. 220 Battery St., San Francisco, Calif.
- Wiley, W. H., Mining Engineer. Palm Drive, Glendora, Calif.
- Wilfley, Clifford R., Mining Engineer. Manager, Barstow Mine. Private ore-testing laboratory. Ouray, Colo.
- Wilkins & Devereux, H. A., J. Wilkins, W. B. Devereux, Jr., J. H. Devereux, Consulting Mining Engineers. 120 Broadway, New York; London, Eng.; Mexico D. F. Cable: Kenreux.
- Wilmot, H. C., Mining Engineer. 32 W. 40th St., New York City.
- Wilson, George Benton, Consulting Mining Engineer. With the American Smelting & Refining Co., Salt Lake City, Utah.
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- Wilson, W. C. W., Consulting Mine, Mill and Smelter Accountant. Lundbreck, Alberta, Canada. Sudbury, Ont., Canada.
- Winchell, Horace V., Consulting Mining Geologist. 826 First National-Soo Line Bldg., Minneapolis, Minn. Cable: Racewin.
- Winwood, Job H., Mining Engineer. Continental Bank Bldg., Salt Lake City, Utah.
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- Wood, Ernest Clifford, Con. Min. Eng. Examinations and Reports. Developments directed. 308 Empire State Building, Spokane, Wash.
- Wood Ore Testing Co., The Henry E., Assayers. Ore Tested in Carload Lots. Write for Circulars. 1734 Arapahoe St., Denver, Colo.
- Worth, John G., Mining Engineer. 836 Real Estate Trust Bldg., Philadelphia, Penn. Room 1100, 68 Broadway, New York.
- Wrampelmeier, E. L. S., Mining Engineer. 1006 Hobart Bldg., San Francisco, Calif.
- Wright, Charles Will, Mining Engineer. Ingurtosu, Sardinia, Italy. Cable: "Wright," Arbus. Code: Bedford-McNeill.
- Wright, Louis A., Casilla No. 125 D, Santiago, Chile, S. A. Cable: Lawright, Santiago. Code: Bedford-McNeill.
- Y**
- Yeatman, Pope, Mining Engineer. At present in Government service. Therefore no professional work undertaken.
- Young, E. J., Consulting Geologist and Engineer. Offices and Laboratory, Story Bldg., Los Angeles, Calif. Examinations and Reports on all Mineral Deposits, Formations and Processes of Extraction. 20 years experience in the Western States, Pacific Coast States, Mexico, and Central America.
- Young, Jacob W., Mining Engineer. Florence Mining & Milling Co., Marysvale, Utah.
- Yung, M. B., M. E., Examinations in China. 26 Des Voeux Road, Central Hong Kong, China. Cable: "Anme." Codes: West. Union, Moreing & Neal's.
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Lane Mill & Machinery Co., Los Angeles, Calif.
Morse Bros. Mach. & Supply Co., Denver, Colo.
Senn Concentrator Co., 611 First Nat. Bank Bldg., San Francisco, Calif. Senn Panning Motion Batea Amalgamator: cap. 50 tons per 24 hr.; diam., 8 ft.; water required in pulp or sand, about 200 gal. per ton dry ore; reqs. 1/2 hp.; shipping weight, 3500 lb. Pulp or placer sand is fed down into bowl where swirled around with liquid quick. Coarse gold is amalgamated and traveling amalgam and quick caught. Continuous feed forces lighter part of solids from bowl and onto plates covering batea top, where panning motion keeps pulp loose and settles fine gold onto plates. Escape of quick or amalgam is prevented.

Traylor Engineering & Mfg. Co., Allentown, Pa.

Armature Repair Machinery

Electric Service Supplies Co., Philadelphia, Pa.

Asbestos

Aspromet Co., Pittsburgh, Pa.

Assayers

Baker & Co., Inc., Newark, N. J.
Ledoux & Co., Inc., 99 John St., New York.
Pitkin, Inc., Lucius, 47 Fulton St., New York.

Attorneys, Patent

Jas. L. Norris, Washington, D. C.

Axles, Locomotive

American Locomotive Co., 30 Church St., N. Y.

Balances

Ainsworth & Sons, Wm., Denver, Colo.
Denver Fire Clay Co., Denver, Colo., U. S. A.
Analytical, assay, button balances, made by Keller, Ainsworth, Troemner, Thompson, Oertling, Voland, Becker, Sartorius and Kern.
Mine & Smelter Supply Co., The, 42 Bway., N. Y.
Thompson Balance Co., Denver, Colo.
Troemner, Henry, 911 Arch St., Phila., Pa.

Bearings, Ball & Roller

Hyatt Roller Bearing Co., Metropolitan Tower, 23rd St., New York City. Branch, Chicago, Ill.

Belting, Conveyor

Boston Belting Co., Boston, Mass.
The Diamond Rubber Co., Akron, Ohio.
Goodrich Co., The B. F., Akron, Ohio.
Rubber for hardest service. "Longlife" and "Maxxon" grades for continuous operation and maximum life.
Goodyear Tire & Rubber Co., The, Akron, Ohio.
Mine & Smelter Supply Co., The, 42 Bway., N. Y.
Robins Conveying Belt Co., New York.
U. S. Rubber Co., New York.

Belting, Elevator

Goodrich Co., The B. F., Akron, Ohio.
Special rubber elevator belts.
Goodyear Tire & Rubber Co., The, Akron, Ohio.
Schieren Co., Charles A., New York City.
"Duxbak." Moisture-resisting leather.
U. S. Rubber Co., New York.

Belting Leather

Schieren Co., Charles A., New York City.

Belting Leather (Waterproof)

Schieren Co., Charles A., New York City.

Belting, Link Leather

Schieren Co., Charles A., New York City.

Belting, Perforated Leather

Schieren Co., Charles A., New York City.

Belting, Transmission

Goodrich Co., The B. F., Akron, Ohio.
Rubber belts for drives. Friction surface and rubber covered.

Graton & Knight Mfg. Co., Worcester, Mass.
"Spartan," water, steam, oil and heat resisting.

Goodyear Tire & Rubber Co., The, Akron, Ohio.
Schieren Co., Charles A., New York City.
"Duxbak." Moisture-resisting leather.
U. S. Rubber Co., New York.

Blasting Supplies

Aetna Explosives Co., 2 Rector St., New York.

Blowers

Connersville Blower Co., The, Connersville, Ind.
Rotary positive type. Two impellers, balanced at all speeds.

General Electric Co., Schenectady, N. Y.
Hendrie & Bolthoff M. & S. Co., Denver, Colo.
Mine & Smelter Supply Co., The, 42 Bway., N. Y.
Morse Bros. Mach. & Supply Co., Denver, Colo.
Roots Co., P. H. & F. M., Connersville, Ind.
Low-pressure sizes to 42,105 cu.ft. per min.

Blowers, Centrifugal

Ingersoll-Rand Co., 11 Broadway, New York.
Turbo-blowers for blast and converter work.
All pressures and volumes.

Boilers

Abendroth & Root Mfg. Co., 233 B'way, N. Y.
Hendrie & Bolthoff M. & S. Co., Denver, Colo.
Mine & Smelter Supply Co., The, 42 Bway., N. Y.
Moore & Co., C. C., Engineers, San Francisco, Cal.
Morse Bros. Mach. & Supply Co., Denver, Colo.

Boiler Tubes

National Tube Co., Pittsburgh, Penn.

Boilers, Locomotive

American Locomotive Co., 30 Church St., N. Y.

Bolts, Expansion

Electric Service Supplies Co., Philadelphia, Pa.

Books, Technical

McGraw-Hill Book Co., Inc., 239 W. 39th St., New York. Branches: London and Berlin.

Boots and Shoes

Goodrich Co., The B. F., Akron, Ohio.
White rubber mining boots and shoes.
(Red line around top.)

Brick, Fire

Harbison-Walker Refractories Co., Pittsburgh, Pa.

Bridges

Foundation Co., 233 Broadway, New York.

Bridges, Ore Handling

American Bridge Co., 30 Church St., New York.

Bridges, Suspension

Roebeling's Sons Co., John A., Trenton, N. J.

Buckets, Elevator

Bartlett & Snow Co., The C. O., Cleveland, O.

Hendrick Mfg. Co., Carbondale, Penn.

Buckets, Orange Peel and Clamshell

Industrial Works, Bay City, Mich.
Designed for quick attachment or removal.

Buckets, Ore

Mine & Smelter Supply Co., The, 42 Bway., N. Y.
Watt Mining Car Wheel Co., Barnesville, Ohio.

Buckets, Skip

Bartlett & Snow, The C. O., Co., Cleveland, O.

Building Paper

Aspromet Co., Pittsburgh, Pa.

Cableways

Flory Mfg. Co., S., Bangor, Penn.
Lidgerwood Mfg. Co., 96 Liberty St., N. Y. City.
Roebeling's Sons Co., John A., Trenton, N. J.

Cages, Hoisting

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Hendrie & Bolthoff M. & S. Co., Denver, Colo.
Mine & Smelter Supply Co., The, 42 Bway., N. Y.
Ottumwa Iron Works, Ottumwa, Iowa.
Traylor Engineering & Mfg. Co., Allentown, Pa.

Candles

Standard Oil Co., Chicago, Ill.

Carbons and Bortz

Diamond Drill Carbon Co., World Bldg., Park Row, New York, N. Y.

Car Replacers

Electric Service Supplies Co., Philadelphia, Pa.

Cars, Gable Bottom

Easton Car & Construction Co., Easton, Penn.

Cars, Hopper

Easton Car & Construction Co., Easton, Penn.

Cars, Ore

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Atlas Car & Mfg. Co., Cleveland, Ohio.
Easton Car & Construction Co., Easton, Penn.
Mine & Smelter Supply Co., The, 42 Bway., N. Y.
Sanford-Day Iron Co., Knoxville, Tenn.
Capacity 8 to 25 cu.ft. Any gage.
Steel; end or side dump.

Traylor Engineering & Mfg. Co., Allentown, Pa.
Watt Mining Car Wheel Co., Barnesville, Ohio.

Cars, Quarry

Easton Car & Construction Co., Easton, Penn.

Traylor Engineering & Mfg. Co., Allentown, Pa.

Castings

R. D. Nuttall Co.

Cement, Belt

Schieren Co., Charles A., New York City.

Cement Floors

Aspromet Co., Pittsburgh, Pa.

Cement, Iron

Smooth-On Mfg. Co., Jersey City, N. J.

In 1-, 5-, 10- and 25-lb. cans.
"Smooth-On" iron cements, metallize and become part of metal to which applied.

Cement-Placers, Jet

Cement-Gun Co., Inc., Allentown, Penn. Cable: Cementgun. Branches: New York, Chicago, Salt Lake City, Seattle, and Vancouver, B. C.
Three sizes. Capacities variable according to number of nozzles, hose, sizes and air pressures. The "Cement-Gun" is a portable apparatus for depositing cement or "Gunitite" coatings by air pressure for covering old and new structures, building new ones and grouting or filling cracks. See advertisement.

Chains, Transmission

Morse Chain Co., Ithaca, N. Y.

For drives up to 5000 hp. Reduction ratios to 7 and 8 to 1.
"Rocker-Joint" to reduce wear; quiet, positive.

Chemical Apparatus

Mine & Smelter Supply Co., The, 42 Bway., N. Y.

Chemicals

General Chemical Co., Herreshoff Furnace Dept. B, 25 Broad St., New York, N. Y.
Grasselli Chemical Co., The, Cleveland, Ohio.
Roessler & Hasslacher Chemical Co., New York.

Circuit Breakers, Electric

Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.

Clamps (trolley)

Electric Service Supplies Co., Philadelphia, Pa.

Classifiers

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Colorado Iron Works Co., Denver, Colo., U. S. A.
"Akins" spiral revolving in inclined trough.
Deister Machine Co., Ft. Wayne, Ind., U. S. A.
Denver Engineering Works Co., Denver, Colo.
"Richards" pulsator for table feed; "Ovoca" for sand slime separation.

Dorr Co., The, Denver, Colo.

Hendrie & Bolthoff M. & S. Co., Denver, Colo.
James Ore Concentrator Co., Newark, N. J.
Mine & Smelter Supply Co., The, 42 Bway., N. Y.
Traylor Engineering & Mfg. Co., Allentown, Pa.

Coal and Ore Handling Machinery

Lidgerwood Mfg. Co., 96 Liberty St., N. Y. City.

Compressors, Air

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Bury Compressor Co., Erie, Penn.
Chicago Pneumatic Tool Co., Chicago, Ill.
Fuel oil, gas, steam power driven.
Hendrie & Bolthoff M. & S. Co., Denver, Colo.
Ingersoll-Rand Co., 11 Broadway, New York.
Branches: Boston, Birmingham, Butte, Cleveland, Chicago, Denver, Duluth, El Paso, Knoxville, Los Angeles, Philadelphia, Pittsburgh, St. Louis, Seattle, Salt Lake City, New Orleans, Scranton, Juneau.

"Imperial" "Ingersoll-Rogler" "Turbo"—all sizes, pressures, types. Stationary and portable.

Moore & Co., C. C., Engineers, San Francisco, Cal.
Morse Bros. Mach. & Supply Co., Denver, Colo.
Norwalk Iron Works Co., So. Norwalk, Conn.

Size to suit work.

Sullivan Machinery Co., Chicago, Ill., U. S. A.

Steam and power drive.

Tandem compound Corliss, angle compound, belt or motor drive, portable, underground motor driven.

Concentrators, Table

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Deister Concentrator Co., The, Ft. Wayne, Ind.

Prices on application.

Deister No. 3 slimer for fines and slimes in either single- or double-deck types; Deister No. 4 for sands either roughing or finishing, classified or unclassified, in single-deck type only.

Deister No. 5 for coarse and fine classified sands in either single- or double-deck type.

Overstrom table for fine and coarse feeds has large capacity for roughing or finishing in either single- or double-deck type. Head motion and under construction for all tables designed to reduce upkeep and operating costs. Table makes more than one-product concentrate if desired.

Deister Machine Co., 1933-2003 E. Wayne St., Ft. Wayne, Ind., U. S. A. No. 1 London Wall Bldgs., London Wall, E. C.

Prices on application.

Denver Engineering Works Co., Denver, Colo.

Hendrie & Bolthoff M. & S. Co., Denver, Colo.

"Isbell" takes unclassified feed.

Card concentrators.

James Ore Concentrator Co., Newark, N. J.

Mine & Smelter Supply Co., The, 42 Bway., N. Y.

Morse Bros. Mach. & Supply Co., Denver, Colo.

Senn Concentrator Co., 611 First Nat. Bank Bldg., San Francisco, Calif.

Senn Panning Motion. One size: 6 ft x 6 ft.

9 in.; cap. 30 tons of —65 mesh, 75 tons of

FJAB

HOLLOW
Rock Drill Steel

SOLID
Rock Drill Steel

Hexagon, Octagon, Quarter-Octagon, Round and Cruciform.

A. MILNE & COMPANY

(Established 1887)

745 Washington St., New York 8 Oliver St., Boston, Mass.
Chicago Branch: 550 Washington Boulevard, Chicago, Ill.
Sole and Direct Representatives for the United States and Canada.

NICHOLS

Copper Company

Refiners of
COPPER

Consignments of Ore, Mattes and Blister Copper solicited

Manufacturers of
COPPER SULPHATE
(BLUE VITRIOL)

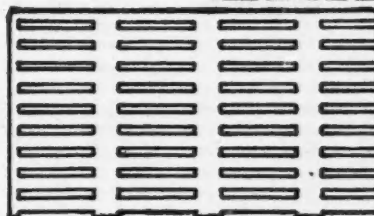
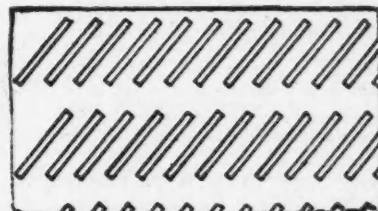
LAUREL HILL, Borough of Queens, New York
and 25 Broad Street, New York



Perforated Metals

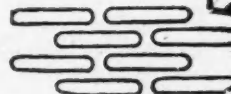
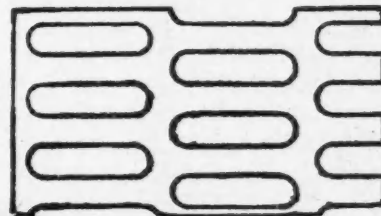
of every description for
Mining and Milling Machinery,
stamp battery screens,
Stone, coal and ore screens

Diagonal slot perforations made in all widths of opening by 1/2-inch in length, in steel or other metals.

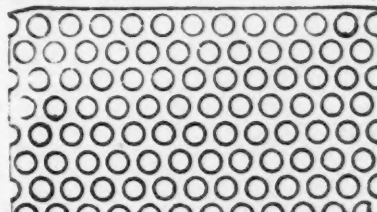


Straight slots, often preferred to the diagonal slots. Made in all widths of openings by 1/2-inch in length; also other lengths in many widths.

Oblong perforations hit-and-miss endways, made in all sizes.



Furnished also hit-and-miss sideways, thus.



Round perforations, all sizes, made in all kinds of metal, and any thickness in proportion to diameter of hole. Where a close or even grade of product is required the round perforation is found to be best for the purpose.

THE HARRINGTON & KING PERFORATING CO.
620 North Union Avenue, Chicago, Ill.
New York Office: 114 Liberty Street

—20 mesh, 150 tons of —8 mesh per 24 hr.; feed water 360 to 500 gal. per ton ore; dressing water, 100 gal. per ton —65 mesh. Reqs. $\frac{1}{2}$ hp.; shipping weight, 3500 lb. Continuous panning motion keeps heavy pulp bed loose and settles metal particles through loose barren gangue without regard to size of particles. Moving belt withdraws concentrates from under waste which gradually moves down into tails. Can handle large tonnage and make sand, about 200 gal. per ton dry ore; reqs. $\frac{1}{4}$ exceptionally high extraction with only enough water to keep pulp loose.

Traylor Engineering & Mfg. Co., Allentown, Pa.

Condensers

Alberger Pump & Condenser Co., New York City. Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa. Worthington Pump & Machinery Corp., 115 Broad-

Connectors, solderless

Westinghouse Elec. & Mfg. Co. E. Pittsburgh, Pa.

Contractors, Diamond Drilling

Longyear Co., E. J., Minneapolis, Minn. Sullivan Machinery Co., Chicago, Ill., U. S. A. Modern outfits and skilled operators ready.

Controller Regulator

Electric Service Supplies Co., Philadelphia, Pa.

Converters, Electric Rotary

Power & Mining Mch. Works, 115 B'way, N. Y. Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.

Converters, Horizontal and Vertical

Allis-Chalmers Mfg. Co., Milwaukee, Wis. Traylor Engineering & Mfg. Co., Allentown, Pa.

Conveyors and Elevators

Allis-Chalmers Mfg. Co., Milwaukee, Wis. Bartlett & Snow, The. C. O. Co., Cleveland, O. Jeffrey Mfg. Co., The, 974 N. 4th St., Columbus, O.

Conveyors, Belt

Bartlett & Snow, The. C. O. Co., Cleveland, O. Morse Bros. Mach. & Supply Co., Denver, Colo. Power & Mining Mch. Works, 115 B'way, N. Y. Robins Conveying Belt Co., New York. Stephens-Adams Mfg. Co., Aurora, Ill.

"Unit Carrier" operates for long time on grease originally packed in bearings at factory and requires minimum of attention. Entire steel construction combines strength and light weight with great flexibility and range of adjustment. See advertisement on inside front cover for branch office addresses.

Traylor Engineering & Mfg. Co., Allentown, Pa.

Coolers

Bartlett & Snow, The. C. O. Co., Cleveland, O.

Copper Steel Sheets

American Sheet & Tin Plate Co., Pittsburgh, Pa.

Couplings, Air Hose

Hardsoeg Wonder Drill Co., Ottumwa, Iowa. $\frac{1}{2}$ ", $\frac{3}{4}$ " and 1" hose. No springs or threads.

Cranes, Locomotive

Industrial Works, Bay City, Mich. Five to 160 tons cap. Steam, electric, gasoline.

Crusher Parts

Traylor Engineering & Mfg. Co., Allentown, Pa.

Crushers

Allis-Chalmers Mfg. Co., Milwaukee, Wis. Bacon, Earle C., Havemeyer Bldg., New York. Bartlett & Snow, The. C. O. Co., Cleveland, O. Braun-Corporation, The, Los Angeles, Calif. Laboratory steel frame jaw crushers. Braun-Knecht-Heimann Co., San Francisco, Cal. Buchanan Co., Inc., C. G., New York. Colorado Iron Works Co., Denver, Colo. Jaw crushers and rolls in many sizes. Denver Engineering Works Co., Denver, Colo. Denver Fire Clay Co., Denver, Colo., U. S. A.

Jaw type.

Hendrie & Bolthoff M. & S. Co., Denver, Colo. Herman, John, Los Angeles, Cal. Jeffrey Mfg. Co., The, 974 N. 4th St., Columbus, O. Mine & Smelter Supply Co., The, 42 B'way, N. Y. Morse Bros. Mach. & Supply Co., Denver, Colo. Power & Mining Mch. Works, 115 B'way, N. Y. Standard Equipment Co., Hartford, Conn. Stroh Steel-Hardening Process Co., Pittsburgh, Pa. Traylor Engineering & Mfg. Co., Allentown, Pa. Gyrotary crushers in sizes from 2 to 10 inclusive; jaw crushers, Blake type from 7"x10" up to 66"x86"; crushing rolls in all standard sizes from 18"x10" up to 72"x36". Universal Road Machinery Co., Kingston, N. Y. Webb City & Carterville Foundry & Machine Works, Webb City, Mo. Roll type, designed for ready accessibility.

Cups, Grease (See "Grease Cups")

Cutting Apparatus

Davis-Bourmonville Co. See "Oxyacetylene Apparatus."

Cyanide

Roessler & Hasslacher Chemical Co., New York.

Cylinders, Steel

National Tube Co., Pittsburgh, Penn.

Diamonds, Black (See "Carbons and Bortz")

Dredges

Flory Mfg. Co., S., Bangor, Penn. New York Eng. Co., 2 Rector St., New York. Union Construction Co., San Francisco, Calif. Yuba Manufacturing Co., The, San Francisco, Calif.

Dredging Machinery

Lidgerwood Mfg. Co., 96 Liberty St., N. Y. City.

Drills, Churn

Union Construction Co., San Francisco, Calif.

Drilling, Core

Longyear Co., E. J., Minneapolis. Pennsylvania Drilling Co., Pittsburgh, Penn. Sullivan Machinery Co., Chicago, Ill., U. S. A.

Drills, Core

Dobbins Core Drill Co., Inc., 110-114 W. 42d St., New York.

Ingersoll-Rand Co., 11 Broadway, New York.

Calyx—cores 1 $\frac{1}{2}$ to 18". Depths to 4000 ft.

Longyear Co., E. J., Minneapolis.

Sullivan Machinery Co., Chicago, Ill., U. S. A.

Drills, Diamond

Longyear Co., E. J., Minneapolis, Minn.

Cores removed of any size to any depth.

Sullivan Machinery Co., Chicago, Ill., U. S. A.

Drills, Electric

Denver Rock Drill Mfg. Co., Denver, Colo.

Ingersoll-Rand Co., 11 Broadway, New York.

Drills, Hammer

Chicago Pneumatic Tool Co., Chicago, Ill.

Denver Rock Drill Mfg. Co., Denver, Colo.

"Dreadnaught"—self-rotating, valveless, hammer drill, with water device; for drifting, tunneling and all heavy drilling. Can be used unmounted with spring handle for sinking, with water device or blow valve. "Clipper"—self-rotating, valveless, hammer drill, with water device or blow valve mounted or unmounted, for drifting, sinking, etc. "Waugh" Stopping: Valveless or valve; hammer drills; for stopping or upraising; equipped for either high or low pressure.

Hardsoeg Wonder Drill Co., Ottumwa, Iowa.

All sizes and weights to 145 lb.

Have combination piston, valve and hammer.

For stopping, sinking and all mining purposes.

Ingersoll-Rand Co., 11 Broadway, New York.

"Jackhammers," self-rotating hand hammer drills for every mining operation. Unmounted for down holes, mounted for light drifting, also with Leyner water device. "Leyner-Ingersoll" water drills for drifting, mining, tunneling. "Butterfly" type. "Stopehammers" "BC" and "CC" for raising, stopping, etc.

McKiernan-Terry Drill Co., 21 Park Row, New York.

Sullivan Machinery Co., Chicago, Ill., U. S. A.

Whitcomb Co., Geo. D., Rochelle, Ill.

Drills, Piston

Chicago Pneumatic Tool Co., Chicago, Ill.

Hardsoeg Wonder Drill Co., Ottumwa, Iowa.

All sizes and weights.

For use with air or steam.

Ingersoll-Rand Co., 11 Broadway, New York.

"Butterfly," "Sergeant," "Electric Air." All sizes. Also heavy quarry and submarine types.

Sullivan Machinery Co., Chicago, Ill., U. S. A.

Drills, Prospecting

Ingersoll-Rand Co., 11 Broadway, New York.

Longyear Co., E. J., Minneapolis.

New York Eng. Co., 2 Rector St., New York.

Rotation, sinking of casing, recovery of material accomplished at same time with "Empire."

Sullivan Machinery Co., Chicago, Ill., U. S. A.

Dryers, Ore

American Process Co., 68 William St., New York.

Especially designed and built for all materials.

Bartlett & Snow, The. C. O. Co., Cleveland, O.

Colorado Iron Works Co., Denver, Colo.

Morse Bros. Mach. & Supply Co., Denver, Colo.

Ruggles-Coles Eng. Co., 50 Church St., New York City.

Traylor Engineering & Mfg. Co., Allentown, Pa.

Dryers, Sand & Coal

Electric Service Supplies Co., Philadelphia, Pa.

Ruggles-Elec. Engineering Co., 50 Church St., N. Y. City.

Dumps, Rotary

Wood Equipment Co., McCormick Bldg., Chicago, Ill.

Dust Hood

Multi-Metal Separating Screen Co., 253 W. 19th St., New York, N. Y.

Dust Protectors (See "Respirators")

Dynamite

Aetna Explosives Co., 2 Rector St., New York.

Electrical Supplies

Electric Service Supplies Co., Philadelphia, Pa.

Mine & Smelter Supply Co., The, 42 B'way, N. Y.

Elevators, Bucket

Bartlett & Snow, The. C. O. Co., Cleveland, O.

Robins Conveying Belt Co., New York.

Stephens-Adams Mfg. Co., Aurora, Ill.

See advertisement on inside front cover for branch office addresses.

Traylor Engineering & Mfg. Co., Allentown, Pa.

Employees

Business Men's Clearing House, Denver, Colo.

Supts., assayers, mill men sent all parts of world.

Engines, Gas and Gasoline

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Chicago Pneumatic Tool Co., Chicago, Ill.

Mine & Smelter Supply Co., The, 42 B'way, N. Y.

Morse Bros. Mach. & Supply Co., Denver, Colo.

Engines, Oil

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Chicago Pneumatic Tool Co., Chicago, Ill.

Hendrie & Bolthoff M. & S. Co., Denver, Colo.

Ingersoll-Rand Co., 11 Broadway, New York.

Engineers and Draftsmen Instruments & Supplies

Mine & Smelter Supply Co., The, 42 B'way, N. Y.

Morse Bros. Mach. & Supply Co., Denver, Colo.

Engines, Steam

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Morse Bros. Mach. & Supply Co., Denver, Colo.

Exhausters

Connorsville Blower Co., The, Connorsville, Ind.

Morse Bros. Mach. & Supply Co., Denver, Colo.

Excavators, Cableway

Sauerman Bros., 1138 Monadnock Block, Chicago, Ill.

Excavators, Dragline

Sauerman Bros., 1138 Monadnock Block, Chicago, Ill.

Feeders, Ore

Bartlett & Snow, The. C. O. Co., Cleveland, O.

James Ore Concentrator Co., Newark, N. J.

Mine & Smelter Supply Co., The, 42 B'way, N. Y.

Stephens-Adams Mfg. Co., Aurora, Ill.

Traylor Engineering & Mfg. Co., Allentown, Pa.

Filter Cloth, Metallic

American Continuous Filter Co.

(See United Filters Corp.)

Kelly Filter Piece Co., Salt Lake City.

(See United Filters Corp.)

Sweetland Filter Press Co., Brooklyn, N. Y.

(See United Filters Corp.)

Filters

American Continuous Filter Co.

(See United Filters Corp.)

Colorado Iron Works Co., Denver, Colo.

"Portland" continuous revolving drum. For cyanide slimes, flotation concentrates, etc.

Kelly Filter Press Co., Salt Lake City, Utah.

(See United Filters Corp.)

Sweetland Filter Press Co., Brooklyn, N. Y.

(See United Filters Corp.)

Traylor Engineering & Mfg. Co., Allentown, Pa.

United Filters Corp., Felt Bldg., Salt Lake City, Utah.

Fire Forcing Presses

Wood & Co., R. D., Philadelphia, Penn.

Fireproof Roofing

Aspromet Co., Pittsburgh, Pa.

Flange Presses

Wood & Co., R. D., Philadelphia, Penn.

Flood-Lighting Projectors

Electric Service Supplies Co., Philadelphia, Pa.

Flotation Machines

Southwestern Eng. Co., Inc., 106 W. 3rd St., Los Angeles, Calif.

Flotation, Oil

Colorado Iron Works Co., Denver, Colo.

Portland filter for dewatering concentrates.

Flotation Oils

Flotation Oil & Chemical Co., 2 Rector St., N. Y.

General Naval Stores Co., 175 Front St., N. Y.

Pine oils, pine tar oils, turpentine, coal tar oils, wood creosotes, etc.

Georgia Pine Turpentine Co., 160 Perry St., New York City.

Pensacola Tar & Turpentine Co., Gulf Point, Fla.

Forges

Denver Fire Clay Co., Denver, Colo., U. S. A.

Oil-fired for drill steel. Send for catalog.

Ingersoll-Rand Co., 11 Broadway, New York.

Monarch Eng. & Mfg. Co., Baltimore, Md.

Foundations

Foundation Co., 233 Broadway, New York

Framers, Timber

Denver Engineering Works Co., Denver, Colo.

Hendrie & Bolthoff M. & S. Co., Denver, Colo.

Furnaces, Assay

Braun Corporation, The, Los Angeles, Calif.

Braun-Knecht-Heimann Co., San Francisco, Cal.

Denver Fire Clay Co., Denver, Colo., U. S. A.

"Case" patent. One, two- or three-muffle design unit system, low pressure air.

Mine & Smelter Supply Co., The, 42 B'way, N. Y.

Furnaces, Bullion Melting

Braun Corporation, The, Los Angeles, Calif.

Braun-Knecht-Heimann Co., San Francisco, Cal.

Denver Fire Clay Co., Denver, Colo., U. S. A.

"Case" patent. Oil-fired, low-pressure air, high temperatures quickly attained.

Send for catalog.

Mine & Smelter Supply Co., The, 42 B'way, N. Y.

Monarch Engineering & Mfg. Co., Baltimore, Md.

Furnaces, Crucible, Tilting and Refining

Monarch Engineering & Mfg. Co., 1206 American Bldg., Baltimore, Md.

Furnaces, Crucible, Tilting Metal

Mine & Smelter Supply Co., The, 42 B'way, N. Y.

Monarch Engineering & Mfg. Co., 1206 American Bldg., Baltimore, Md.

Furnaces, Electric

General Electric Co., Schenectady, N. Y.

Furnaces, Mechanical Roasting

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Dwight & Lloyd Sintering Co., Inc., N. Y. City.

General Chemical Co., Herreshoff Furnace Dept., B. 25 Broad St., New York, N. Y.

Ten sizes, 5 to 7 hearths, 381 to 1925 sq. ft. hearth area.

Cylindrical steel shell contains vertically superimposed hearth. By rabble arms operated from center of top hearth, roasting ore travels from center of top hearth, down through lower ones, discharging from rim of lowest. Heated air for combustion travels upward.

Mine & Smelter Supply Co., The, 42 B'way, N. Y.

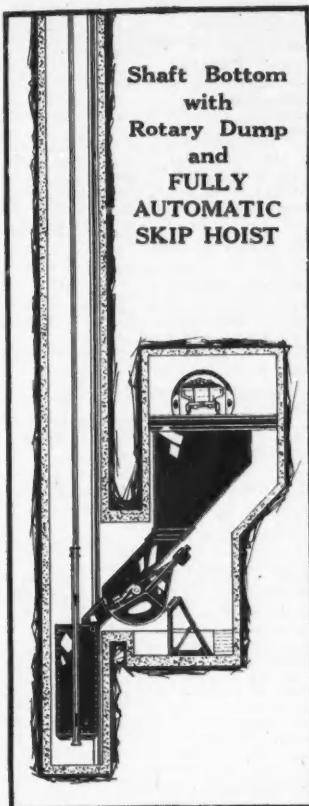
Morse Bros. Mach. & Supply Co., Denver, Colo.

Traylor Engineering & Mfg. Co., Allentown, Pa.

Wedge Mechanical Furnace Co., Greenwich Point, Philadelphia.

Varying stock sizes, number of hearths and hearth areas.

Hearths placed one above



ELIMINATING MEN BY HOISTING ORE WITHOUT HUMAN ASSISTANCE

Fully Automatic Skip Hoists eliminate men by hoisting ore without human assistance.

In mines equipped with Fully Automatic Skip Hoists, the ore is dumped into a hopper at the shaft bottom. The Skip Hoist does the rest. It starts automatically as soon as ore is dumped, operates continuously as long as there is ore to hoist, and then automatically stops. It loads, hoists, dumps, and descends entirely without human assistance. No men are required to place cars on cages, or take off empties, or load skips. No hoisting engineer is needed.

Nearly every shaft mine can use Fully Automatic Skip Hoists to good advantage for any capacity and any lift. Complete, interesting data gladly furnished to those interested in this better method of hoisting ore without human assistance.

Write for this data today.

The C. O. Bartlett & Snow Company

Main Office and Works: Cleveland, Ohio, U. S. A.

Eastern Offices: New York, N. Y.

PINE FLOTATION OILS

Pensacola Tar & Turpentine Co.
F. E. Mariner, Pres. Gull Point, Fla.

Automatic
Improved
For All
Materials

DRYERS

Economical
Efficient
Great Capacity
American
Process Co.
68 William St.
NEW YORK

FLOTATION

PURE PINE OIL PINE TAR OIL
HARDWOOD AND COAL TAR CREOSOTE

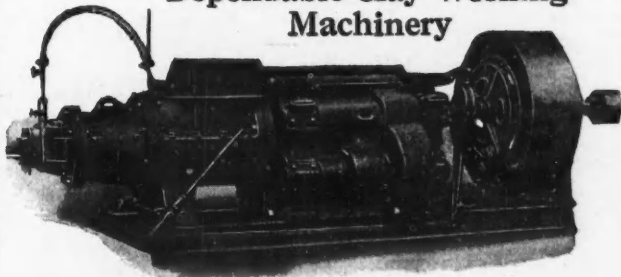
General Naval Stores Co., 90 West St., New York

RUGGLES-COLES ORE DRYERS

Dryers for all purposes.

Write for catalogue about them and find out why they are preferred.
RUGGLES-COLES ENGINEERING COMPANY, Works: York, Pa.
Western Office: 322 S. Michigan Ave., Chicago, Ill. Eastern Office: 50 Church St., New York City

Dependable Clay-Working Machinery



Operated and recommended by the prominent Fire-brick, Building brick, Faving block, Hollow building block, Fire-proofing, Chimney block, Chemical tile, and Zinc Companies of the country.

E. M. FREESE & CO., Galion, Ohio
DEPENDABLE MACHINERY OF PROVEN EFFICIENCY

Pine Flotation Oils

Our Oils are pure and are producing excellent results on various ores.

Georgia Pine Turpentine Co. of New York
156, 158, 160, 162 Perry Street
New York City

Plants: Fayetteville, N. C.; Collins, Ga.
Western Branch: P. O. Box 1994, Salt Lake City.

Furnaces, Smelting

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Colorado Iron Works Co., Denver, Colo.
Morse Bros. Mach. & Supply Co., Denver, Colo.
Traylor Engineering & Mfg. Co., Allentown, Pa.

Fuses, Electric

Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.

Gas Producers

Wellman Seaver Morgan Co., The, Cleveland, O.
Wood & Co., R. D., Philadelphia, Penn.

Gas Purifiers

Wood & Co., R. D., Philadelphia, Penn.

Gear Cases

Electric Service Supplies Co., Philadelphia, Pa.

Gears

Fawcett Machine Co., Pittsburgh, Penn.
Philadelphia Gear Works, 1120 Vine St., Philadelphia. Cable Address: "Philgear."
All sizes.

All descriptions gear cutting and wheels.

R. D. Nuttall & Co., Pittsburgh, Penn.
Stroh Steel-Hardening Process Co., Pittsburgh, Pa.

Gears, Bevel

Philadelphia Gear Works, 1120 Vine St., Philadelphia. Cable Address: "Philgear."

Gears, Cast

Cleveland Worm & Gear Co., Cleveland, Ohio.

Gears, Cut and Worm

Cleveland Worm & Gear Co., Cleveland, Ohio.

Gears, Double Helical

Caldwell & Sons Co., H. W., 17th St. and Webster Ave., Chicago.

Falk Co., The, Milwaukee, Wis.

Any face to 42 in.; diameter to 12 ft.
Staggered herringbone teeth with continuous tooth engagement. Machine-cut from solid blanks.

Fawcett Machine Co., Pittsburgh, Penn.

Gears, Rawhide

Philadelphia Gear Works, 1120 Vine St., Philadelphia. Cable Address: "Philgear."

Generators, Electric

Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.

Gravel Washing Plants

Sauerman Bros., 1138 Monadnock Block, Chicago, Ill.

Grease Cups

Lunkenheimer Co., The, Cincinnati, Ohio.

Grinders, Ore

Braun Corporation, The, Los Angeles, Calif.
Braun-Knecht-Heimann Co., San Francisco, Cal.

Laboratory machines for ore coke and coal.
Freese Co., E. M., Galion, Ohio.
Mine & Smelter Supply Co., The, 42 B'way, N. Y. C.

Grinders, Sample

Denver Engineering Works Co., Denver, Colo.
Mine & Smelter Supply Co., The, 42 B'way, N. Y. C.

Traylor Engineering & Mfg. Co., Allentown, Pa.

Hangers, Mine

Electric Service Supplies Co., Philadelphia, Pa.

Head Frames, Mine

American Bridge Co., 30 Church St., New York.

Headlights, Incandescent Mine

Electric Service Supplies Co., Philadelphia, Pa.

Hoists, Compressed Air

Lidgerwood Mfg. Co., 96 Liberty St., N. Y. City.

Hoists, Electric

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Denver Engineering Works Co., Denver, Colo.

English Iron Works, Kansas City, Mo.
Flory Mfg. Co., S., Bangor, Penn.
Hendrie & Bolthoff M. & S. Co., Denver, Colo.

Lidgerwood Mfg. Co., 96 Liberty St., N. Y. City.
Branches: Philadelphia, Pittsburgh, Chicago, Seattle.

Hoists, Portable

Ottumwa Iron Works, Ottumwa, Iowa.
Traylor Engineering & Mfg. Co., Allentown, Pa.

Vulcan Iron Works, Wilkes-Barre, Penn.
Wellman-Seaver Morgan Co., The, Cleveland, O.

Branches: New York and Denver, Colo.
Any size or capacity. Designed for any job.
First or second motion.

Hoists, Gas and Gasoline

Lidgerwood Mfg. Co., 96 Liberty St., N. Y. City.
Mine & Smelter Supply Co., The, 42 B'way, N. Y. C.

Hoists, Steam

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
English Iron Works, Kansas City, Mo.

Flory Mfg. Co., S., Bangor, Penn.
Hendrie & Bolthoff M. & S. Co., Denver, Colo.
Holmes & Brothers, Inc., Robt. Danville, Ill.

Lidgerwood Mfg. Co., 96 Liberty St., N. Y. City.
Sizes up to 1000 hp.

Mine & Smelter Supply Co., The, 42 B'way, N. Y. C.
Ottumwa Iron Works, Ottumwa, Iowa.

Sullivan Machinery Co., Chicago, Ill. U. S. A.
First motion Corliss and geared slide valve with automatic cut-off.

Vulcan Iron Works, Wilkes-Barre, Penn.
Wellman-Seaver-Morgan Co., The, Cleveland, O.

Hoists, Skip

Bartlett & Snow, The, C. O. Co., Cleveland, O.

Hoists, Steam

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
English Iron Works, Kansas City, Mo.

Flory Mfg. Co., S., Bangor, Penn.
Hendrie & Bolthoff M. & S. Co., Denver, Colo.

Holmes & Brothers, Inc., Robt. Danville, Ill.
Lidgerwood Mfg. Co., 96 Liberty St., N. Y. City

Sizes up to 1000 hp.
Mine & Smelter Supply Co., The, 42 B'way, N. Y. C.

Ottumwa Iron Works, Ottumwa, Iowa.
Sullivan Machinery Co., Chicago, Ill. U. S. A.

First motion Corliss and geared slide valve with automatic cut-off.

Vulcan Iron Works, Wilkes-Barre, Penn.
Wellman-Seaver-Morgan Co., The, Cleveland, O.

Hose, Air

Denver Rock Drill Mfg. Co., Denver, Colo.
Wire wound, blue jacket and red jacket drill hose.

The Diamond Rubber Co., Akron, Ohio.
Goodrich Co., The B. F., Akron, Ohio.

Sizes 1/2" up.
Wrapped duck and braided fabric types. See "Commander." Resists injury through twists.

Goodyear Tire & Rubber Co., The, Akron, Ohio.
Hardsoc Wonder Drill Co., Ottumwa, Iowa.

1/2" 3/4" 1" plain and armored. Fitted with nipples and patent coupler.

U. S. Rubber Co., New York City.

Hose Clamps, Malleable

Knox Mfg. Co., 821 Cherry St., Philadelphia, Pa.

Houses, Steel Shaft

American Bridge Co., 30 Church St., New York.

Hydraulic Accumulators

Wood & Co., R. D., Philadelphia, Penn.

Idlers, Conveyor

Conveying Weigher Co., The, New York City.

Instruments, Surveying

Ainsworth & Sons, Wm., Denver, Colo.
Berger & Sons Co., C. L., Boston, Mass.

Buff & Buff Mfg. Co., Boston, Mass.
Transits, levels, current meters.

Insulating Materials, Electric

Electric Service Supplies Co., Philadelphia, Pa.
Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.

Iron and Steel

Aspromet Co., Pittsburgh, Pa.
Asbestos protected, corrugated plates and shapes.

Jackets, Water

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Traylor Engineering & Mfg. Co., Allentown, Pa.

Jigs

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Denver Engineering Works Co., Denver, Colo.

Richards pulsator jigs and raffles.
James Ore Concentrator Co., Newark, N. J.

Mine & Smelter Supply Co., The, 42 B'way, N. Y. C.
Power & Mining Mch. Works, 115 B'way, N. Y.

Traylor Engineering & Mfg. Co., Allentown, Pa.

Kilns, Rotary

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Process Co., 68 William St., New York.

Power & Mining Mch. Works, 115 B'way, N. Y.

Laboratory Machinery

Braun Corporation, The, Los Angeles, Calif.
Braun-Knecht-Heimann Co., San Francisco, Cal.

Denver Fire Clay Co., Denver, Colo., U. S. A.
Mine & Smelter Supply Co., The, 42 B'way, N. Y. C.

Lacing, Leather

Schieren Co., Charles A., New York City.

Lamps, Acetylene

Dewar Manufacturing Co., 28-30 35th St., Brooklyn, N. Y.

Milburn Co., The, Alexander, Baltimore, Md.
Simmons Co., John, 34 35th St., Brooklyn, N. Y.

Pioneer, Baldwin and Zar, cap and hand lamps, 3- to 12-hr. capacity.

Wolf Safety Lamp Co., 74 Washington St., N. Y.

Lamps, Electric

Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.

Lamps, Safety Cap

Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.

Lamps, Guards

Electric Service Supplies Co., Philadelphia, Pa.

Lightning Arresters

Electric Service Supplies Co., Philadelphia, Pa.
Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.

Line Material, Overhead

Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.

Linings, Ball Mill

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Traylor Engineering & Mfg. Co., Allentown, Pa.

Linings, Tube Mill

Traylor Engineering & Mfg. Co., Allentown, Pa.

Locomotives, Compressed Air

Porter Co., H. K., 1203 Union Bldg., Pittsburgh, Penn.

Locomotives, Electric

General Electric Co., Schenectady, N. Y.
Jeffrey Mfg. Co., The, 974 N. 4th St., Columbus, O.

Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.

Locomotives, Electric Storage Battery

Atlas Car & Mfg. Co., Cleveland, Ohio.
General Electric Co., Schenectady, N. Y.

Jeffrey Mfg. Co., The, 974 N. 4th St., Columbus, O.

Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.
Whitcomb Co., Geo. D., Rochelle, Ill.

Locomotives, Gasoline

Fate Co., The, J. D., Plymouth, Ohio.
Vulcan Iron Works, Wilkes-Barre, Penn.

Whitcomb Co., Geo. D., Rochelle, Ill.

Locomotives, Industrial

American Locomotive Co., 30 Church St., N. Y. City.
Porter Co., H. K., 1203 Union Bldg., Pittsburgh, Penn.

Whitcomb Co., Geo. D., Rochelle, Ill.

Locomotives, Mine

American Locomotive Co., 30 Church St., N. Y. City.
Porter Co., H. K., 1203 Union Bldg., Pittsburgh, Penn.

Whitcomb Co., Geo. D., Rochelle, Ill.

Locomotive Parts

American Locomotive Co., 30 Church St., N. Y. City.

Locomotives, Storage Battery**Locomotives, Steam**

American Locomotive Co., 30 Church St., N. Y. City.
Porter Co., H. K., 1203 Union Bldg., Pittsburgh, Penn.

Branch: 30 Church St., New York.
Vulcan Iron Works, Wilkes-Barre, Penn.

Lubricating Oils

Standard Oil Co., Chicago, Ill.

Magnetic Pulleys

Dings Magnetic Separator Co., 673 Smith St., Milwaukee, Wis.

Magnetic pulleys in all sizes. When used as head pulley in belt conveyor, it converts latter into magnetic separator. Will save machinery by throwing out unbreakable iron substances, such as hammer heads, etc.

Magnetic Mfg. Co., Milwaukee, Wis.

Meters, Electric Current

Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.

Metal, Asbestos Protected

Aspromet Co., Pittsburgh, Pa.

Metals and Alloys

Primos Chemical Co., Primos, Del. Co., Penn.
Cable: "Briquette, Phila." Branches: Vanadium and Lakewood, Colo.

Agents: Allan S. Davison & Co., Pittsburgh, Pa.

Metals, Noncorrosive

International Nickel Co., The, 43 Exchange Place, New York.

"Monel" metal. Tough, acid-resisting alloy. Rods, flats, castings, sheets, strips and wire.

Metals, Perforated

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Frdle Perforating Co., Rochester, N. Y.

Harrington & King Perforating Co., The, 620 N. Union Ave., Chicago, Ill. Branch: 114 Liberty St., New York.

All sizes and shapes of perforations; all kinds and thicknesses of metals.

Screens for trommels, stamp mills, jigs, etc.
Hendrick Mfg. Co., Carbondale, Penn.

Mills, Ball, Tube and Pebble

Abbe Engineering Co., 22 Broadway, New York.

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Colorado Iron Works Co., Denver, Colo.

Denver Engineering Works Co., Denver, Colo.
Hendrie & Bolthoff M. & S. Co., Denver, Colo.

Herman, John, Los Angeles, Calif.
Mine & Smelter Supply Co., The, 42 B'way, N. Y. C.

Power & Mining Mch. Works, 115 B'way, N. Y.
Traylor Engineering & Mfg. Co., Allentown, Pa.

All sizes and capacities.

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Lane Mill & Machinery Co., Los Angeles, Calif.
Cable: "Lanemill."

Sizes: 5-, 7- and 10-ft. Capacities: 10, 20 and 40 tons per 24 hr.

"Slow-speed" Chilean mills, 20- and 40-ton mills can be sectionalized for transportation on pack animals.

Traylor Engineering & Mfg. Co., Allentown, Pa.
Wellman-Seaver-Morgan Co., The, Cleveland, O.

Mills, Stamp

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Colorado Iron Works Co., Denver, Colo.

Denver Engineering Works Co., Denver, Colo.
Hendrie & Bolthoff M. & S. Co., Denver, Colo.

Power & Mining Mch. Works, 115 B'way, N. Y.
Traylor Eng. & Mfg. Co., Allentown, Penn.

Mine Hangers & Insulators

Electric Service Supplies Co., Philadelphia, Pa.

Minerals and Ores, Rare

Ward's Natural Science Estab., Rochester, N. Y.

Mining Representatives

Camphus, Rives & Gordon, Inc., Apartado (P. O. Box) 1709, Office 512-13 Mutual Bldg., Mexico, D. F.

Molybdenum Ore, Buyers of

Primos Chemical Co., Primos, Del. Co., Pa. Cable: "Briquette, Phila." Branches Vanadium and Lakewood, Colo.

Agents: Allen S. Davison & Co., Pittsburgh, Pa.

Motors

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.

Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.

Motor Generator Sets

General Electric Co., Schenectady, N. Y.
Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.

Motor Control

Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.
For all types and capacities of motors.

Netting, Wire

Ludlow-Saylor Wire Co., St. Louis, Mo.
"Hex" poultry netting. Stack netting for locomotives.

Catalog No. 45.

Nickel

International Nickel Co., The, 43 Exchange Place, New York.

Oiled Clothing

Goodrich Co., The B. F., Akron, Ohio.
So'westers, jackets, apron pants. Rubber goods for abrasive wear.

Oils, Flotation (See "Flotation Oils")

Ore, Buyers and Sellers of

American Metal Co., New York City. Agents: Campana des Minerales y Metales, Mexico City and Monterey; South American Metal Co., Santiago, Chile.

American Smelting & Refining Co., 120 Broadway, New York.

Agents: Kleinwort, Sons & Co., London, Eng.

CARBIDE LAMPS

FLOAT FEED
Patented

The Simplest of All Lamps

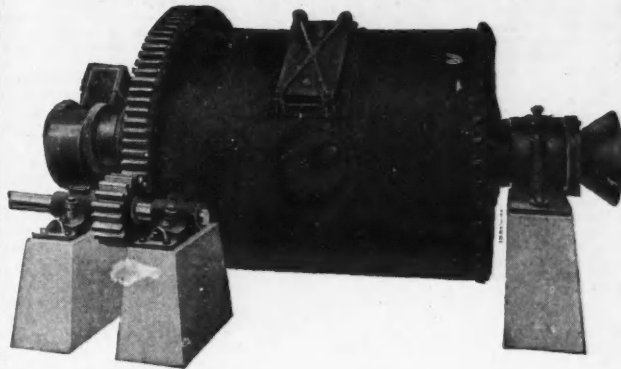
It is less complicated than other lamps. You simply charge it with carbide and water, open the valve full wide, light and it burns and it keeps on burning until the charge is completely used up. No raking. No shaking. No adjusting.



Care of this lamp is equally simple. May we send you evidence of this in the form of a sample lamp? No obligation incurred on your part.

DEWAR MANUFACTURING CO., Inc.
28-30 Thirty-fifth St. Brooklyn, N. Y. 100 Wellington St., W. Toronto, Ontario

The Standard Ball Mill *is all the name implies*



S T A N D A R D
IN WORKMANSHIP.
IN EFFICIENCY.
IN DURABILITY.
IN PRICE.
In all that is embodied in Ball Mills.

Self-locking lining requiring no bolts through the shell, insuring longer wear of the lining. No special lifting devices required. A proven crushing device of the highest efficiency in the simplest form.

Made in all sizes, the following sizes carried in stock for immediate shipment:

5 x 4 ft.	Capacity	10 tons per hour to 12 mesh
4 x 5 ft.	"	8 " " " " " " "
4 x 3 ft.	"	3 " " " " " " "
3 x 3 ft.	"	1 1/2 " " " " " " "
36 x 30 in.	"	1 " " " " " " "

Laboratory or Sample Mills; following are charge mills.

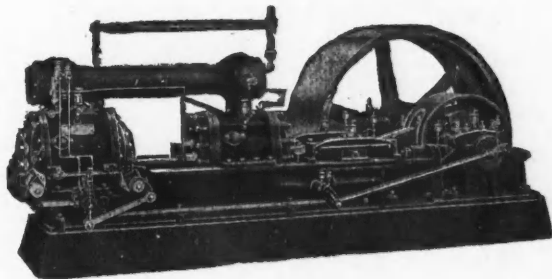
36 x 30-in., Capacity per charge 300 pounds.
30 x 21-in., Capacity per charge 120 pounds.
Full line of Manganese Steel Balls, sizes 1 to 4-in., and also High Carbon Forged Balls.

Write for Catalogue
The Morse Bros. Machinery & Supply Co.
Denver, Colorado

AUTOMATIC SELECTIVE PROPORTIONAL UNLOADERS

are found exclusively on the

Norwalk Compressor



These improvements mark a new era in compressor construction. They gain the instant and favorable attention of all skilled engineers. For the usual hackneyed claims of *economy, durability and efficiency*, let our forty years' experience be an assurance of adequate and discerning attention to every feature.

The Norwalk Iron Works Company
South Norwalk Connecticut

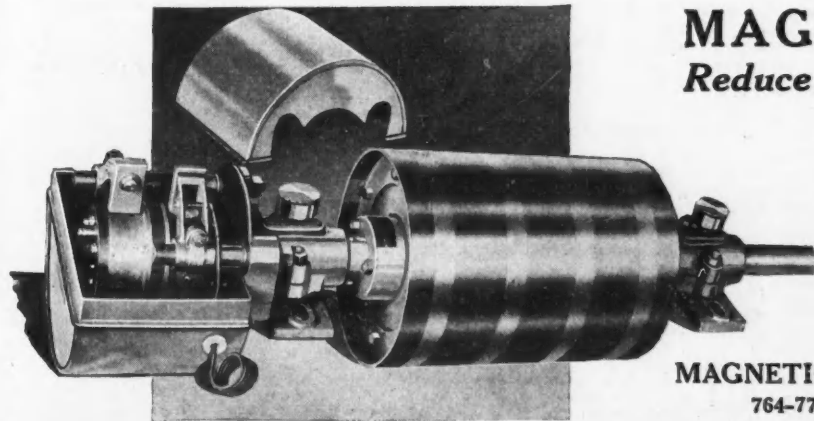
MAGNETIC PULLEYS

Reduce repair bills by protecting Ore Crushers

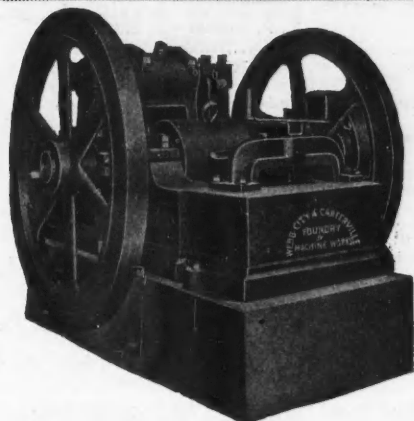
Magnetic Separation removes tramp iron from conveyed material, thus eliminating two channels of loss: *the cost of repairs, and the expensive shut-downs which follow injury to Ore Crushers.*

Bulletin No. 24 gives full description of Magnetic Pulleys.

MAGNETIC MANUFACTURING COMPANY
764-770 Windlake Ave., Milwaukee, Wis.



- land; W. A. Price and Geo. J. Ewart, City of Mexico; F. D. Aller, Antofagasta, Chile, wort, Sons & Co., London, England; W. A. Price and Geo. J. Ewart, City of Mexico; F. D. Aller, Antofagasta, Chile.
- American Zinc & Chemical Co.**, Langeloth, Pa. American Zinc, Lead & Smelting Co., 55 Congress St., Boston, Mass.
- Arizona Copper Co.**, Clifton, Ariz.
- Balbach Smelting & Refining Co.**, Newark, N. J.
- Bartlesville Zinc Co.**, 52 Broadway, New York.
- Beer, Sondheimer & Co.**, 61 Broadway, New York. Branch: 1101 Newhouse Bldg., Salt Lake City, Utah.
- See advertisement.
- Consolidated Mining & Smelting Co. of Canada, Ltd.**, The Trail, British Columbia.
- Grasselli Chemical Co.**, The Cleveland, Ohio.
- Hardy Charles**, 50 Church St., New York.
- Hegeler Zinc Co.**, The Danville, Ill.
- Illinois Zinc Co.**, Peru, Ill.
- International Smelting Co.**, 42 Broadway, New York. Ore Purchasing Department: 621 Kearns Bldg., Salt Lake City, Utah. Smelting Works: International, Utah, and Miami, Ariz. Refineries: Raritan Copper Wks., Perth Amboy, N.J.; Internat. Lead Refining Co., E. Chicago, Ind. Irvington Smelting & Refining Works, Irvington, N. J. Branch Office: New York.
- Leavit & Co.**, C. W., 30 Church St., New York.
- Matthiessen & Hegeler Zinc Co.**, La Salle, Ill.
- Nichols Copper Co.**, 25 Broad St., New York.
- See advertisement.
- Pass & Son, Ltd.**, Capper, Bristol, England.
- Pennsylvania Smelting Co.**, Pittsburgh, Penn.
- Phelps, Dodge Corp.**, New York City.
- Phillip Bros.**, 29 Broadway, New York.
- St. Joseph Lead Co.**, 61 Broadway, New York.
- United Metals Selling Co.**, 42 Broadway, New York. European Agents: C. S. Henry & Co., Ltd., 12 Leadenhall St., London, E. C.
- See advertisement.
- United States Smelting, Refining & Mining Co.**, 55 Congress St., Boston, U. S. A. Works: Midvale, Utah; Needles, Calif.; Gold Road, Ariz.; Kennett, Calif.; Chrome N. J.; Grasselli, Ind.; Pachuca and Real del Monte, Mexico.
- See advertisement.
- Vernon Metal & Produce Co., Inc.**, 25 Beaver St., New York City.
- Vogelstein & Co., L.**, 42 Broadway, New York.
- Ores, Samplers of**
- Beach & Co.**, 204 Boston Bldg., Denver, Colo. Supervise weighing and sampling at smelters.
- Ledoux & Co., Inc.**, 99 John St., New York.
- Pitkin, Inc.**, Lucius, 47 Fulton St., New York.
- Overhead Line Material**
- Electric Service Supplies Co.**, Philadelphia, Pa.
- Oxy-Acetylene and Oxy-Hydrogen Apparatus**
- Davis-Bourneville Co.**, General offices and factory: Jersey City, N. J.
- Widest range of equipment for welding and cutting and production of acetylene, oxygen and hydrogen. Sales offices: New York, Chicago, Boston, Philadelphia, Pittsburgh, Cleveland, Cincinnati, Detroit, St. Louis, San Francisco, Seattle, Toronto, Canada.
- Oxy-Acetylene, Welding and Cutting Apparatus**
- Milburn Co.**, The Alexander, Baltimore, Md. "Milburn" oxy-acetylene apparatus.
- Packing**
- The Diamond Rubber Co.**, Akron, Ohio.
- Garlock Packing Co.**, Palmyra, N. Y.
- Goodrich Co.**, The B. F., Akron, Ohio.
- Sheet, tubular, spiral, square, rubber and duck.
- Goodyear Tire & Rubber Co.**, The, Akron, Ohio.
- U. S. Rubber Co.**, New York.
- Packing, Hydraulic**
- Schieren Co.**, Charles A., New York City.
- Packing, Rod**
- U. S. Rubber Co.**, New York.
- Packing, Sheet**
- U. S. Rubber Co.**, New York.
- Pebbles, Grinding**
- Wood & Co., R. D.**, Philadelphia, Penn. All kinds and sizes, 1 to 72 in.
- Pipe, Spiral Riveted**
- Abendroth & Root Mfg. Co.**, 233 B'way., N. Y. C.
- American Spiral Pipe Works**, Chicago, Ill. To 40 in. diameter and 40 ft. long.
- Pipe, Steel**
- National Tube Co.**, Pittsburgh, Penn.
- Pipe, Wood**
- National Tank & Pipe Co.**, Portland, Ore. Machine Banded Pipe in sizes 2" to 32". Continuous stave pipe up to 14".
- Bedwood Mfrs. Co.**, San Francisco, Calif.
- Platinum**
- Baker & Co., Inc.**, Newark, N. J. Branch: New York.
- Hammered ware of all sizes and shapes.
- Bishop & Co.**, Platinum Works, J., Malvern, Pa.
- Powder, Blasting**
- Aetna Explosives Co.**, 2 Rector St., New York.
- Power Transmission Machinery**
- Traylor Engineering & Mfg. Co.**, Allentown, Pa.
- Presses, Filter**
- American Continuous Filter Co.** (See United Filters Corp.)
- Kelly Filter Press Co.**, Salt Lake City, Utah. (See United Filters Corp.)
- Shriver & Co.**, T., 826 Hamilton St., Harrison, N. J.
- Sweetland Filter Press Co.**, Brooklyn, N. Y. (See United Filters Corp.)
- United Filters Corp.**, Felt Bldg., Salt Lake City, Utah.
- Worthington Pump & Machinery Corp.**, 115 B'way., New York City.
- Presses, Hydraulic**
- Wood & Co., R. D.**, Philadelphia, Penn.
- Publishers, Technical Book**
- McGraw-Hill Book Co., Inc.**, 239 W. 39th St., New York. Branches: London and Berlin.
- Pulverizers, Coal**
- Power & Mining Mch. Works**, 115 B'way, N. Y.
- Traylor Engineering & Mfg. Co.**, Allentown, Pa.
- Pulverizers, Ore**
- Bartlett & Snow, The. C. O. Co.**, Cleveland, O.
- Braun Corporation, The**, Los Angeles, Calif. Laboratory machines for all purposes and prospecting.
- Braun-Knecht-Heinmann Co.**, San Francisco, Cal.
- Mine & Smelter Supply Co.**, The, 42 B'way., N. Y. C.
- Traylor Engineering & Mfg. Co.**, Allentown, Pa. Agents: San Francisco, Pittsburgh, Chicago.
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- Taber Pump Co.**, 295 Elm St., Buffalo, N. Y.
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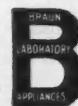
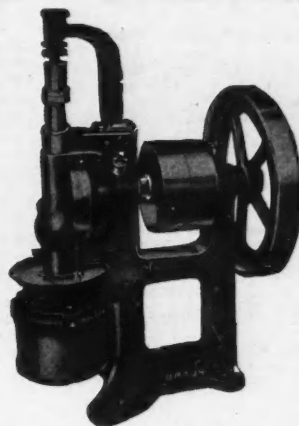
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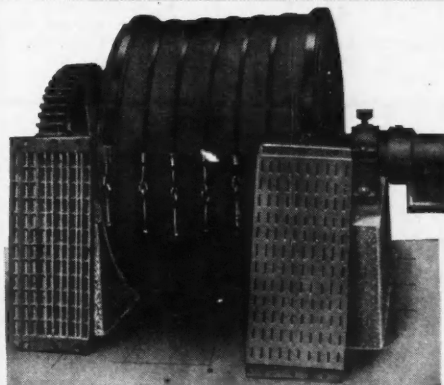
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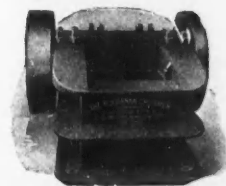
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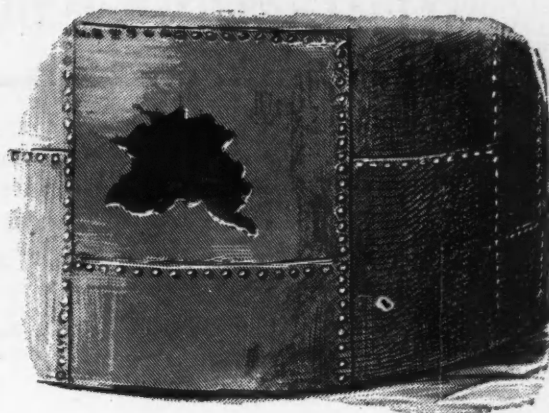
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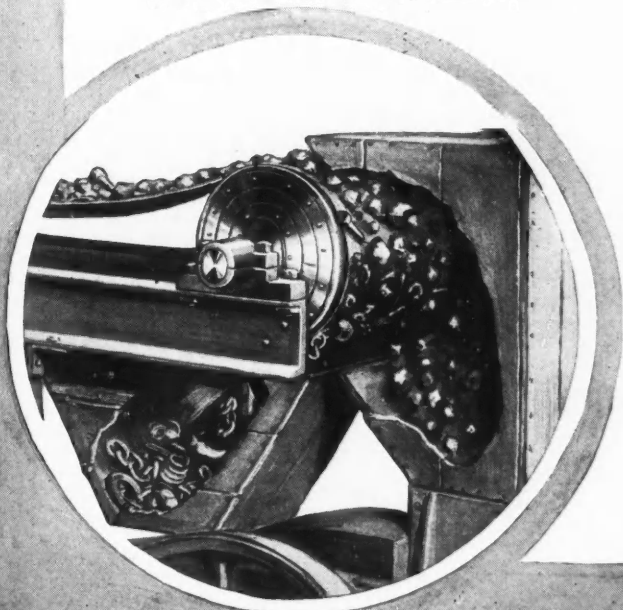


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