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SHIFTER MOVING TRACK ON DUMPS WHERE SPREADERS ARE USED

Steam-Shovel Mining on the Mesabi Range—II*

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The overburden removed from orebodies on the Mesabi range is dumped on areas that show no underlying ore material. Three general methods are practiced in building these dumps, in each the important considerations being length of haulage and height of dump. Size and type of equipment

depend on the yardage to be removed and the number of shovels to be employed on the work. Stripping equipment is afterward utilized in ore-digging operations, with the exception that the ore is shipped in specially built cars, which differ from those used to handle the overburden.

BARREN ground or ground where the underlying ore is known to be available only by the underground system of mining is commonly used in Mesabi range operations for stripping dumps. For the purposes of description, stripping dumps may be class-

ified, according to their position, the manner in which they are started or the method of operating, as side-hill dumps, trestle dumps, slush dumps, muskeg or lake dumps and caved-ground dumps.

A hillside, where the dump track can be laid at a level grade and the height of the dump will increase rapidly as the track is thrown horizontally, is an ideal arrangement. When a height of 40 ft. is reached, it is good practice to carry the dump in two benches or

*The second of a series of three articles describing present practice of the larger mining companies in developing and operating open-pit mines on the Mesabi range. The first of these appeared in the Mar. 2 issue of the "Engineering and Mining Journal."

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decks. If a greater height is used, the settling of the dump often causes trouble. Under average conditions, dumps from 25 to 40 ft. high give the best results.

Trestle dumps are used in most cases where a hillside location is not available. Trestles, similar to that shown in Fig. 1, are built of round timber with 3- or 4-post bents, spaced 16 ft. center to center and varying in height from 16 to 25 ft. Trestle legs are from 8 to 12 in. diameter, stringers 10 to 14 in., braces 3 to 5 in. and 8-ft. railroad ties are used for caps. Such trestles are designed to carry only the empty cars.

Bents less than 4 ft. high are seldom built, but blocking and cribs of old ties are used to raise the end of the dump track to meet the grade of the trestle. Filling the trestle proceeds as follows: The train is pushed out to the trestle with the cars ahead of the locomotive; several cars are dumped on one side, one at a time. The

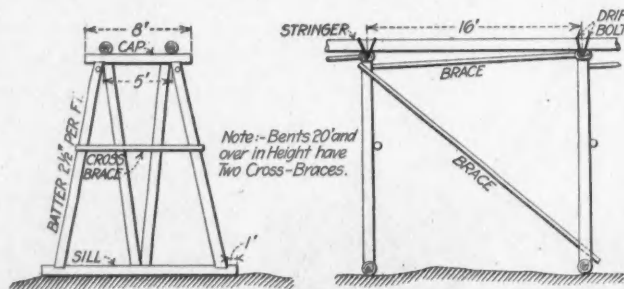


FIG. 1.—TYPICAL TRESTLE BENT USED ON MESABI RANGE STRIPPING DUMPS

empty cars are pushed out on the trestle and the operation is repeated on the opposite side. Heavy dumping on one side of a trestle will cause undue strain on the legs. When the trestle has been filled with dirt for its entire length, the track is shifted to an outer edge of the dump and the cars are emptied from that, so that the dump is widened. Usually the trestle is so placed that the dump can be "fanned out" on both sides. If sufficient room is available, the trestle is made long enough to allow several dumps to be started at intervals along its length. It is good practice to keep the edge of the dump straight, as this facilitates the throwing of the track. Frequently the track is jacked up and filled as the dump is widened out, which increases its height as the width is increased. When the limiting distance has been reached horizontally, it is common practice to throw the track back, raise it up and make a new level by working back over the part already filled. Another method is to build a second trestle on the first dump and to start a second deck in the same manner as the first deck.

A slush dump may be made by the use of a trestle, substantial enough to carry the loaded train, fitted with an apron 6 to 8 ft. wide, on the dump side. A 3- to 4-in. pipe line, perforated with $\frac{1}{4}$ - to $\frac{1}{2}$ -in. holes at short intervals, is laid along the upper edge of the apron against the ends of the ties, and water, flowing through the openings in the pipe, washes the dumped material off the apron and down the bank. At one dump on the shore of a lake, where the material handled was principally quicksand, a different arrangement was used: Trains were dumped until the track was filled; the accumulated material was then washed down the bank with lengths of 2-in. hose attached to a 4-in. pipe line at 100-ft. intervals. This type of dump is used for fill-

ing lakes and swamps where the necessary amount of water is easily available. Considerable stripping can be disposed of without moving the tracks, but the system is not practicable in freezing weather.

Muskeg swamps make unsatisfactory dumping grounds and are avoided whenever possible. Dumps on such ground may settle suddenly in spots, leaving the track hanging in the air, or may slide sideways, taking tracks, train and all over the edge. When the dump settles, the surface of the swamp often bulges up as high as the top of the dump, so that filling a dump trestle across a muskeg swamp is nearly impossible, although it has been done in a few cases; but by building the trestle along the edge of the swamp, the muskeg can sometimes be forced ahead of the dumped material. If such dumps are used intermittently, the danger of the tracks settling under a train is somewhat lessened.

The main difficulty with dumps that are fanned out into ponds or lakes is the sudden settling along the edge. The action of the water, agitated by the material being dumped, undercuts the face of the dump until it suddenly sloughs off or settles. Comparatively shallow water will often cause this. I recall one place where a 40-ft. dump was extended across a pond formed by water that had collected behind another dump. The pond was less than 5 ft. deep, but that was enough to cause a slough of the dump so that the track settled suddenly, carrying a locomotive and several cars over the edge.

At Carson Lake, near Hibbing, considerable stripping yardage was dumped before all the water had been pumped from the lake. Unusual difficulties were encountered, for, in addition to the water, there was a layer of soft silt and liquid blue clay extending to a depth of 70 ft. at the center of the lake basin. The undercutting action of the water, added to the settling and sliding of the mud, caused frequent serious delays. The position of the dump was selected with a view of making the lake basin safe for the subsequent mining of the underlying ore by the caving method.

CAVED AREAS OVER WORKINGS USED AS DUMPS

Caved ground above underground mine workings is sometimes used for dumps. The additional weight of the dump does not greatly affect the weight on the underground timber and filling the caves prevents surface water from collecting and breaking through into the lower workings. The expense of pumping water from the caves, frequently necessary in older underground mines, is eliminated by this method of filling the sunken areas. Blasting underground rooms causes the dump to settle, but information regarding the situation of the room and the time of blasting is furnished the dump foreman so that he may plan his work accordingly. Dumps of this kind are usually started from a trestle.

The details of dumping operations vary with each stripping job and will depend on the equipment used, size of the job, type of dump, etc. Three methods in common use are thus described:

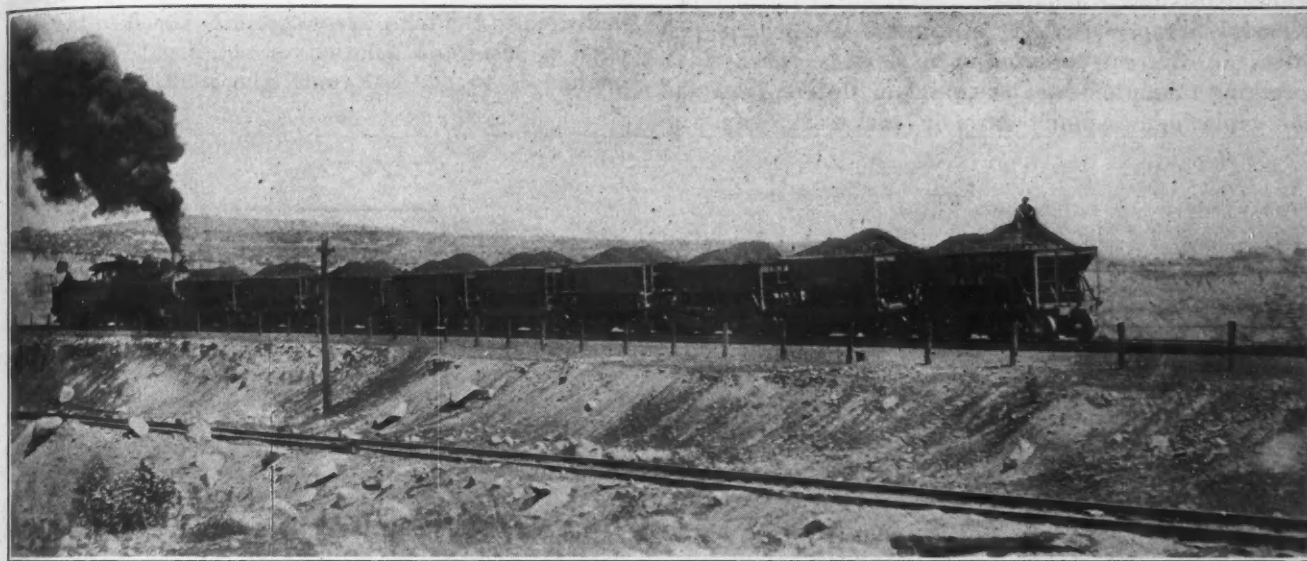
First method: A side plow or "dozer" is used to level off the dump to the height of the track for a width of about 5 ft. The track is then jacked up, shifted over 3 or 4 ft., lined up and blocked in such a manner as to carry the cars but not the locomotive. Dumping is then started at the end nearest the pit, and a shoulder is carried toward the further end of the dump, so that

the track has ballast and can support the weight of the locomotive as the shoulder is advanced. When the limit of the dump is reached, all the material that can be dumped is placed on the end length and the remaining track is filled to the limit, working back to the beginning of the dump. The "dozer" is then used again and the operations are repeated.

Second method: A plow having a spread as wide as 30 ft. is used to level off the dump 18 in. below the track. The dump is then refilled and the spreader used until the limit of spread has been reached. The last plowing is made level with the track, which is then shifted over 12 to 15 ft., lined and the operations are repeated. This method is used in connection with 20-cu.yd. cars and heavy equipment. An accompanying illustration shows a track shifter which is used with this

this size can handle the track work on four dumps. With the third method, a foreman and six men on each shift can handle all the work required for one dump. Each dump is provided with a shanty 6 x 8 ft. for sheltering the dump crew. In addition there is a 16 x 16-ft. shelter-house, centrally located in easy reach of all the dumps, where the track crew can eat and spend their noon hour. At night stripping dumps are lighted by kerosene or gasoline torches, powerful acetylene lamps of the portable type or electric lights, when practicable.

Equipment used in stripping varies widely. The yardage to be moved, class of material, available dumping ground and the time limit for completion of the work are some of the points to be considered in selecting the size and type of equipment. The larger mining companies and stripping contractors usually transfer



A 19 X 26-IN. LOCOMOTIVE PUSHING NINE 50-TON CARS OUT OF A PIT ON A 1.5% GRADE

type of dump. As shown, the track has been raised, but the shifting cable is hanging slack. The lower boom is an A-frame fitted at the point with a steel casting in the form of a link, so that the frame may be clamped to the left or to the right of the center line of the machine, according to the pull to be taken. For example: If the track is to be shifted to the left, as in the illustration, the frame is swung to the left and clamped and the shifting cable is fastened to the right-hand rail.

Third method: The track is made safe for both cars and locomotive and the first train out is dumped. The dump crew then level off the dirt and line the track over 1 ft. or more, if possible, along that part of the dump just filled. After the track is ballasted, the next train is dumped further along and the next section of track lined over as before, working toward the end of the dump. With a high dump, several trains may be emptied before a sufficient shoulder is formed to allow the track to be lined over. The crew levels the dirt and throws the track between trains. With this method there is always room to dump a train.

With the first and second methods, a dump crew consisting of a foreman and one or two men is required on each dump and both shifts. A track crew is also required, consisting of a foreman and 14 men working day shift only. Under ordinary conditions a crew of

part of their equipment from one mine to another. All parts of the stripping operation depend directly on the steam shovel. The number and size of the shovels at an operator's disposal determine the rest of the equipment. As shown by a previous tabulation, the tendency of operators is toward larger steam shovels and stripping cars. There are several Model 300 shovels and one Model 261 of the drag-line type in use at the present time on the Mesabi range. Most of the mining companies do at least part of their own stripping work, and in such cases the shovels, locomotives, etc., used for stripping are later used in removing the ore by open-cut methods. The following list is a fair average of the equipment that is being used at the present time by some of the larger mining companies in stripping work and in removing ore:

Steam shovels used are of Marion or Bucyrus manufacture, Model 91 or 100, and equipped with 2½- to 4-cu.yd. dipper. With each shovel is required nine 6-ft. track sections, 36 ties, two pair of rail clamps, two large and two small jack-blocks, 50 ft. of 4-in. rubber siphon-hose, 100 ft. of 2-in. canvas water-hose and 50 ft. of ¾-in. steam hose. In addition, two poles are provided for moving jack-blocks, also picks, shovels, pinch bars, sledges, etc. Baldwin or American locomotives having 19 x 26-in. steam cylinders supply the motive power, and are equipped with 8½- to 10½-in. cross-com-

pound air pumps, for operating automatic dumping stripping cars, and steam-turbine generators for lighting. Each locomotive carries two camel-backs, a piece of 1½-in. hoisting chain consisting of seven or nine links with a 10-in. coupling link in each end and 20 ft. of 1-in. chain with a round hook on one end and a grab hook on the other. This equipment is used in replacing cars and locomotives on the track. Ordinarily a chain is attached to the locomotive by removing the movable knuckle from the draw bar and dropping the pin through the link or round hook in the end of the chain. A cast-steel wrecking knuckle having a hook on one end is sometimes carried. This hook allows the chain to be connected directly to the locomotive without removing the regular knuckle from the draw bar.

All-steel, 16- or 20-cu.yd., automatic air-dump cars, manufactured by Kilbourne & Jacobs Co. or the Western Wheeled Scraper Co., are in general use in the district. A 30- or 40-ton Brown hoist is used as a wrecking crane and carries chains of different lengths for replacing stripping cars on the track, handling

EQUIPMENT REQUIRED IN MESABI STRIPPING

(Based on 2½ million cu.yd. of overburden and assuming same equipment will be used for subsequent open-pit mining).

Machinery	
Steam shovels	3
Locomotives	10
Stripping cars	110
Frame Structures	
Coal dock	Salt tank
Water tank	Trestles
Building	
Pumping plant	Oil house
Power plant	Sand house
Carpenter shop	Barn
Blacksmith shop	Powder magazine
Machine shop	Powder thawing house
Office	Pipe racks, tool sheds, switch shanties
Warehouse	Dwellings
Miscellaneous	
Track	Push cars
Pipe lines	Tools
Wagons	Lights

shovel booms, lifting and moving track, loading ties and other supplies on flat cars and like work. Most mining companies own several flat cars of the standard railroad type, but on small jobs they are sometimes hired, and frequently smaller sizes of cars are built by the operators from parts of the old stripping cars. Flat cars are constantly used to carry ties and rails into the pit or to the dump, and to transport repair parts, tools and various supplies from one part of the operation to another.

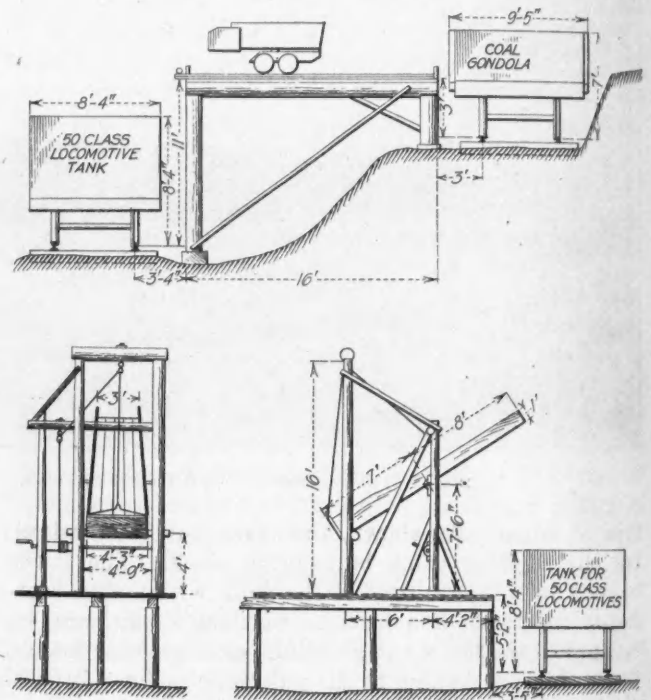
Dump plows vary from those built on the trucks of a 7-yd. stripping car, having a spread of 5 ft. and known as a "dozer," to large dump spreaders which cut 18 to 24 in. below the dump track and distribute the dirt for a width of 20 to 30 ft. A dump plow or spreader varying between these two sizes is usually found on each stripping job, although the larger type is coming into more general use.

The consumption of coal varies with the kind of material handled, length of haul to dumps, track gradient and other operating conditions. Ordinarily a fair average is three tons per steam shovel and two and one-half tons per locomotive per 10-hour shift; so that the coal supply for the pit equipment under consideration should be about 35 tons per shift. It is desirable to have at least two days' coal supply on hand, which, in this instance, would probably result in storage facilities for 100 to 150 tons. Frequently a permanent

trestle, with storage bins or pockets, is so placed that it will serve both stripping and ore trains. In such cases coal is shipped to the mine in hopper-bottom ore cars. Temporary coaling devices, used in stripping operations, vary from plank slides on the side of a cut to platforms of the types shown in Figs. 2 and 3. These temporary devices are used when the coal is unloaded by hand from gondolas.

HOT SALT SOLUTION PREVENTS FREEZING OF THE CAR BOTTOMS

A wooden or steel tank of 20,000 to 30,000 gal. capacity should be placed at some convenient point near the main line stripping track at sufficient elevation to supply water to the shovels at all parts of the stripping and to the locomotives. The salt tank is a rectangular wooden box of 2000 to 2500 gal. capacity. Salt is delivered to the tank in sacks and is added to the water until a saturated solution is obtained. (A common method is to add salt until the solution will float a



FIGS. 2 AND 3.—DEVICES FOR COALING LOCOMOTIVES WHERE COAL IS UNLOADED

potato.) Frequently the salt tank is placed near the power or pumping plant, so that a small pipe from the boiler supplies enough steam to keep the solution at the boiling point. Otherwise a small vertical boiler is installed. A hose is used to sprinkle the cars with the hot solution in freezing weather.

Permanent coal trestles are usually built with 12 x 12 in. of sawed timber placed on a pile foundation or on 12 x 12 in. mud sills. Stringers are 9 x 16 in.; ties, 6 x 8 in. and 3 x 12 in. plank are used for cross and sway braces. Dump trestles are usually built of round timber, as before described. Where a dump track or stripping track crosses a railroad main line, the railway company usually requires that a standard steel bent be built at the overhead crossing.

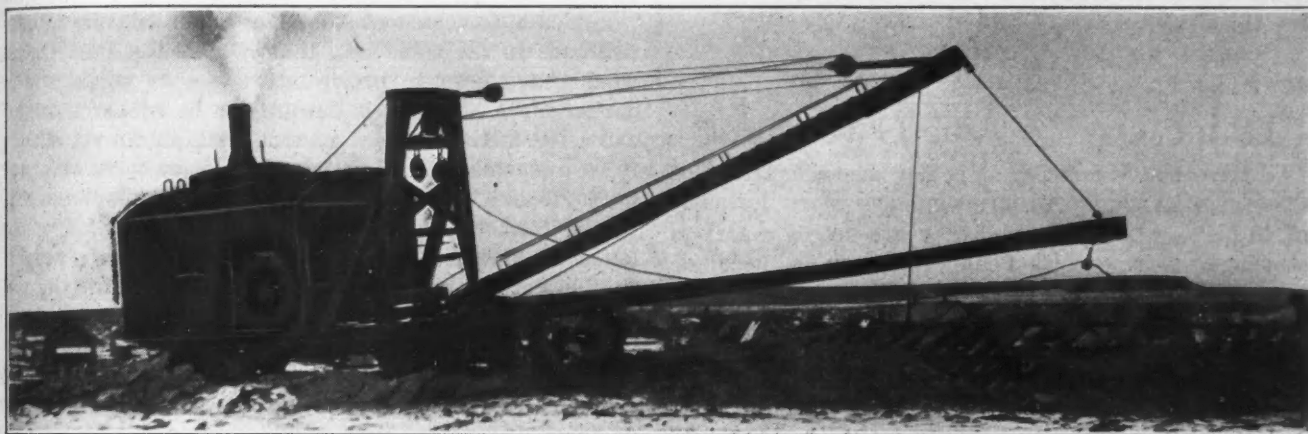
Installation of the pumping plant depends largely on the source of the water supply. It is common practice to dam up a creek or ditch fed by the discharge

from an underground mine or to take water from one of the ponds or swamps which are numerous on the range. If the underlying orebody is not drained by an adjacent mine, it is often necessary to sink a pump shaft, usually outside of the stripping limits, and from this drainage drifts are driven out under the pit. A number of the larger open-pit orebodies were first opened up as underground mines, and the pumping then done has facilitated the matter of drainage. When the water for the pit equipment is supplied from a shaft, the pumping plant and power house are usually combined and the shops built near by. A plant corresponding to the pit equipment described would probably consist of a frame building, brick nogged and covered with corrugated sheet iron; two firebox boilers with closed feed-water heater; injector and feed-water pumps; a duplex pump for fire protection and possibly a small generator for lighting purposes.

It is common practice to have the machine, blacksmith and carpenter shops under one roof. Where

the operators. Thawing houses are built according to recommendations furnished by the du Pont Powder Co. and are 5 x 8 ft. outside. Shallow drawers with 1-in. holes perforating the bottom are provided in which to store the cartridges, and are accessible from the outside of the building. A radiator in the back part of the thawer house is supplied with hot water through a 1-in. pipe from a heater in a separate building. The heater is a small water-jacketed stove fired with coal. The building over the heater is 4 x 4 ft. and is placed not less than 10 ft. from the thawing house. A frame building covered with ship-lap or drop-siding, having six stalls and a harness room, constitutes the barn.

Sand for use on the locomotives is screened through a 4-mesh screen and dried to prevent freezing. The usual type of sand drier is a cylindrical stove 2 ft. in diameter and 5 ft. high. A funnel-shaped hopper 4½ ft. in diameter is placed around the upper part of the stove and rests on a cast-iron ring at the bottom of the fire box. The ring is perforated with ¾ x 1½-in. open-



TEN-TON LOCOMOTIVE CRANE MOVING ORE-LOADING TRACK

steam power is used, the engine is frequently placed in the machine shop and line shafting run through the partitions to the other shops. The machine shop equipment consists of one 30-in. engine lathe, one 30 x 30-in. x 8-ft. planer, one radial drill with 5-ft. arm, one bolt cutter (to cut to 3-in. diameter), one pipe-threading machine (to cut up to 8-in. diameter), one oxy-acetylene cutting and welding outfit, one 100-ton hydraulic wheel press, one emery wheel, and one 48-in. grindstone. The blacksmith shop equipment comprises two stationary forges, one 1100-lb. steam hammer and one blower. The carpenter shop is modestly equipped, containing one 16-in. jointer, one circular saw and one band saw.

A roundhouse for repairing shovels and locomotives is customarily built of rough lumber covered with tar paper. Shovels and locomotives working in ore are usually repaired during the winter, and temporary roundhouses or repair sheds are sometimes made in sections so that they may be taken down and stored when not in use. It is often convenient to have the office and warehouse combined and near the shops. Other small buildings, such as oil house, tool sheds, and pipe racks, are of such size and shape as best suit operating requirements.

Powder magazines of heavy sheet steel are furnished by the powder company supplying the explosives. Sheet-iron magazines for caps and fuses are usually built by

ings. Screened sand is shoveled into the top of the hopper and when dry runs out through the perforations at the bottom. The stove is placed in a shed 10 x 12 ft. and situated near the coal dock. A bin for the dried sand is built at one end of the shed, and the sand is carried to the locomotives in pails. If a number of locomotives are used, a small headframe and pocket are sometimes built over the sand house. Sand is hoisted from the drier to the pocket in small skips operated by a hand windlass; the pocket is fitted with a spout of 3-in. pipe and the flow of sand regulated by a gate operated from the locomotive by means of a ¾-in. rod.

MAP MEASUREMENTS DETERMINE TRACK REQUIREMENTS

The track required for a stripping job is usually figured from measurements made on a map which shows the stripping limits, dumping ground, proposed shop tracks, and other operating details. For the type of equipment in general use today, 80-lb. rail with ties 6 to 7 in. thick are the standard for stripping work.

In warm weather the shovels are supplied with water by pipe lines placed through the pit. Considering the three-shovel job, 3-in. mains with 1½-in. branches would probably be used. Usually branch lines are laid in the cuts behind the shovel and are extended by the pit crew as needed. When the shovel is moved back, these lines are broken and relaid in the new cut. Water is pumped

to the shovel through the 2-in. canvas hose carried on each shovel. In freezing weather water is siphoned from a locomotive tank through the 4-in. rubber siphon hose which forms part of the shovel equipment.

One contractor is using two swinging arms of 3-in. pipe provided with flexible joints made up of ells and nipples, to supply the shovel with water. One arm, placed on a shovel, is fitted with an ell and 15 in. of pipe so that with an arm extended the 15-in. piece points upward. The other arm, placed on the locomotive, is fitted out in the same way, except that the 15-in. piece points downward. The end of the pipe from the shovel is enlarged so as to allow the pipe from the locomotive to enter a few inches. Water is forced from the locomotive tank through this pipe connection by a steam jet. The combined length of the pipe arm is a little greater than the maximum distance from the loading track to the shovel, but with the three joints in the connection it is equally convenient for shorter distances. This device seems to be satisfactory and saves dragging an expensive 50-ft. length of siphon hose behind the shovel.

(To be continued.)

"Taking Over" by the Government*

We have had a number of ocular demonstrations of the way in which the Government does work formerly left to private initiative, and they are not of a sort to encourage further experiments that may be needless. Government control of the coal industry can hardly be called a glittering success. What improvement has been wrought by the Government operation of the railroads has been mostly due to the fact that the Director General is doing every day, in the way of pooling freight, etc., what the railway managers were strictly forbidden to do. In shipbuilding itself, the Government has not shown superior efficiency or economy. It is now universally admitted that the ship program was held up at least two months by the squabbling and dilatoriness of Government officials. Labor troubles and strikes in shipyards have not disappeared at a Governmental touch. High cost and delay are nearly everywhere synonymous with Governmental enterprises.

It is only fair to private contractors for the Government that explanations held valid for the latter should at least be allowed to weigh something for the former. The unusually severe winter, and the snarled-up railway transportation, have been, for example, considered a sufficient excuse for the breakdown of the Fuel Administration. It is but just to inquire what was the effect of the same conditions upon the enormous and complicated work at Hog Island. Then there is the question of speed as necessarily swelling cost. It was rightly argued as a good defense of the expensive army cantonments that they had to be built in a great hurry. That always means large outlay. Contractors know well that there is such a thing as the most economical pace of construction. But when, under pressure, it has to be exceeded, the costs inevitably mount. This is so in private work, and it cannot be avoided in Government work. So that the really impartial and scientific inquiry in regard to the vast and apparently excessive

expenditure at Hog Island would be—just as it was in the matter of the cantonments and other work done for the Government under rush orders—whether the speed attained warranted the money spent. This fundamental business question has not emerged clearly in the Congressional investigation.

It is to be remembered that there are various forms of Government "taking over." It may be entire, it may be partial, it may be only nominal. The carrying of the mails, for instance, has been completely taken over by the Government. No individual citizen can engage in it, though it has been powerfully contended that a private corporation could do the work both better and cheaper than the Government. But most of the assumptions of control of private business by the Government since the war began have not gone beyond a general direction. The efficient managers and the body of skilled workers have been left in their places. Mr. McAdoo, we know, has not interfered with the staffs of the railroads, and he has sought to associate with himself the most competent railway men.

For the Government to have taken charge of the railroads in the same way that it runs the Post Office, would have been to precipitate a deeper chaos and a darker night. And it is devoutly to be wished that the extension of Government control of shipbuilding, should it be undertaken at Hog Island or elsewhere, may not go to foolish extremes of meddling and displacement. If you cannot make a man an officer by sewing epaulettes on his coat, you certainly cannot make a man a shipbuilder or builder of any kind by calling him a Government inspector. And if any one lesson has been taught by the experiments and exasperating delays and confessed blunders of the last year, it is that as Government interference goes up, speed and economies go down.

New Mining and Geological Map of Colorado

An interesting blueprint map of Colorado, in colors, has been placed upon the market by R. W. Chase.¹ The map was compiled from the State Geological Survey Map of Colorado and the Hayden Geological Map. It shows the distribution of the principal geological divisions, from the Archæan to the Tertiary, together with the occurrence of the various metals, oil and gas. The different formations are colored in vivid tints, and cross-hatching has been omitted, making the map particularly clear and free from superfluous detail. There is a graphic representation of the geological epochs, together with a statement of the principal minerals occurring in each epoch. A brief summary is also given of the principal occurrences of gold, silver, lead, copper, zinc, tungsten, molybdenum, carnotite-uranium, iron and manganese, as well as the Colorado mineral production for 1916. A generalized section indicates the structural relation between the major formations.

An Aluminum Factory at Bereg, Hungary, is being constructed to produce metal from alunite by a new process, according to *Echo des Mines*. German papers, the source of this information, state that the new works are being built by a group of Hungarian industrial interests.

*From the "Evening Post"

¹Mining Engineer, Denver, Colo.

Molybdenum Industry in Norway*

Molybdenum mining in Norway has been super-stimulated by the war demand. Practically all the Norwegian output comes from mines in the southern part of the peninsula. Elmore vacuum process is used in most of the concentrators, but several Minerals Separation plants are being erected. The Norwegian concentrates are said to carry only 75 to 80% of molybdenum sulphide.

FOR several years prior to the war Norway had been recognized as one of the chief producers of molybdenum. In those halcyon days the world's annual output of molybdenum was approximately 200 tons, of which Norway produced about one-quarter. During the year 1916 Norway is said to have exported 140 tons of molybdenite concentrates averaging about 75% MoS₂. Situated as Norway is, both politically and geographically as regards the warring nations, it was to be expected that her molybdenum supplies would be in great demand.

Naturally it was not possible to impose the British-controlled price of 105s. (about \$25) per unit of MoS₂ upon the Norwegian producing companies; hence the local price has risen to extraordinary figures, and artificial and perhaps dangerous conditions have thereby been created in the Norwegian molybdenum mining industry today. One result of these conditions is that, while before the war there were two or three mines eking out a bare existence, today the two or three genuine producers are paying fabulous dividends, while there are dozens of other companies, owning anything from the merest prospect to a partly developed outcrop, which are hurriedly erecting large and expensive plants in the attempt to reach the producing stage before the tide of inflated prices turns.

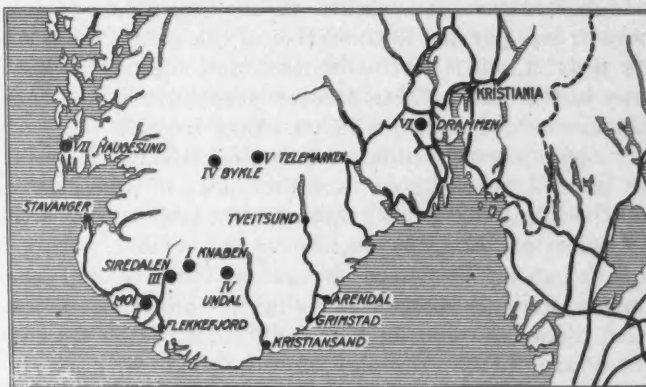
ONLY ONE MINE MAKES A 90% PRODUCT, MOST MINES PRODUCING 75% CONCENTRATES

Under the conditions imposed by the present abnormal state of affairs, it is almost impossible to write an unbiased account of molybdenum mining in Norway. On the other hand, these same conditions have produced a more than usually interesting phase in the mining industry of a country so abnormally situated. In a paper¹ entitled "Molybdenite and Its Occurrences," Sydney H. Ball says: "No molybdenite mine should be opened unless 90% concentrates can be produced for from \$800 to \$1000 per ton." If this axiom were strictly followed, there would be practically no molybdenite produced in Norway today. In the first place, there is no plant in Norway producing 90% concentrates, and certainly no mine produces a ton of 75% concentrates at a less cost than \$2500, with the present abnormal cost of labor, materials, etc., in Norway. One small mine—the Haugholmen, near Dalen—produces a ton or two a year of 90% hand-picked ore, but no information is at hand to show how much it costs.

*Excerpts from a paper "Molybdenum in Norway" by Ernest R. Woakes in Bull. 160, I. M. M.

¹"Eng. and Min. Journ.," Aug. 25, 1917.

In Norway the unit of weight when dealing with molybdenite ore or concentrates is the kilogram of pure MoS₂, i.e. 100%, and the krone is the unit of value. In normal times about 18 kr. are equivalent to £1 (1 kr. = \$0.268). The exchange rate has varied considerably during the war and has been as high as 13 kr. It is desirable for purposes of comparison to take some medium fixed rate, so in this paper 15 kr. are assumed to equal £1. By the summer of 1917 the price had risen to from 35 to 40 kr. per kg. of MoS₂ pure, the latter price being readily obtainable for parcels of hand-picked ore assaying over 80% MoS₂. But the former figure,



MOLYBDENUM MINES AND PROSPECTS OF SOUTHERN NORWAY

viz., 35 kr., soon became more or less the established price for concentrates of over 70%, a penalty being generally imposed at the rate of half a krone per unit below 70%. At these rates, therefore, 75% molybdenite concentrate is worth 26,250 kr., equal to £1750 (\$8317), per metric ton. These figures are naturally somewhat startling, but clearly indicate the artificiality of the molybdenum situation in Norway today. Expressed in terms which will be more familiar, the values named imply that an ore carrying 0.5% of MoS₂ is equal in value to quartz carrying 2 oz. 15 dwt. gold per metric ton.

The rise in value has been accompanied by a continual rise in costs—skilled labor which before the war cost 6 kr. per shift of 10 hours now costs 12 kr. per shift of eight hours. The price of food, stores and machinery has increased at an even higher rate. Before the war there were probably two or three mines that could produce a ton of concentrate at a cost of between £200 and £300; today these cost figures must be doubled, and on the newer mines quadrupled.

PRESENT PRODUCTION OBTAINED ENTIRELY FROM SOUTHERN NORWAY

Although molybdenite occurs in many parts of Norway, practically the whole of the production is obtained from mines in the southern part of the peninsula, where the great mass of the country rock is granite or granite-gneiss. Most of the orebodies occur in this rock, but there are exceptions, notably the Gursli and Dalen mines, which will be referred to in detail later on. There may be said to be three fairly well-defined types of molybdenum-ore deposits in Norway. These, of

course, are not always clearly distinguishable, even in the same mine, and the impregnated granite type occurs in more or less degree in all the deposits in that rock.

The first and possibly most important type is the quartz lode, with its prominent outcrop. The Kvina and Knaben No. 1 mines are good examples of this type, though actually the mineral occurrences are decidedly different in the two mines. The prosperous Dalen mine is another instance of a quartz lode, but here again the conditions are markedly different from any other and the country rock is a siliceous slate.

The second type is the most common, the most deceptive, and, in my opinion, the least likely to lead to any permanent or workable orebodies. In the Knaben district the type is common, and its characteristics are a highly mineralized fissure in the granite, running more or less parallel to the strike of the quartz veins of the district, viz., north-northeast and dipping rather flatly to the east. These fissures sometimes have a certain amount of width, which is filled in with more or less decomposed granite. Little free quartz is seen, but at and near the surface the faces of the fissure and the filling matter are often highly mineralized with molybdenite. At a few feet below the surface, nothing is left but an ill-defined fissure or fracture, but the country rock is sometimes slightly mineralized, for short distances along and on both sides of the fissure. There are many examples of this class of mine in Norway, so it is unnecessary to name them. The third type is the molybdenite-impregnated granite. There are two or three promising occurrences of this type in Norway, of which Knaben No. 2 mine and the Undal mine are examples, while Gursli apparently has a molybdenite-impregnated norite deposit. None of these has yet reached the producing stage, but all should shortly arrive at that condition, and may yet prove to make the most successful mines.

ELMORE VACUUM CONCENTRATION USED

Practically all the successful molybdenite concentrators in Norway are Elmore vacuum concentrators. A Swedish firm now controls the patent rights in Scandinavia and manufactures the plant. All the mills are similar in design. The ore from the mines is first crushed in Blake type rock breakers, then passed through a ball mill, the favorite type of ball mill at present being the Gröndal, made by the firm of that name in Stockholm. After the requisite sizing and return of the oversize to the Gröndal, the ore passes on to the Elmore units.

Mica and copper are the impurities which cause most trouble; where these do not occur in undue proportion, a good extraction is obtained and the concentrates run from 75% to 80% MoS₂. There is a good deal of talk about flotation concentration, both by mechanical and compressed-air agitation. Two small units of the former type were seen in operation, and neither was doing good work, but the conditions could not be said to be favorable. Several of the mines have small hydro-electric power plants of their own, with oil engines as auxiliaries. Others use oil engines entirely, and Gursli is connected up to a public hydro-electric station.

The table gives the names of the molybdenum mines and prospects at present operating in Norway. They are grouped according to the district in which they

occur, and where possible the name of the owner or operating company is given. A/S means "Aktieselskab" or "share company." The groups are numbered in roman figures, and on the map similar figures indicate the approximate geographical situation of the group. The mines in the table are also roughly classified by means of the capital letters A, B, C and D. Class A represents a producing mine with a concentrator; B class, a producing mine without a concentrator; C class, a mine that will probably be a producer, and which is erecting a concentrator; D class are chiefly prospects, or mines which are closed down or which produce only negligible quantities of mineral.

District	Map Reference	Name of Mine	Name of Company or Owner	Class
Knaben fjord	I	Knaben No. 1.....	Blackwells Development Corporation, Ltd.	A
		Knaben No. 2.....	Corporation, Ltd.	C
		Kvina.....	A/S Kvina Gruber	A
		Ornehommen.....	A/S Ornehommen Gruber	A
		Baenkehei.....	Ths. S. Falck	A
		Lilleknaben.....	Anglo-Scandinavian Minerals, Ltd.	C
		Hommen.....	Nielsen, Stavanger	C
		Roma.....	A/S Roma Gruber	D
		Sandtjern.....	A/S Molybden	D
		Lister & Mandal.....	Herr Hjelm	D
Moi.....	II	Gursli.....	A/S Gursli Gruber	A
Siredalen.....	III	Gursli II.....	T. H. Falck & Blumental	D
		Orsdal.....	Kristiania Minekompani	C
Mandal.....	IV	Sandsmark.....	A/S Sandsmark Gruber	C
		Undal.....	A/S Undalen Gruber	A
		Bykle.....	Kobernuteus Interesnakab	D
		Dalen.....	A/S Dalen Gruber	A
Telemarken.....	V	Haugholmen.....	Herr Tarjer Midbgarden	B
		Bandakali.....	Kristiania Minekompani	B
		Noraberg.....	Kristiania Minekompani	D
		Berge Gruber.....	Kristiania Minekompani	D
		Sinnaes.....	Kristiania Minekompani	D
Drammen.....	VI	Syversvolden.....	Syversvolden Gruber	B
		Sell & Gurholdt.....	Sell & Gurholdt	B
Haugesund.....	VII	Skjold.....	Kristiania	D
		Vatterfjord.....	A/S Skjoldveg Molybden	B
			A/S Vatterfjord Molybden Gruber	D
Northern Islands and Districts		Langvaten.....	(a)	D
		Tjaarsdalskampen.....	(a)	D
		Smolen.....	(a)	D
			(a)	D

(a) Details not available.

MINES OF THE KNABEN DISTRICT

The Knaben district is best reached by rail from the port of Stavanger to Flekkefjord, thence by motor boat to Oie, and by cart road to Knaben. It is a long day's journey from Flekkefjord. The Knaben No. 1 mine is the oldest in the district, and has been a continuous producer on a considerable scale. The mine is owned by a British company, which is now opening up and equipping a new No. 2 Knaben mine.

The bearing of all the lodes in the district is approximately north-northeast, with a flat underlie to the east. The No. 1 mine consists of an adit level and a 60-ft. and an 80-ft. level below the adit. At and above the adit level, in the main orebody, three lodes or branch lodes are worked, and the rock between them was often mineralized. Below the adit only the eastern or hanging-wall lode shows any strength; little ore has been found at or below the 80-ft. level. In the upper workings the mineralization occurred over a width of 30 ft., with some fine veins of solid mineral; masses of solid molybdenite have been found; one piece weighing over 4 cwt. was presented to Sheffield University. The hanging wall is gneissic granite, while the footwall is often porphyritic. Outside the main orebody the fissure is badly defined and erratic, and there is little impregnation of the country rock with molybdenite. There remains a considerable tonnage of arches and pillars to remove, and several thousand tons of dumps and tailings to re-treat. The plant consists of the usual crushing machinery and one Elmore unit. The company owns a 150-hp. hydro-

electric plant, with oil engine auxiliaries. The output of the mine has not been regular and has averaged five tons of 75% to 90% concentrates per month. This plant has produced some high-grade concentrates, as high as 94%, but latterly the grade has been lower.

The Kvina mine is situated on the same mineral belt as the Knaben, and about a mile to the north. The lode is very flat and worked entirely through adits. At the surface there was a strong quartz outcrop, but the lode was never defined as at Knaben No. 1. The hanging wall is granite, and the footwall appears to be entirely broken up, and a large amount of segregation to have taken place, so that masses of quartz and pegmatite are found. The ore occurs at the contact of the quartz and granite and also at the quartz and pegmatite contacts, and there is a good deal of impregnation of the granite. Masses of molybdenite-impregnated rock often occur in the footwall, apparently far removed from any contact. The concentrator is well designed and contains two Elmore units, a picking belt, and a Gröndal mill; a feature being that three-throw plunger pumps are used in place of bucket elevators. The company operates its own hydro-electric plant. The ore is low grade, probably about 0.3% or even less. At pre-war prices there could have been but little profit; now, however, the company is doing well, and produces from three to four tons of 75% concentrates per month.

Knaben No. 2 mine is situated about two miles south of Knaben No. 1. A mass of molybdenite-impregnated granitic gneiss is being developed. Crosscuts and opencuts show this mass to extend over a length of several hundred feet, and in some places to over 100 ft. in width. Its depth is not known. Well-mineralized joints are found throughout the mass, which is expected to mill about 0.5% MoS₂. Crushing plant sufficient for two Elmore units is being erected, and one of the latter is already installed. The main-adit crosscut is being connected with the concentrator by means of an aerial ropeway about one-half mile long.

IMPORTANT DEVELOPMENT AT ORNEHOMMEN MINE

The Ornehommen is an important Norwegian company started since the war. The plant and workings are situated about a mile northwest of Knaben No. 2. The company has erected an 80-hp. hydro-electric plant and a large concentrator capable of holding four Elmore units, two of which are erected; the mine and concentrator are connected by means of a short single-rope aerial tramway. The mine consists of crosscuts and adit levels driven on a narrow and erratic mineralized fissure in granite, and has produced a ton or two of concentrates since the starting of the concentrator in July last. The company is believed to be on the lookout for other properties in the district; it incurred a capital expenditure of 1,100,000 kr. before producing.

Baenkehei is a small mine adjoining No. 2 Knaben on the north, and is also working on a small mineralized joint in the granite. Its plant consists of an oil engine and one flotation unit, which started in July and has produced a ton or two of low-grade concentrates.

Lilleknaben mine is owned by an English company, and is situated immediately south of No. 1 Knaben. The company is erecting a Minerals Separation flotation plant. Little underground work has been done, but there is a mineralized fissure showing on the surface.

The Hommen mine is situated south of Knaben No. 2, and is being opened up as a trial by some of the Kvina shareholders. They are erecting a flotation unit. The Roma, Sandtjern, Lister and Mandal are all prospects, which so far have done little work.

GURSLI MINE IN THE MOI DISTRICT

The Gursli mine is situated within a few miles of Moi, a station on the railway from Stavanger to Flekkefjord. The company has been promoted during the war, and a large output from the mine was anticipated. Nearly 1,000,000 kr. has been expended in bringing it to a producing stage. The outcrop occurs on the face of a cliff on the shore of a lake, and two parallel fissures have been crosscut and driven on at two or three levels. The rock in which the veins occur is probably norite, and the molybdenite is not as pure as that usually found in the Knaben district. Mica and copper pyrites occur in sufficient quantities to interfere with the concentration. At present the mine does not show indications that these mineralized fissures in the more basic rock will prove more prolific as molybdenite bearers than have the similar occurrences in granitic gneiss. Within a short distance of the mill the company has begun work on a molybdenite-impregnated norite mass, but it appears to be of low grade and to carry the interfering minerals above referred to.

The concentrator contains a more ambitious crushing plant than is usual at these mines, and has two Elmore units erected, with space prepared for two more. The company first erected a small flotation plant at Flekkefjord. Its experimental running, however, was said not to have been satisfactory; at any rate, an Elmore plant was chosen for the large plant at the mine. The Gursli II is at present only a prospect; it has been on the market for some time.

SIREDALEN AND MANDAL DISTRICTS

Siredalen is reached from Sirnes, a station on the railway near Flekkefjord. The Orsdal mine from 1904 onward was worked for some years by the British Molybdenum Co., Ltd., but after making a small production was abandoned, and has recently been taken up by a Norwegian company. The mine is interesting as producing small quantities of wolfram. The Sandsmark is a new local company and little is known of its prospects, though it is erecting a concentrator containing two Elmore units.

The Bykle is an old mine in a very inaccessible part of the country. The ore is low grade and impure, and the mine is not at present in operation, though attempts have recently been made to restart it.

The Undal mine is a new property in a new district, and a Norwegian company of large capital has spent large sums on its development and equipment. No underground work has yet been done, but a number of opencuts over a length of 700 miles have shown the occurrence of three or more parallel joints or veins in granite. At some points these joints are well mineralized, and the intervening rock, over widths varying from 5 to 20 ft., is strongly mineralized with disseminated molybdenite. A well-built and rather ambitious-looking concentrator has been erected, containing a powerful crushing plant with two Gröndal mills and four Elmore units. The motive power is a semi-Diesel

engine. This company may have a successful future when it overcomes preliminary treatment difficulties and conditions in Norway become normal.

The Telemarken district is best reached from the port of Arendal, thence by train to Tveitsund and by motor car to Bandakslisli, on Lake Bandaks. The Dalen mine is beautifully situated at the western end of Lake Bandaks. From Dalen a day's motor ride through magnificent scenery takes one to Odda, on the Hardanger Fjord, where the Alby United Carbide works are situated. The Dalen mine started producing at the end of 1916, and since that date has produced more molybdenite than any other mine in Norway in a similar period. The mine is situated about 1200 ft. above the lake, and is connected with the concentrator on the lake by an aerial ropeway.

DALEN DEPOSIT IN SILICEOUS SLATE

The Dalen ore deposit consists of a flat "hungry-looking" quartz vein in a fine-grained siliceous slate. The quartz vein varies in width from 3 ft. to a few inches, and outcrops on the mountain side over a length of 200 miles. It dips slightly to the west and does not extend into the mountain, but peters out to a mere stringer in a length of 200 ft. The slate walls are clean; there is no impregnation of molybdenite into the slate. The quartz vein is faulted by vertical faulting planes, and in places one or two smaller and parallel veins are showing. In the neighborhood are other masses of barren quartz, and a small copper mine has also been in operation. The quartz vein would appear to be an apophysis from the granite which occurs about a mile off on the south side of the lake, and the whole occurrence seems to indicate that the molybdenite in the granite is to be attributed to the quartz constituent of that rock.

The Dalen concentrator contains two Elmore units, and the motive power is oil engines. Besides concentrates the mine produces clean hand-picked ore, including crystals of molybdenite. A special price is paid for these crystals provided they attain a certain diameter. It is stated that the perfect cleavage of the crystals enables leaves to be separated of a mica-like form and that these leaves are used for the intensifiers in wireless telegraphy.

The Haugholmen and Bandakslisli mines are situated in the granite on the south side of the lake and produce a small amount of high-grade hand-picked ore. Berge Gruber and Sinnaes and Noraberg are all prospects under trial, the two former near Vraadal, and the latter near Dalen.

DRAMMEN, HAUGESUND AND NORTHERN DISTRICTS

In the Drammen district several trials have been made on small highly mineralized fissures in granite. Some fine specimens and a few hundredweight of clean hand-picked ore obtained, but so far there are no mines of importance. The Syversvolden mine is being developed in a small way.

In the northern part of Norway on the island of Ostvaago is a small mine called the Vattenfjord, equipped with one Elmore unit, which makes a small, intermittent production. Molybdenite is said to occur at other places in the north at Smolen, Langvaten and Tjaarsdalskampen; but the available information indicates that the production from the northern districts is at present insignificant.

Reviewing the above bald statement of facts as regards the present state of the Norwegian molybdenum industry, the question that naturally arises is: What effect will the artificial stimulant of the war have upon the future of the molybdenum output? The answer, of course, depends on what will be the after-war demand and price for molybdenum. Provided the post-war price does not fall below 80s. (about \$19) per unit of MoS₂, the Norwegian output of molybdenum could be maintained at about 100 tons per annum, which figure would represent a doubling of the pre-war production. It is also probable that in the near future ferromolybdenum will be manufactured in Norway, the conditions in that country being particularly favorable for electro-metallurgical operations.

Tungsten Manufacture at Widnes, England

Owing to the curtailment in the supply of tungsten following the declaration of war, the British government sanctioned the erection at Widnes, in Lancashire, of a works for the production of tungsten powder. This plant was built through the cooperative action of a number of makers of high-speed steels. In order to secure an adequate supply of raw material, the High Speed Steel Alloys, Ltd. (the company controlling the works), purchased tungsten mines at Tavoy, in Burma, where active development is in progress. The Oct. 26 issue of *Engineering* gives the following account of the treatment methods used at Widnes:

The ore, wolframite, is received crushed to pass a 1-in. ring. The ore is first sampled and assayed, and is then raised to a series of bins on a higher floor, lots of ore of different quality being kept separate. From these bins it passes to grinding machines and thence to calcining furnaces, magnetic separators, or fine-grinding mills, according to its nature. Ores containing tin or bismuth are subjected to magnetic separation, the tungsten mineral being slightly magnetic.

The finely ground ore is mixed with a calculated quantity of sodium carbonate and the mixture heated to about 1000° C. in hand-fired reverberatory furnaces and subjected to constant rabbling. The ore mixture is selected to yield a uniform furnace product, as far as is practicable. The furnace charge is drawn off into slag pots, and when cool is broken up by hammers and fed to a jaw breaker, where it is reduced to about 1-in. cubes, then finely ground and the sodium tungstate extracted in steam-heated circular vats. The solution is passed through filter presses, decomposed by hydrochloric acid, the tungstic oxide being washed by decantation, passed through centrifuges from which it is taken in the form of a thick, yellow paste, and dried.

Scheelite, tin-tungsten slimes, tin residues mixed with small quantities of tungsten ore, and other residues are treated in a separate plant and the impure sodium tungstate is purified before it is used in the main process. The tungstic oxide is reduced (procedure not described) and the metal ground to powder, washed, and dried. Given adequate supplies of ore, the works are capable of producing daily three tons of tungsten powder of 99% purity—a quality higher than that obtained in the German product.

The Branch-Raise Sub-Level Caving System of the Ruth Mine*

A system of caving that combines in modified form the branch-raise system of the Inspiration and the stope-sill sub-level development of the Ray mines. The self-caving character of the Ruth orebody and capping is utilized and started by simple horizontal undercutting and controlled by drawing through a system of raises to a motor-haulage level that is driven in waste below the ore.

THE Ruth orebody of the Nevada Consolidated Copper Co., so far as developed, is roughly oval in plan, major and minor axes about 1600 ft. and 1200 ft. respectively, average thickness about 120 ft., and with a general dip of about 15° to the northwest. According to generally accepted theory, the orebody is

body were determined in this manner. Drilling is still in progress. The porphyry area is intruded entirely within sedimentaries, limestones and shales; and, in so far as the underground workings have shown, the porphyry, the sedimentaries near the contact, and the country underlying the ore (igneous or sedimentary) are soft, heavy, and in places swelling ground. All openings have to be carefully and stoutly timbered and constantly eased off and repaired.

The mine is at present served by two shafts, the Star Pointer, the vertical main-working shaft, and the Ingersoll, an incline used for waste and supplies. The two shafts are about 2600 ft. apart at the surface, are connected on the 500-ft. level, and a connection is now being driven on the 600-ft. level. The 300-ft. level, which is finished, and the 400-ft. level, which is nearly completed, are accessible only from the Ingersoll shaft and connecting raises from the 500-ft. level.

The 300-ft. level was developed for the shrinkage stope and pillar system, similar to that used successfully at the Ray Consolidated Copper Co.'s mines. By this method shrinkage stopes are carried up 10 to 15 ft. wide in panels at 25-ft. centers and at right angles to a series of parallel hand-tramming drifts 25-ft. apart. After the stopes are completed, the whole area is drawn, the pillars between stopes cave and the capping is allowed to settle. At the outset this method applied to the Ruth orebody was fairly satisfactory, but after a considerable area had been caved the weight became so great that the tramming levels could not be maintained open for the passage of cars except at considerable expense.

RAISES REMAIN OPEN BETTER THAN DRIFTS

Branch raises were then driven to tap the tramming drifts, as shown in Fig. 3, so that the ore could be run directly to the motor-haulage level below. It was then observed that these branch raises below the working level stood up well, even when the level itself was heavy and hard to hold. The next step was to do away with the costly tramming level, and after some experimenting with size of raises, position of square sets, fingers, etc., the following system was evolved and is in use at present:

On the 500-ft. level there were two parallel haulageways about 200 ft. apart; a third was then driven midway between. From these haulageways, branch raises were driven, as shown in Fig. 1, so that the branches intersect at a plane 50 ft. above the haulageways at 12½-ft. intervals. The plane of a raise series is normal to the haulageways, and the series are spaced at 25-ft. centers. A square set is put in at the top of each of the branches, and from this square set two short finger raises are driven, as shown in Fig. 2. Control chute gates are placed in the square sets at the bottom of the finger raises. The tops of the finger raises are spaced 12½-ft. centers in the direction of the plane of the raise series and alternately 14- and 11-ft. centers at right angles to this plane, as shown in Figs. 1 and 2, the 14-ft. spacing coming over the square sets and the 11-ft.

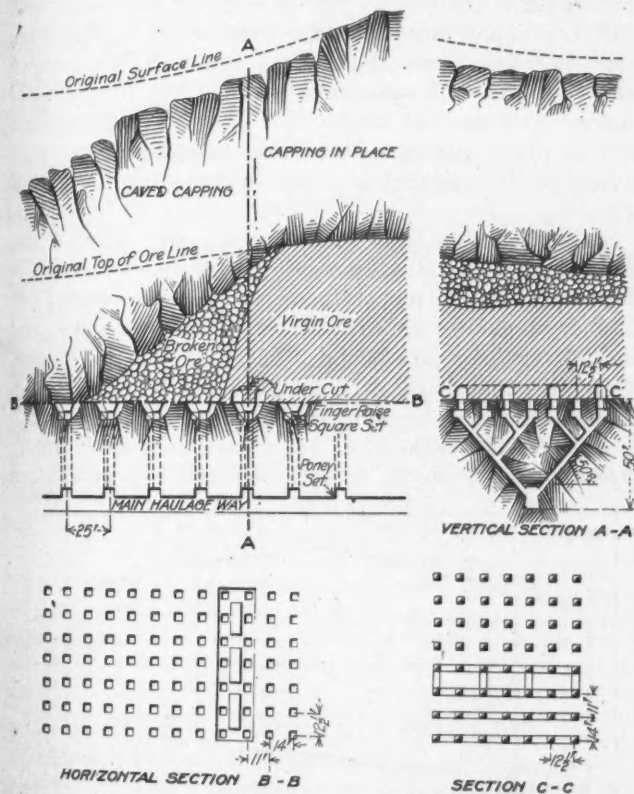


FIG. 1. SECTIONAL DIAGRAMS OF MINING METHOD

the result of a secondary enrichment of primary sulphides in porphyry leached *in situ* by meteoric waters and reprecipitated below ground water level. Copper occurs as chalcocite, chalcocite coating pyrite, and a little chalcopyrite. The leached zone, or capping, covering the ore varies in thickness from 110 to 540 ft., averaging about 410 ft. The ore is blue gray in color, and the capping, light yellow to brown.

Ore was first discovered in quantity on the levels from the Ruth shaft, now caved. Further development was by churn-drill holes, and the form and size of the ore-

*Abstract of a paper entitled "Branch-Raise System at the Ruth mine, Nevada Consolidated Copper Co.," by Walter S. Larsh, presented before the New York meeting of the American Institute of Mining Engineers, February, 1918.

interval between fingers of two adjacent raise series. The raises start from the haulage level from a pony set $5 \times 6 \times 6\frac{1}{2}$ ft. high placed over a main drift set. The raises all have manway and chute compartments, up to the square sets, and are cribbed with 4×12 in., or 6×12 in. timber, depending on the ground. They are 3×6

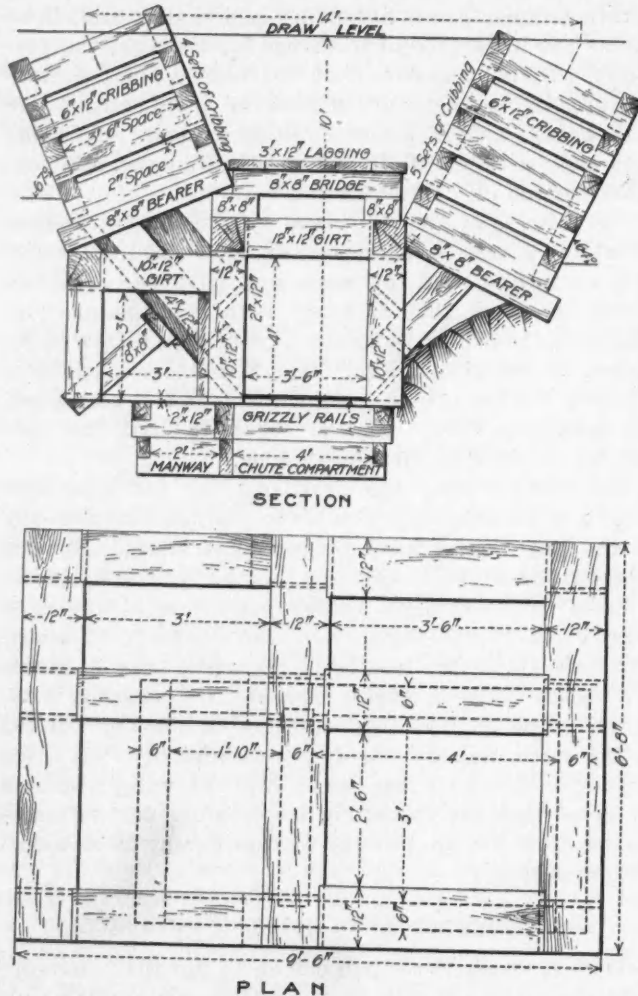


FIG. 2. DETAILS OF TIMBERING AT FINGER RAISES

ft. 4 in. inside dimensions (chute 3×4 ft., manway 2×3 ft., 4-in. divider). The fingers are $3\frac{1}{2} \times 3\frac{1}{2}$ -ft. square, in the clear of 6×12 -in. cribbing. Arc gates are used in the pony sets, plank gates in the square sets, and a grizzly, made of old rails, in the square set at the top of each branch.

OREBODY UNDERMINED OVER AREA OF SPACED RAISES

The plane or slightly warped surface connecting the tops of the fingers is considered the "draw" level, though no level is maintained there. In mining, the tops of the fingers in a raise series are connected by drifts, where the ground will permit, as indicated by the broken line in Section AA of Fig. 1; at every other branch the drifts are connected by short crosscuts, leaving small pillars between drifts and crosscuts, which are then drilled and blasted, thereby making a clean undercut or slice at the "draw" level. In starting a new block, it is sometimes necessary to stope up for a short distance over the first raise series, but after one or two series have been undercut the ground above the draw level caves readily, and all that is then necessary is to undercut each succeeding raise series by running the crosscuts to the

cave already formed and shooting the pillars to the cave, retreating from the outer limits of the orebody toward the shaft. As there is a finger raise every $12\frac{1}{2}$ ft. the undercutting can be started almost anywhere in a series. If the ground is too bad to permit undercutting by drifts, as much of the work as possible is done from the tops of each finger. It is never difficult to start a cave in the Ruth. The men always work in virgin ground and in small openings while driving the raises and in undercutting drifts and crosscuts. After the undercutting is completed and the draw started, chute spouts and gates are placed in the two remaining sides of the square set not occupied by the finger raises, but no finger raises are driven.

The critical part of the whole system is to draw the ore properly after it has been caved. Care must be taken to pull the ore down evenly so as not to mix in the capping. The ore tonnage expectancy from each raise series is calculated from the head of ore over the draw level as predetermined by drill holes, raises, or other workings, all data being charted. From the charts, a working model showing the position of the capping over each chute is made up. The amount to be drawn each shift from each finger chute is determined daily by the stope engineers from the charts, model and tons drawn record, and the information is given to the foreman and bosses. The angle of the contact between caved ore and capping from raise series caved to completion to virgin ground being undercut is maintained between 30 and 40 degrees.

The tons drawn from each raise are estimated by the chute tappers and draw bosses. They report this to the stope engineer. This estimate is checked against the number of motor cars drawn from the main raises, and the discrepancies are proportioned back to the fingers. While this distribution is not absolute, it is not practicable actually to measure the amount drawn from each finger. As the capacity of the motor cars is definitely known, a good check is obtained for the production

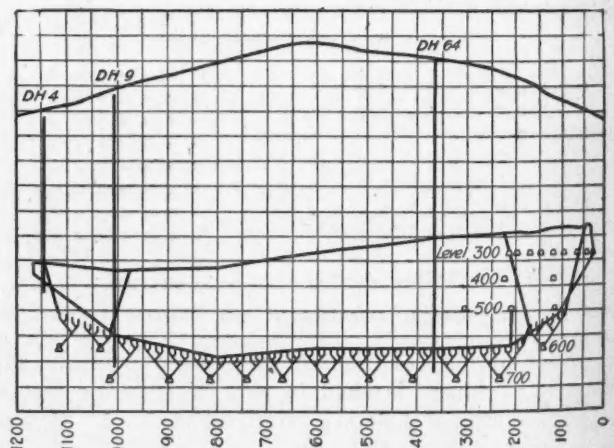


FIG. 3. DRILL-HOLE SECTION OF OREBODY AT RUTH

from each raise series; the errors compensate, and the differences between "estimates" and actual car measurements are not great, as with practice the chute tappers becoming adapt in estimating (the cribbing in the raises, which are all standard size, is of material assistance in estimating the draw).

After the day's draw is corrected, it is plotted on the charts. The model is then adjusted from the charts, the remaining expectancy and the amount to be drawn

from each place are noted and the draw sheets made out for the underground men. The charts and models are kept up daily and each shift is given its draw sheet.

The haulageways and main raises on and above the 500-ft. level are in ore, so that in drawing this ore from the next lower level the timber will be drawn in and some trouble is expected. The mine is now being opened up to establish the "draw" level at the bottom of the orebody except where the height of ore to be drawn will exceed 125 ft. The bottom of the orebody, as determined by the churn-drill holes, was contoured and the levels were laid out to give a maximum vertical interval between draw and haulage levels of 80 ft. and a minimum of 40 ft. As the raises are driven on a 50° vertical angle, the spacing of the haulage drifts is controlled by the distance between the haulage level and the bottom of the ore. The average cost of drifts is \$25 and raises \$10 per ft., and allowing sufficient solid ground over the drifts properly to protect them, the most economical distance between draw and haulage levels is 60 feet.

In only one part of the mine has the drawing been completed over an area large enough to use the results as a basis of future expectations. In Block No. 1, over the 500-ft. level, between raises Nos. 17½ and 19½, an area drawn of 250 x 225 ft., the results obtained are shown in the table.

ORE EXTRACTION FROM BLOCK NO. 1

Expectancy Tons Grade, %	Extraction Tons Grade, %	Tons Recovery %	Copper Recovery %
139,437 2.23	251,508 2.07	105(a)	97.8

(a) The extraction in tons recovered represents the percentage of tons actually drawn to tons of predetermined expectancy, and a 105% recovery indicates an admixture of 7.2% capping if it be assumed that 97.8% of the ore was recovered—Editor.

Better results in extraction are obtained in drawing over a fairly large area than in drawing a high narrow orebody, as the ore has a much better chance to cave. Drawing too rapidly causes chimneys of capping to run down through the broken ore, which should be avoided.

The proposed development plan for the mine gives an average height of ore of 97.5 ft. and an average distance between draw and haulage levels of 62 ft. A part of the orebody which has a thickness of about 200 ft. will be divided by the 600-ft. level into two drawing levels; the rest of the mine will be developed by one drawing level.

Refractory Properties of Silica

The refractory properties of silica is the subject of a paper by H. Le Chatelier and B. Bogitch in *Comptes rend* (translated in *Journ. Soc. Chem. Ind.*). The reputed melting point of kaolin (1700° C), according to the authors, is the same as that of silica, but is really the temperature at which the clay can just sustain a load of about 1 gram per sq.cm. If the material is loaded with 10 kg. per sq.cm., its melting point will be 400° C. lower. Silica, on the contrary, has a true melting point which is independent of the pressure, and shows no appreciable softening. The pressure required to crush an article made of silica decreases progressively with increased temperature, as shown by the following results on a "Star" (U. S. A.) silica brick: 15° C., 170 kg. per sq.cm.; 520°, 158; 670°, 150; 800°, 139; 950°, 125; 1050°, 120; 1200°, 85; 1320°, 62; 1460°, 50; 1540°, 37; and 1600° C., 30 kg. per sq.cm. On extrap-

olating these figures to 1700° C. (the normal temperature of the arches of steel furnaces), the crushing strength of the bricks would only be 12 kg. per sq.cm., but as this is about 10 times the pressure of the superincumbent brickwork, the stability of the bricks in the arches is assured.

This mechanical strength at high temperatures is a special characteristic of silica bricks; it is not possessed by clay or magnesia bricks, though magnesia has a higher melting point than silica. In a silica brick, the silica forms a continuous network, the pores of which are penetrated by the molten silicates without affecting the strength of the brick. The formation of this network by the recrystallization of the silica is due to the different solubilities of the various forms of silica, quartz crystallizing from the molten magma first as cristobalite and later as tridymite.

The quality of silica bricks depends primarily on the development of a satisfactory network by careful control of the proportion of fluxes, the temperature of the bricks when in use, the formation of the network, and its eventual destruction. Several bricks which gave excellent results in use were found to contain 3-5% metallic oxides corresponding to 8-14% sulphates, the ratio of the oxides to sulphates averaging 35:100. This ratio may be determined with fair rapidity and is characteristic of satisfactory silica bricks. The temperature at which the bricks should be burned depends on the purpose for which they are to be used. For lining steel furnaces, a burning temperature of 1700° C. is desirable. For the distillation of oil, on the contrary, a much lower burning temperature will suffice, and the bricks may contain twice the metallic oxides mentioned above.

The formation of the network is the most delicate part of the manufacture of silica bricks. It requires a prolonged heating at about 1450° C. for several days, the rate of formation being most rapid when the grains of quartz in the brick are extremely minute. A sufficiency of larger grains must be present, however, in order to prevent the formation of the minute fissures which are produced when the material is composed wholly of fine grains.

When the bricks in use are heated rapidly to the temperature at which any unconverted quartz grains are inverted, the expansion which accompanies this change of form breaks the network and lessens the strength of the bricks. Moreover, the pressure of the brickwork in an arch opposes any lateral expansion and produces spalling, which is one of the worst defects of badly made silica bricks. In a well-burned brick, an expansion also occurs at the moment when larger grains of quartz are inverted to cristobalite, but its effect is less serious, as these grains are able to expand in all directions, and it occurs sufficiently slowly for the network to be reformed at the point where it has been damaged. Nevertheless, this phenomenon notably reduces the strength of the bricks. The results of determinations of the sulphate equivalent of the oxides, true and apparent sp.gr., and the crushing strength at 1600° C. after 60 re-heatings showed clearly that good silica bricks, after heating for one hour at 1600° C., have a crushing strength of at least 10 kg. per sq.cm. A prolongation of the heating at this temperature reduces the crushing strength of well-fired bricks, but increases that of underburned ones.

Precipitation of Gold with Charcoal from Cyanide Solutions*

Precipitation of gold-bearing cyanide solutions by means of powdered charcoal was adopted at the Yuanmi mine, Yuanmi, Western Australia, after exhaustive laboratory experiments. The best results were obtained from charcoal recovered from the water seal of a down-draught gas-producer at the mine, in which local mulga was used as fuel. This charcoal was a waste product. The precipitating agent in the charcoal was occluded gas. Quenching while red hot produced the best results. The charcoal was washed free of ash and the clean product crushed to a degree of fineness to be determined by comparative precipitation tests; all must pass through a 150-mesh screen (I.M.M. standard). Experiments showed that wet-crushed charcoal has five times the precipitating power of dry-crushed charcoal, and the finer particles have a greater efficiency than the coarser particles, even of 150-mesh product.

The charcoal sludge was fed by means of a centrifugal pump into three Moore-Edmands precipitation units equipped with filter frames of the vacuum type, spaced 4 in. centers; the agitation of cyanide solution, which gravitated to the units, and of the charcoal sludge, was effected by propellers attached to a spindle revolving in the lower portion of the precipitation unit at 190 r.p.m. The units were charged with about 300 lb. of charcoal sludge (dry weight). Before cake forming was started, the pulp was thoroughly agitated. To prevent channeling while the process was going on, the vacuum was periodically shut off, the cakes were dropped, and the sludge was thoroughly agitated.

The capacity of charcoal to precipitate gold soon decreases. The process was therefore carried on in two or more stages. The cyanide solution drawn off from the first unit was delivered by the vacuum pump to a storage tank, whence it flowed to the second precipitation unit, and so on. When the charcoal in the first unit lost its power for rapid precipitation, the charcoal in the second unit was still little impaired. The flow of solutions was then reversed, and the maximum precipitating power from a given quantity of charcoal obtained. The amount of gold precipitated per ton (2000 lb.) of mulga charcoal averaged about 770 ounces.

When the precipitating power of the charge in the units neared exhaustion, as indicated by assay, the plant was cleaned up. A charge lasted from 10 to 20 days, according to the amount of gold in the solutions. Precipitation was not directly proportional to value of solutions, but rich solutions more speedily exhausted the power to precipitate rapidly. To clean up, the vacuum was released and the cakes were dropped and emulsified by the propellers. The sludge was run into a concrete tank beneath the units and the moisture removed in a clean-up press of the ordinary type. While damp enough still to be adhesive, the precipitate was placed in lumps in braziers constructed of strong wire screening, 1/4-in. aperture, and burned to an ash, a process which took about a day and a half and was carried out in a lock-fast chamber. There was practically no loss by dusting or volatilization. The ash remaining to be

smelted amounted to about one-third of the weight of charcoal fed into the units. There was no trouble in smelting the ash with the usual fluxes, and the wear on crucibles was much less than from zinc precipitate. The smelted gold, without refining, was remarkably pure.

British Mineral Production

The statistical report for 1916 has just been issued by the British Home Office. The mineral and metal output from mines and quarries is presented in the following tables, which give the 1916 and 1915 production:

MINERAL PRODUCTION, UNITED KINGDOM

Mineral	1915	1916
	Long Tons	Long Tons
Alum shale	7,911	6,261
Antimony ore	2 1/2
Arsenical pyrites	421	300
Arsenic	2,496	2,545
Barium compounds	62,477	76,034
Bauxite	11,723	10,329
Bog ore	1,986	1,095
Chalk	3,233,897	2,786,321
Chert, flint, etc.	102,698	50,592
Clay and shale	8,871,821	6,500,388
Coal	253,206,081	256,375,366
Copper ore	579	787
Copper precipitate	243	241
Fluorspar	33,123	54,731
Gold ore	5,086	1,338
Gravel and sand	2,350,267	1,961,650
Gypsum	247,229	219,284
Igneous rocks	6,085,415	4,843,176
Iron ore	14,235,012 (a)	13,494,658 (b)
Iron pyrites	10,535	10,481
Lead ore	20,744	17,107
Lignite	1,783	500
Limestone (other than chalk)	11,115,909	10,541,573
Manganese ore	4,640	5,140
Natural gas	87,000 (c)	85,000 (c)
Ocher, umber, etc.	8,989	10,159
Oil shale	2,998,652	3,009,232
Salt	2,005,605	1,960,448
Sandstone	2,520,856	1,999,308
Slate	226,037	176,827
Soapstone	850	301
Sulphate of strontia	640	2,513
Tin ore (dressed)	8,144	7,892
Tungsten ores	331	394
Uranium ore	82	51
Zinc ore	12,057	8,476

METALS OBTAINED FROM UNITED KINGDOM ORES

Metal	1915	1916
	(d)	(d)
Aluminum	(d)	(d)
Antimony	4 (e)	(e)
Copper, tons	234 1/2	278
Gold (bar), oz.	1,256	273
Iron, tons	4,567,351	4,319,096
Lead, tons	15,520	12,573
Silver, oz.	96,448	86,485
Sodium	(d)	(d)
Tin, tons	4,968	4,697
Zinc, tons	4,096	3,000

(a) Exclusive of 312 tons of micaceous iron ore, used for paint, and placed under the heading "Ocher, Umber, etc." (b) Exclusive of 302 tons of micaceous iron ore, used for paint, and placed under the heading "Ocher, Umber, etc." (c) Cubic feet. (d) Information not supplied. (e) Contained in antimony ore and lead ore.

German Oil-Saving Rules

These methods of saving lubricating oils are posted in the machine shops of Germany:

Use only closed oil cans, with spouts that will deliver drops, or at most only a thin stream.

Use all lubricating apparatus strictly according to instructions and put the oil only where it will actually lubricate. If a machine has automatic droppers, shut off the supply while machine is standing.

Do not use cylinder oil on shafting or elsewhere when cheaper oil will answer.

Keep all rubbing surfaces in good condition. Rough surfaces and too tight boxes consume more oil. Worn and leaky bearings waste oil.

Always use drip pans, and arrange to filter and cleanse the oil so caught. It is as good as new.

Collect all greasy waste and wiping cloths, so that the oil may be recovered. Never burn them.

Be careful about using lubricating oil for cooling a bearing. Water will often do as well.

Be careful about using oil for cleaning and polishing. Never clean the hands with oil. A greasy cloth will do as well.

*Excerpted from a paper by H. G. Walton, Report of the Department of Mines, Western Australia, for year 1916.

The Slogan

By
Berton Braley

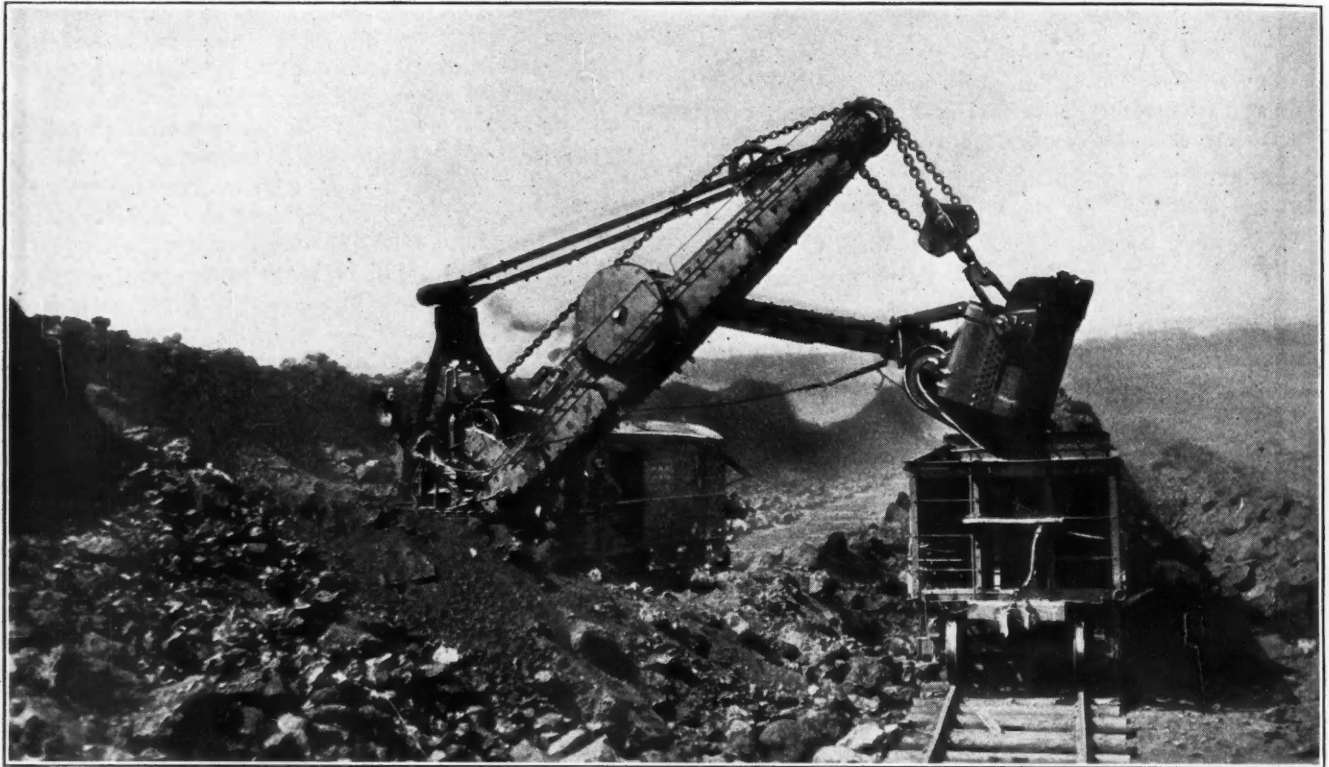
WE'VE made the motto of "Safety First"
A sort of a universal phrase,
And mine and shop are no longer curst
With the carelessness of the olden days.
It isn't a warning we should forget,
But, till our menacing foe's dispersed,
The motto we need is finer yet:
We shout the slogan of "Country First!"

WE'RE all in service: the boys in line
"Out there somewhere" in a muddy trench;
The mucker down in the deepest mine,
The workman, toiling at lathe and bench;
The shaftman, riding the rattling cage,
The clerk, in letters and bills immersed—
Each has his part in the war we wage,
And each must think of his Country First.

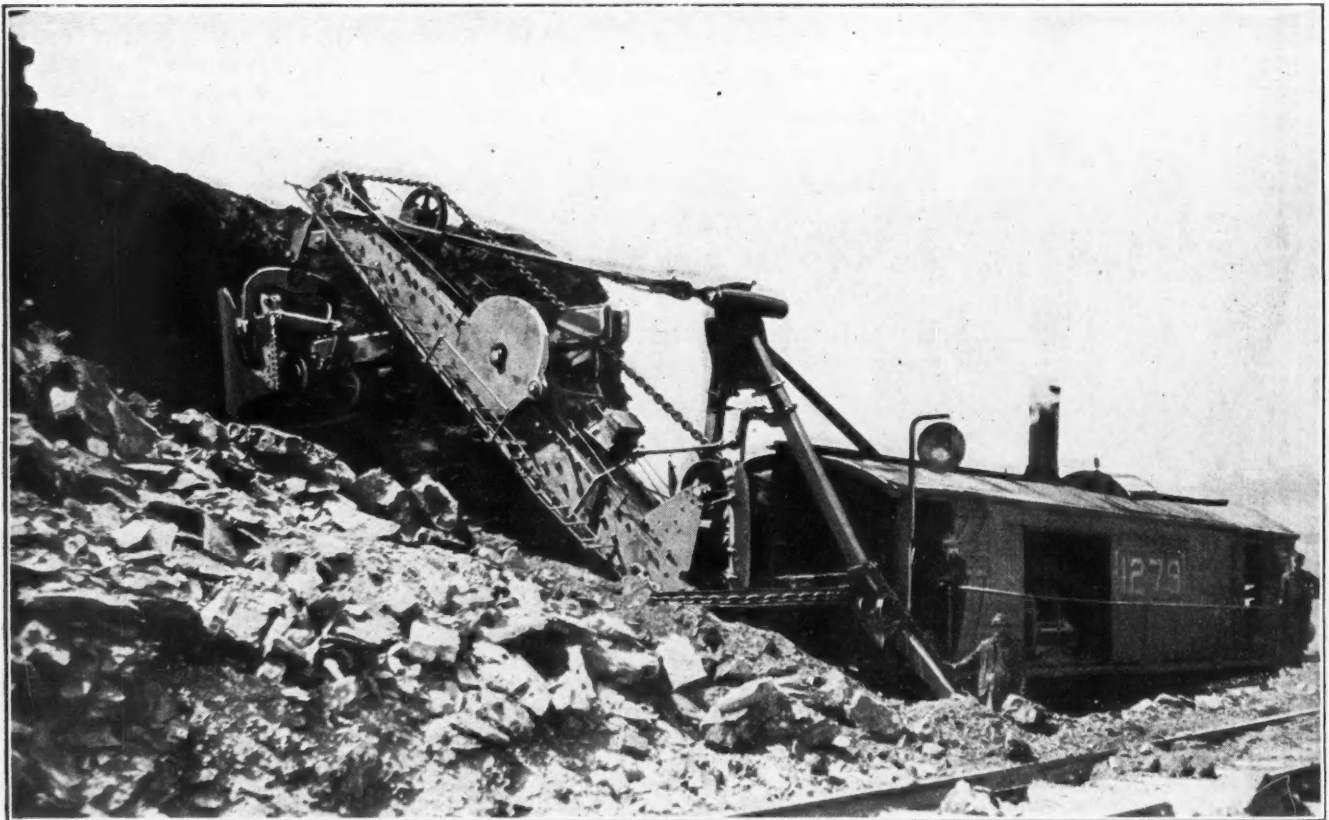
SO we won't be judged by the dividends
That the mine may pay, but the work we do,
And the part we take till the conflict ends,
And the fight for justice and truth is through.
Miner and manager, smelterman,
Whatever the task in which we're versed,
We'll do our bit if we only plan
And sweat and labor for Country First.

LET old-time enmities be forgot,
Let ancient standards be cast aside—
The test is whether we win or not
And whether the things we love abide.
For cash and profit are naught today;
We fight a foeman malign, accurst,
And selfish purposes fade away
Before this slogan of "Country First!"

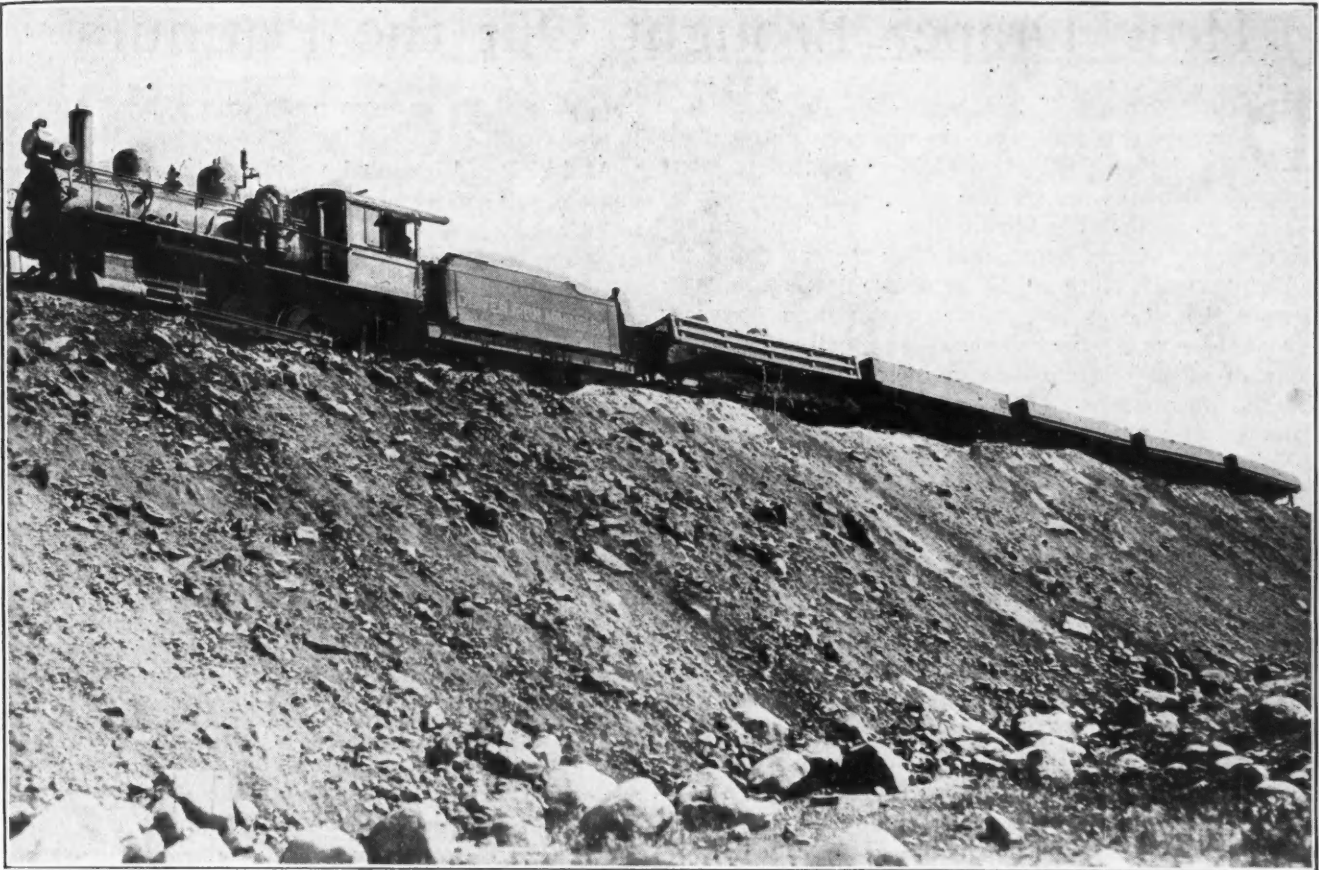
Steam-Shovel Operations on the Mesabi



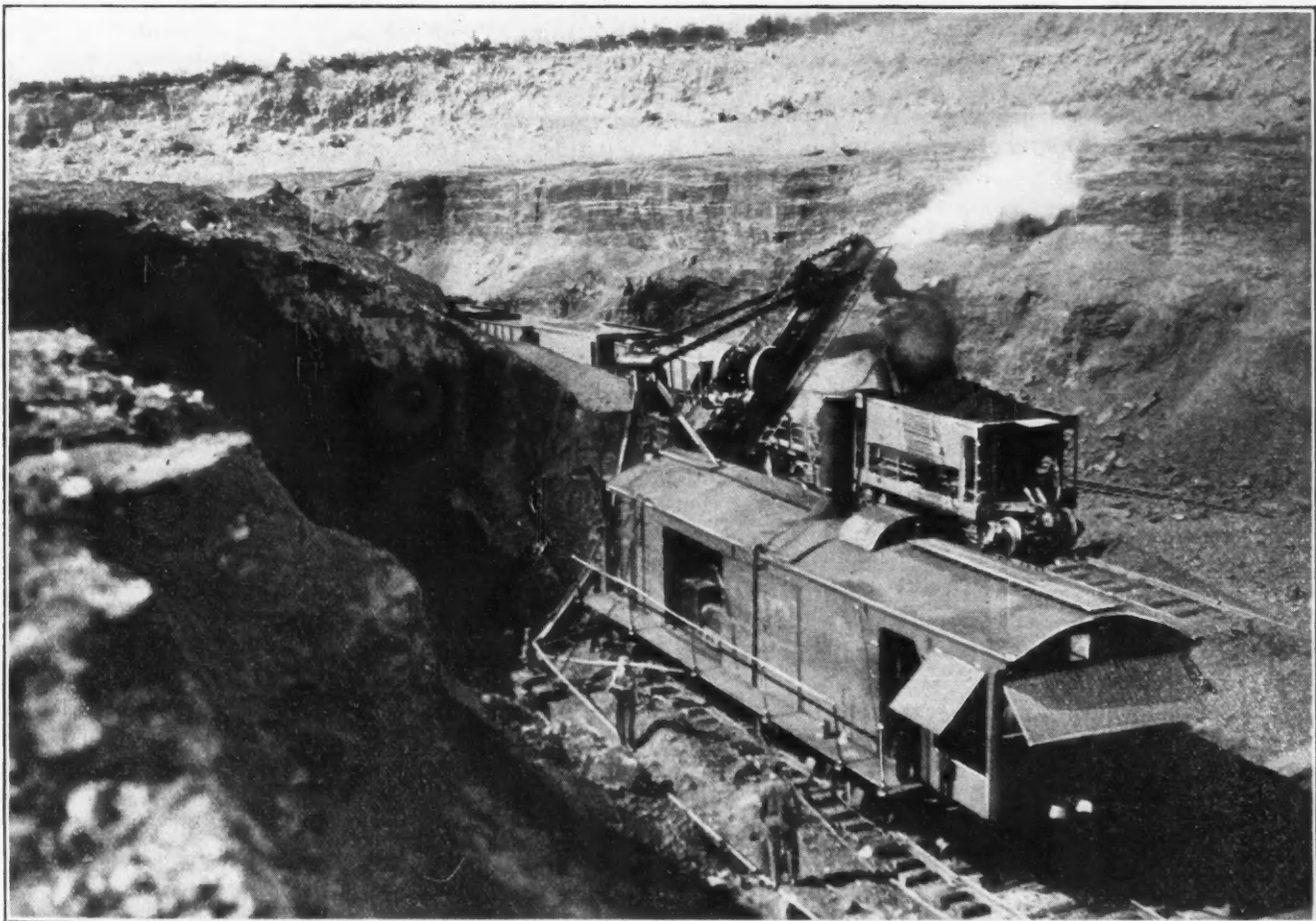
MODEL 91S SHOVEL LOADING ORE



MODEL 91S SHOVEL LOADING BROKEN TACONITE AND ORE



A TRAIN OF 20-CU.YD. AUTOMATIC DUMPING STRIPPING CARS ON 30-FT. DUMP



MODEL 91 SHOVEL LOADING ORE. NOTE CREST OF PIT IN BACKGROUND

How Draper Brought Out the Platinum*

DURING the time just before the United States entered this war, when we who were abroad had got rather tired of making excuses as to why America didn't go in, we felt so sure that she would after a while that Lieutenant Stines, a fellow mining engineer in Russia, determined that he was going to collect as much platinum as he could, because he was certain that it was going to be required in America one of these days. He also knew—as we all knew—that German agents were obtaining much platinum from Russia, and were putting it to a use to which we were conscientious objectors. Lieutenant Stines happened to be connected with large banking interests in Petrograd which were able to finance this undertaking, and they said, "Well, go ahead and collect all the platinum you can."

A good deal of this platinum had to be collected in small lots, as well as in competition with the German agents, and there was more or less difficulty and some danger attached to that, but an amount was collected and deposited in Petrograd, worth about \$2,100,000. To give you some idea of the amount that I had chained to my wrist, let me say that when it was boxed and ready for shipment it weighed 1965 pounds.

Well, when we had this platinum in Petrograd, the question came up of getting it over here. Lieutenant Stines approached the American Express Co., which had recently appointed an agent in Russia, and suggested that it undertake to deliver this platinum in America. That was a little more than the agent wanted to undertake on his own responsibility, so he telegraphed to New York and got the reply that under no circumstances would it be touched at all. As I happened to be connected as consulting engineer to some of the people interested, when I drifted into Petrograd in a peaceful frame of mind they informed me that I was going to take it out. I won't repeat exactly what I said at first, but in the end said, "Well, I suppose I am, then," but I added, "You will have to do exactly as I want and make exactly the arrangements that I desire," because I knew that Russia was full of German agents who would not hesitate as to any means in accomplishing their ends.

That was one factor. The second factor was that, where the Trans-Siberian R.R. passes through Manchuria, there were certain tribes of Manchurian bandits which, if they had known that this material was coming through, wouldn't have hesitated to hold up the train, or to hold up all trains that came through, until they found the right one; and as at the time there was no police security anywhere, and no authority, these bandits would have been quite fearless. I didn't, however, worry much about that, because I was sure that any telegrams which might be sent from Petrograd regarding my departure would get to their destination long after my train had passed; telegrams in Russia usually went by mail, and the mail trains are slower than the Siberian express. But anyway, I said, "Put the platinum in boxes that are so big that one man

couldn't pick up and run away with a box." It was in nine boxes, each weighing, on an average, 215 pounds.

At first I said I wanted a private car on the Siberian express so that no one could get in at all, and then after thinking about it, I said, "No, that would draw attention to myself. I don't want to draw attention at all; I want to go along as if I didn't have anything of special value." So, the embassy was asked to get three adjoining compartments on the Siberian express, which it did.

The shipment of the platinum had been arranged through the Department of Commerce, and it was understood before I left that it would be placed at the disposal of the U. S. Government, either in part or all of it, as the Government might elect. Consequently, it was sealed in Petrograd with the embassy seals on the outside of the boxes, and I was provided with a courier's letter and some envelopes for delivery in Tokio. That was necessary in order to avoid the inquisitive custom officials who might want to know what was in the boxes and might take samples of the platinum; and if they had taken samples it is doubtful what would have been left after they had got through. Having the boxes sealed by the embassy, and with the courier's letter, I was pretty sure that I could bluff them out.

The train leaves Petrograd at 8 o'clock in the evening, and at about half past 6 we loaded the boxes on a dray at the bank and went down through the Nevsky with them, with the bank's porters to carry them on board the train. When we got down to the station, which was more or less congested, because there were big crowds on the platform due to the fact that a train carrying all classes of passengers leaves on the adjoining track for Archangel, there were soldiers, peasants and every other class. We got the platinum on a truck and carried it down the platform, but the porter of the car at once said, "You can't take it in there." I replied, "We have got to take this, it is embassy stuff." He repeated that I couldn't have it in the car; but after six years' experience I knew more or less what to do—it is only a question of how much, that is all. I decided how much he needed, and fortunately my guess was right. Anyway, there was no more difficulty about putting it in the car. It had been arranged that the cashier of the bank should go along with me, and we two decided that we wouldn't overdo our precautions and that we wouldn't even keep the compartment doors closed all the time, though of course we didn't both go away at the same time. One of us went to the restaurant car first and the other went when the first had finished.

Well, we left Petrograd all right and everything was peaceful until we got to Vologda, which is a station about 15 hours from Petrograd. There trouble with the returning soldiers began. You see, the Russian idea of freedom, especially the soldier's, is that any accommodations that anybody else has got he is quite free to take. We were unfortunate when we came into Vologda in that there was a troop train of demobilized soldiers, a great many of whom were going to Siberia. They decided that the express would be much better and very much more comfortable to travel on than the freight

*An account by F. W. Draper at a session of the Mining and Metallurgical Society of America, published in Bull. 116, Jan. 31, 1918, M. M. S. A.

cars which they were using, and so they were going to take it and pack everybody out. Well, there was a long argument about it, and I think that the station master didn't know for a few minutes whether he was going to have a funeral next day or what. Finally, all but about 50 of them were pacified and got out of the way; of these, about 25 or 30 climbed on to the roofs of the cars and the rest of them got on the platforms and in the corridors. But they were more or less peaceful and, a little way down the line, most of them got off. Then, as we went along further we passed troop trains two or three times. Special trains are allotted to the soldiers, and as even then there were so many difficulties due to their crowding on to the passenger trains, the schedule was arranged in this way: Special trains for soldiers were run ahead of the regular passenger trains and the passenger trains never attempted to pass troop trains, because the soldiers would all get off and pile on to the passenger train if this were done.

Our express caught up to a troop train twice, and the soldiers stopped us, as they were short of engines. It would never do for the bourgeoisie to go ahead of soldiers, they argued, and so they would have to take our engine and go ahead. I didn't care anything about that, if they would only stay out of our train so that we could remain. There was food in the dining car and we didn't care particularly about a little lost time.

Such little difficulties aside, we didn't encounter any trouble until we got to the frontier at Manchuria. There the customs men were very insistent, and said that they would have to see what was in my boxes. I showed them my letter with the seals on it, which was written both in English and in Russian, and succeeded in bluffing them off. One of them stated that his superior officer would demand from him a report, and I said I had embassy documents and that if he would apply to the embassy in Petrograd very likely they would tell him what the documents were. Going across the rest of the way to Vladivostok, I didn't find any difficulty. Now that it is all over, I don't see why I worried about it.

My instructions were that when I reached Vladivostok I would find shipping directions. When I reached Vladivostok I didn't find anything, but I deposited all the platinum in the bank and then began to wonder what I should do. Then, however, I got a telegram from Petrograd saying that evidently the telegram to the New York representatives hadn't been permitted to pass the censor and that I must repeat it. So, I had to leave the platinum in Vladivostok and go to Japan to telegraph to New York for instructions. It took eleven days to get a reply from New York to Yokohama. This, of course, was due only to war conditions and because the cables were overcrowded with work. However, I finally got an answer, and my troubles began just when I thought they were all over.

I had figured it all out that I could go back to Vladivostok, get the platinum and take it over by a certain steamer, reaching Yokohama at a certain date, and from there ship it by express. I got it all fixed up and started for Vladivostok. When I got to Tsuruga, the Japanese port from which the boats leave for Vladivostok, the steamer of the Russian volunteer fleet was one day late in coming in. It seems that it had had a characteristic occurrence. One of the firemen had insulted a passen-

ger on the steamer and the third officer, hearing it, had reprimanded him, a thing which in these days of freedom is forbidden. The fireman promptly informed the officer of his opinion of him, and then it reached the captain and ended in more or less of a row. When the captain got back to Vladivostok he refused to take his steamer out unless this fireman was discharged. Well, the fireman put the case up to the Workmen's Council, and after debating the matter, the steamer meanwhile lying at the dock, the Workmen's Council decided that the fireman was to blame, and that he shouldn't have insulted the passenger, but that the officers were also to blame, in that they shouldn't have called this fellow down. Then, in order that there shouldn't be such an occurrence again, the council decided that it would appoint a committee to sail on the ship in order to keep the peace between the captain and the crew. Well, of course, the captain naturally said that he was either running the ship or he wasn't running the ship, and he wouldn't put to sea in that way. All this had delayed the boat, and when finally we got to Vladivostok we were about a day and a half late.

Well, I had three days to spare, and I thought things were still all right. The boat should have sailed again on Saturday night, but owing to the delay had not had time to load before Sunday noon, and therefore we made arrangements with the bank to get the platinum out on Sunday, which required the presence of the bank employees on a holiday. In these days of freedom they don't like to work. They never did, but they like it less now. They finally agreed to be on hand and we got the platinum down to the boat, which was to sail at 5 o'clock. The whistle was blown once and so I felt that it was now all right, and I could say good-bye to Russia. I waited, and when the second whistle didn't come, I began to get uneasy because I had the platinum in my stateroom with me; and when more time passed and still the steamer didn't leave, I made inquiries of the captain. "Well," he said, "the repairs aren't finished yet." It seems that the steamer had two feed pumps in the boiler room, but that one had been out of commission for three months and that the *tovarishi*, which is the Russian for workmen and corresponds with the word citizen as used in the French Revolution, hadn't been able, or more likely willing, to repair it, and now the other one had broken down and wouldn't take in water. However, the captain said, "We are going at 8 o'clock," and so I waited till 8 o'clock, becoming more and more uneasy because a great many people in Vladivostok knew that this platinum had arrived or was about to arrive. The telegrams to the consul with instructions to help us had leaked out from the telegraph office.

When 8 o'clock came and we didn't leave, it was said, "We are going at 10"; 10 o'clock came, and still no sign of departure. So I looked for the captain, and, not finding him, located the first officer, who said, "We are going at 11 o'clock." At 11 o'clock we didn't go. I was getting pretty nervous and pretty tired. I finally said to the first officer, "Well, what *are* you going to do?" He said, "I don't know, they haven't finished the repairs yet. I think, though, we will go about 12 o'clock." I then made up my mind that I was in for it and might as well lie down anyway; so I locked up the port holes

and the cabin door and went to sleep, and my worries apparently didn't affect me too much because I slept until 8 o'clock in the morning. When I awoke we were still tied to the dock, so I approached the captain again. "Well," he said, "the chief engineer will be up in a minute and he will tell us what we are going to do," and when the chief came up I said to him, "What are you going to do now?" He answered, "The repairs are all made now, and we will go out in a few minutes."

We started out about half an hour afterward, but when we got down the bay, about 20 miles, I guess, and were having lunch, I felt the boat stop. The captain got up from the table, went out and was gone perhaps five minutes, and came back, but didn't say anything. A few minutes later I happened to look out through a port hole and saw the land swinging around and I said, "What are we going to do now?" He replied, "We are going back, the feed pump don't work"; and we got back Monday night at 6 o'clock. I said to the captain, "Now, what are we going to do?" He said, "The manager will be here at 9 o'clock tomorrow morning. I guess he will tell us what the plans are." That is typically Russian. There was nothing therefore to do but to stay another night on board with the platinum.

The next morning at 9 o'clock I hunted up the manager, who stated that: "We have lost so much time now we might just as well wait and sail on schedule time, on Saturday." That is also typical. Thus, there was nothing to do but to employ Chinese carts and Chinese drivers, to again parade the streets of Vladivostok to the bank, and wait until the next Saturday.

Next Saturday we did a little better and got away all right, and as soon as we were over in Japan I didn't have to worry any more. I had made arrangements for a special car on the Japanese railways, in which to put the platinum. As usual, the Japanese reporters were on hand and wanted to know what the special car was for. But I was very non-committal, and as I didn't want to tell them anything, they looked upon me as a very suspicious character. When I arrived in Yokohama and had delivered the platinum to the American Express Company, the police began to investigate me and I discovered that there had been a detective watching my family for the last week. The Japanese are most efficient and they published a very nice little piece in the paper about me; it reads as follows:

"A suspicious-looking American, who poses as a Boston merchant, arrived at Tsuruga from Vladivostok on the morning of the 19th and came to Yokohama the next day. He is now registered at a hotel at Yamashita-cho. It is said in this connection that he has been staying in Russia since the outbreak of the war, at which time he went there from America on some important unknown business. The police of Yokohama failed to draw any information from the stranger, and are now keeping a watch on his movements. The American is expected to sail on the 'Empress of China' shortly."

That is about all there is to it. While the platinum was in Japan it was in the hands of the American Express Company, and it was quite a simple matter for me to come the rest of the way. But those little experiences in Russia are so typically Russian they will do to bear in mind, especially this idea, "We will sail next Saturday; what's the use of hurrying?"

Abbe Rene Just Haüy Celebration

The 175th anniversary of the birth of Abbé René Just Haüy, founder of the science of crystallography, was celebrated on the evening of Feb. 28 at the American Museum of Natural History, in New York. The meeting was held under the auspices of the Museum, in cooperation with the New York Academy of Sciences, Section E of the American Association for the Advancement of Science, the New York Mineralogical Club and other institutions. A paper on the life and work of Abbé Haüy, written by the late Louis Pope Gratacap, former curator of mineralogy at the Museum, was read by the secretary of the celebration committee, Herbert P. Whitlock.

Abbé Haüy was born in 1743 in a small village in France and was educated at the Abbey St. Just. It was through his friendship with Dauberton, the mineralogist, that he became interested in the study of crystals, which resulted in his discovery of the principle upon which crystallography is based. He was admitted to the Academy of Sciences, in Paris, in 1783.

George Frederick Kunz, president of the New York Mineralogical Club, was the chairman of the celebration committee. Among those who spoke at the meeting were Robert A. A. Johnston, of the Geological Survey of Canada; Volney Lewis, of the State University of New Jersey, and Alexander N. Phillips, of Princeton University. Letters were read from Henry S. Washington, of the Geophysical Laboratory, Washington, D. C.; Edward S. Dana, of Yale University, and Frank D. Adams, of McGill University, Montreal. Dr. Albert Lacroix, Professor of Mineralogy at the Paris Museum of Natural History, who is now occupying the chair of Abbé Haüy, was the honorary chairman of the celebration committee.

An exhibition of books, portraits and other memorabilia was shown in special cases in the Mineralogical Hall of the Museum. A collection of books, prints and photographs was assembled for the celebration in the Stuart Gallery of the New York Public Library and also at the New York State Library at Albany.

Norway's Raw-Material Department

A new department of the Norwegian government has been established, called the Department of Industrial Supply. It has a separate cabinet minister, and the activities of the new department, according to the *New York Tribune*, will comprise providing for and properly distributing raw materials for Norwegian industries. Special attention will be given to developing the natural resources of the country; for example, utilizing native ores of iron, copper and nickel, turning the ore into metal and working the metal into merchantable condition. This plant not only will enable the existing industries to operate and furnish products for home consumption, but will solve the problem of unemployment. A large staff of experts is employed in the new department making careful, technical studies of the natural resources of the country and the ways in which these may be developed by native talent, so that the country will require the least possible amount of imported goods and may be in a position to meet the abnormal industrial situation.

Canadian Mining Institute Meeting

THE 20th annual convention of the Canadian Mining Institute met at the Windsor Hotel, Montreal, on Mar. 6 to 8, and proved one of the most successful gatherings in the history of the organization, in view of the importance of the subjects discussed. The tone of the proceedings throughout indicated that the participants realized that the country is facing a serious crisis in industrial development owing to problems created by the war. On the first day the report of the council for 1917 showed that the affairs of the institute were in a satisfactory condition. The total membership at the close of the year was 1118, as compared with 1066 on Dec. 31, 1916. The total number of members now in military service is 125. Eleven members have been killed. A large proportion of those with the colors have won military decorations for distinguished service. The treasurer reported a balance of \$1990.

LITTLE CHANGE IN TOTAL METAL OUTPUT

Dr. John McLeish, in presenting the preliminary report on the mineral production of Canada during 1917, showing a total value of \$192,982,837, as compared with \$177,201,534 in 1916, stated that the greater part of this increase was due to increased values and did not represent a growth in the volume of output. The metallic production, in fact, was almost stationary. A preliminary report was presented by T. W. Gibson on the mineral production of Ontario, showing a total value of \$56,845,788, as compared with \$55,002,918 in 1916. Though the value was greater, there was a decrease in tonnage. The falling off in gold production from \$10,339,259 to \$8,698,831 was due to the scarcity of labor and the high cost of materials. Theodore C. Denis, superintendent of mines for Quebec, pointed out the growing importance of the asbestos industry and the urgent need of adopting a system of uniform grading in place of the present confusing classification.

President A. A. Cole's annual address dealt largely with the industrial situation created by the war and problems of reconstruction. He said that Canadians had a great constructive task before them, and that the appeal for preparedness was specially applicable to the institute as representing the basic industry responsible for supplying raw materials. He gave figures showing that in 1915 one-ninth of the total of 2,723,000 wage-earners of Canada were employed in mining and dependent industries, and that, in the same year, of the tonnage supplied to railways 37% was products of mines. President Cole declared the first need to be an inventory of natural resources, to find out wherein the country was deficient, following which the known resources should be developed and deficiencies remedied as far as possible. The address dealt at some length with the great expansion of the iron and steel and other metallic industries. The president of the institute condemned the proposal to discontinue gold mining during the war, pointing out that gold was needed to liquidate any adverse trade balance and to provide a gold reserve to maintain the national credit. He urged that the Canadian Department of Mines should be strengthened and placed under a Minister charged solely with its work and giving it undivided attention, and

that its scope be extended to allow it to study markets closely in cooperation with the Trade and Commerce Department.

The business success of Germany, Mr. Cole said, was largely due to the Cartel system, a combination fostered by the government to help producers market their output. He deprecated as a retrograde step the movement on the part of some to combine all engineers in a single society irrespective of the branch to which they belonged. Discussing the war work accomplished by members, he mentioned particularly the training of disabled soldiers for useful occupations, some of the results obtained being little short of marvelous.

An interesting discussion followed the president's address, several speakers pointing out that mining engineers did not occupy positions among leaders in public life to which their knowledge and experience entitled them. Dr. Goodwin, of Queen's University, Kingston, suggested that the institute should take the initiative in effecting a confederation of the various technical societies. Dr. Balmer Neilly, of Cobalt, referring to the statement that 37% of the railway freight carried was furnished by the mines, said that when an increase of freight rates was proposed the grain growers, lumbermen and others protested vigorously, but the mining interests were silent. Dr. A. W. G. Wilson, of Ottawa, said there were no engineers or men of technical training in the government or in Parliament. Engineers had held aloof from their duties as citizens, he declared. They did not organize, take part in politics or combine to secure recognition. He urged the organization of a central technical committee by the institute in connection with other societies.

GOVERNMENT SUPERVISION OF BASIC INDUSTRIES URGED

A paper on "The Stimulation of the Mining Industry After the War," was read by Dr. A. W. G. Wilson, who covered a wide field, his most noteworthy suggestion being that it is desirable to consider some measure of government control in connection with basic industries, particularly those whose product must be diverted to meet munition requirements. He favored legislation to prevent exporting raw material that could be manufactured in the country, codification of mining laws, legislation to prevent fraudulent advertising and wildcatting, and measures to provide enlarged markets abroad. Dr. Alfred Stansfield favored the creation of a "Board of Energy" to control the distribution of electric power. Dr. Willet G. Miller, of Toronto, thought there were altogether too many laws and regulations interfering with individualism. John A. Dresser, of Ottawa, considered that prospecting depended altogether on whether conditions appealed to the individual prospector, and did not think that much could be done to encourage it. Dr. Porter, of McGill University, advocated provincial legislation to restrict coal waste by operators.

A resolution was moved by Dr. Goodwin and seconded by R. H. Stewart "that in the opinion of the Canadian Mining Institute the time has come for the organization of the technical and industrial societies in such a way as to enable them to take joint action in the

interest of Canadian industries, and that the subject be premitted by this meeting to the Council of the Institute for consideration and for such action as shall promote the organization referred to." The resolution was adopted. It was announced by the president that to commemorate the 20th anniversary of the institute, the first president, John E. Hardman, and the first treasurer, J. Stevenson Brown, would be made life members.

Col. David Carnegie, of the Imperial Munitions Board, Ottawa, presented a paper entitled "Some Problems in the Reconstruction of Industry" embodying a detailed and radical proposition for abolishing the present competitive system and harmonizing the interests of capital and labor. It involves the formation of national and district trade boards representing buyers and manufacturers, to carry on business on behalf of the industry represented and to place government or other orders. It also called for the organization of district production boards representing both employers and employed, acting under government authority, to deal with the questions of maintaining the output and with the conditions of labor.

C. V. Corless, of Sudbury, followed with a paper dealing with the same question, entitled "The Whitley Scheme," treating of what is being done in England in the way of democratizing industry and bringing about cooperation between labor and capital. It is recommended in the report of what is known as the Whitley Committee, a subcommittee of the recently created Reconstruction Department, that an industrial council be established in every organized trade, representing both employers and work people, for the consideration of matters affecting the trade from the view point of all engaged in it. The scheme is approved both by organization of employers and the Trade Union Congress and is likely to succeed. Mr. Corless urged that the full application of the principle of democracy to industry would prove the most successful experiment in increasing efficiency yet tried. There was nothing unreasonable in the demand that all the conditions of the cooperation of labor and capital in industry should meet with the approval of both parties, he declared.

In the discussion which followed, Professor Dale, of McGill University, said that the coming of industrial democracy in Great Britain was due to the advance of education. G. J. Mackay, of Toronto, urged that vocational and technical training should be encouraged by liberal government grants. Dr. Goodwin said that the return from Europe of 300,000 soldiers who had had a training in intelligent cooperation would be a powerful factor in the movement.

A resolution moved by President Cole was adopted to the effect that as antagonism in the relations of capital and labor is due to economic misunderstandings, the Institute endorsed the general position set forward by the paper of Mr. Corless on the necessity of educational reform and instructed the secretary to forward copies to industrial associations so that joint action might be taken in bringing the matter before the educational authorities.

The principal feature of the evening session was an interesting illustrated lecture by W. A. Carlyle on the Rio Tinto mines of Spain. A paper was read by F. H. Sexton on "The Vocational Re-education of Soldiers

from the Mining Industry," which was well received.

At the morning session of the second day, a series of papers dealing with fuel were presented, the first being an account by Edgar Stansfield, of Ottawa, of the work carried on at the fuel-testing station at Ottawa, from which important results in finding substitutes for anthracite were expected. Other papers were: "Fuel Economics," D. B. Dowling, Ottawa; "Anthracite Situation in the United States," Eli T. Conner, Scranton, Penn.; "Waste in Coal Mining," W. J. Dick, Ottawa; and "Possible Contributions of the Cottrell Process to the Fuel Problem," by Dr. J. G. Davidson.

Discussion of the above papers occupied most of the afternoon. G. G. S. Lindsey, of Toronto, stated that he did not think the briquetting of lignites feasible. The economic practicability of manufacturing them, however, was warmly championed by Mr. Dick, Dr. Adams, of McGill University; Dr. Porter and Dr. A. B. McCallum, chairman of the Commission of Industrial and Scientific Research. Dr. Adams stated that the government had spent \$40,000 on a briquetting plant at Estevan, Sask., where it had been demonstrated that two tons of lignite would produce one ton of briquettes. Several of the speakers favored the prohibition of the importation of American anthracite and the more extensive use of Canadian bituminous coal.

A paper on the Groch system of centrifugal flotation by W. E. Simpson and Frederick Groch was read by Mr. Simpson. R. C. Canby presented a paper entitled "Comparison of Points in Flotation, the Moore Filter and Cyaniding Cases," reviewing the judicial decisions in American courts affecting the Minerals Separation Co.'s claims. He contended that a study of these cases show that equity was on the side of the Cobalt mining companies in their resistance to the demands of the Minerals Separation company. Another paper on flotation work at the Highland Valley Mines, in British Columbia, was presented by Frederick Keffer.

In the evening an informal smoker was held, at which Col. C. N. Monsarrat gave an illustrated lecture on the Quebec bridge. W. T. Donnelly, of the U. S. Shipping Protection Commission, described the unsinkable ship invented by himself.

The most important feature of the proceedings on the third day was a paper read by G. M. Colvocoresses on the "Manufacture of Nickel-Copper-Alloy Steel" ("Nico Steel"). The process of its manufacture, he said, was very simple, the treatment of the ore being based upon the assumption that the Sudbury ores are primarily iron ores rather than nickel-copper ores, and that the ternary alloy formed by nature in these ores is a valuable one for conversion into economical use. The Nico steel is a modified natural alloy, the main objection to natural alloys being removed by so mixing the ores as to secure a practically uniform composition.

Other papers presented were one on "Secondary Enrichment in Relation to the Water Level" by L. C. Graton, and "Production and Uses of Stellite" by S. B. Wright. In the afternoon a visit was made to the plant of the Armstrong Whitworth company at Longueuil, where electric steel furnaces were seen in operation. The convention closed with the annual banquet in the evening at the Windsor Hotel.

Details of Practical Mining

Mechanical Efficiency of Gravel Pumps*

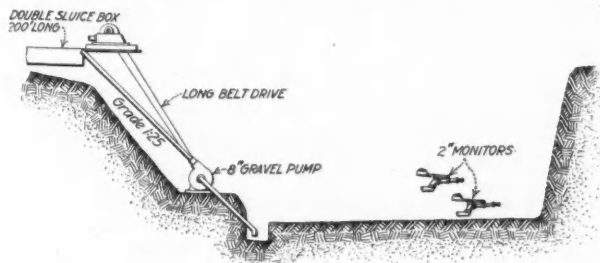
The arrangement of a gravel-pumping plant at the Heawood tin mine, in the Federated Malay States, is depicted in the sketch printed herewith. Pipes supplying monitors and wheel are not shown. The plant consists of two monitors and an 8-in. gravel pump, which is driven with a long belt by a Pelton wheel. The material is elevated into a two-compartment sluice box. The Pelton wheel is above the sluice box, and the discharge water is used for "cleaning up" (the boxes are "streamed" down on separate days), and also to assist in the sluicing when the two compartments are running at the same time.

Pelton wheel—Size of wheel, 24 in.; nozzle, controlled by needle valve, maximum size, 1½ in.

Effective head—The gage pressure was 220 lb. per sq.in., the nozzle being 6 ft. 6 in. above the gage.

Effective head = 508 — 6 ft. 6 in. = 501.5: say, 500 ft.

Quantity of water used—Measurements were taken at a rectangular weir, 20 in. wide, at the discharge of



GRAVEL PUMPING PLANT AT HEADWOOD TIN MINE

the wheel. Depth of water flowing over weir = 5½ in. Quantity of water (from tables) = 4.67 × 20 = 93.40 cu.ft. per min.

$$\begin{aligned} \text{Theoretical hp.} &= \frac{\text{weight of water (lb.)} \times \text{effective head (ft.)}}{33,000} \\ &= \frac{93.40 \times 62.5 \times 500}{33,000} = 88.44 \end{aligned}$$

The gravel pump lifts the water and solids from two 2-in. monitors at 65-lb. pressure and also 20 cu.ft. per min. of seepage water.

Monitors—Nozzles, 2-2 in.; pressures, each 65 lb. per sq.in.; effective head, 150 ft.; discharge, 2 × 120.9 = 241.8 cu.ft. per min.; seepage, 20 cu.ft. per min.; total water raised, 261.8 cu.ft. per min.; yardage cut (by monthly survey), 18000.0 cu.yd.

The ground treated is a soft clay soil containing about 50% sand; 9.67 cu.ft. of water per min. are required to break down 1 cu.yd. of ground per hour.

Gravel pump—Size, 8 in.; speed, 482 r.p.m. *H* = height lifted in feet, 45.7 ft.; *G* = cu.yd. per hour (solids), 25.0 cu.yd.; *S* = cu.ft. per min. (solids), 55.5 cu.ft.; *W* = cu.ft. per min. of water lifted (2-2 in.

monitors at 65 lb. + 20 cu.ft. seepage = 120.9 × 2 + 20), 261.8 cu.ft.; *T* = theoretical hp. (Pelton wheel 93.40 cu.ft. per min. at 500 ft. (effective head), 88.44 hp.

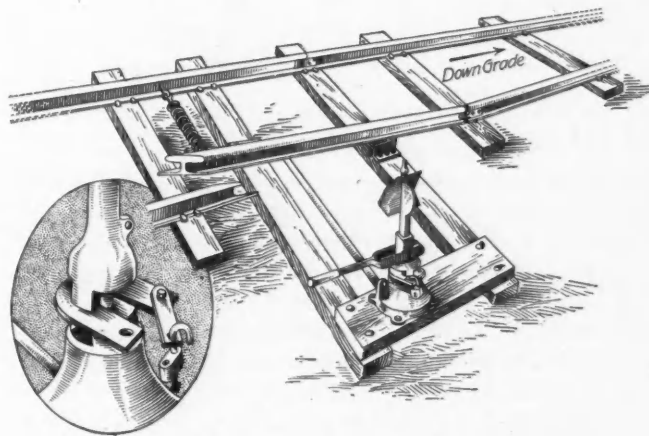
$$\begin{aligned} \text{Overall efficiency of plant} &= \frac{\text{work done}}{\text{work applied}} = \frac{H(62.3W + 100S)}{T \times 33,000} \\ &= \frac{H(62.3W + 45G)}{T \times 33,000} \\ &= \frac{45.7(62.3 \times 261.8 + 45 \times 25)}{88.44 \times 33,000} \\ &= \frac{796,785.90}{2,918,520} = 0.2730 = 27.30\% \end{aligned}$$

Mechanical efficiency of gravel pump including long belt drive (efficiency of Pelton wheel estimated at 75%),

$$M.E. = \frac{27.30}{75} = 36.40\%$$

Derailing Switch for Mine Use

At one of the Mesabi range mines, where a drift enters the mine workings from the side of a hill, a safe and adequate derailing switch has been installed. Loaded cars come out from the mine on a grade and continue up a slope until the stockpile is reached. To prevent cars breaking away from the train and running down the grade into the main drift, it was necessary to provide a spring switch that would remain open at all times except when the loads were going out and



DERAILING SWITCH FOR MINE USE

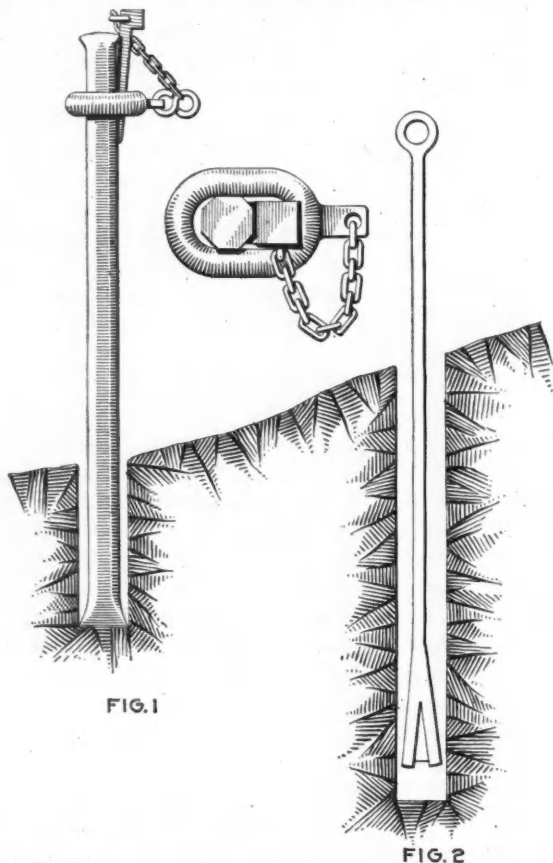
the empty cars coming back, and so arranged that the switch required attention only when the train was entering the main drift. This was done in the following manner and is shown in the sketch. The derail was attached to the opposite side of the track by means of a wire spring and also fastened to the switch rod. To prevent locking the switch stand, which would hold the derail permanently in place, a U-shaped plate, made of ½-in. sheet iron and provided with a strap and padlock, was placed underneath the locking device of the switch stand. By means of this U-plate, the bolt of the switch

*Excerpt from an article by T. R. A. Windeatt, in Bull. 56, I. M. M.

stand was prevented from dropping down into its socket and at all times, unless held shut by the brakeman of the train, the derail remained open.

Extracting Stuck or Broken Drills

Devices in use on the Rand for extracting stuck or broken drills are illustrated in the accompanying sketch. Fig. 1 shows a drill extractor for releasing a drill stuck in a hole and consists of a $\frac{3}{4}$ -in. oval steel collar and a steel wedge. The collar is placed over the offending

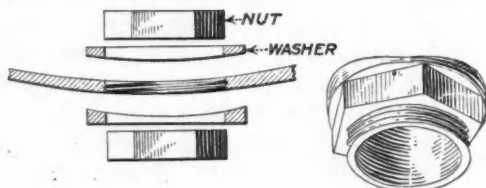


DEVICES TO EXTRACT STUCK OR BROKEN DRILLS
Fig. 1—Extractor for stuck drills. Fig. 2—Device for removing fragments of broken drills.

drill steel and the wedge driven in, and a few blows with a hammer on the bottom of the collar will generally release the drill. Fig. 2 illustrates a device for removing broken pieces of steel from a drill hole, and consists of a length of $\frac{3}{4}$ -in. round iron to which is welded a split saucepan handle. The device is forced over the end of the fragment in the hole and withdrawn.

Tightening Small-Pipe Connections

At a plant where it became necessary to make some additional small connections to steel tanks, the tanks were

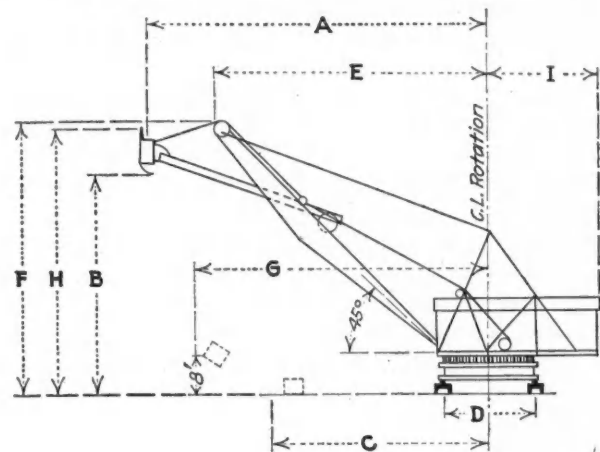


LOCKNUTS AND WASHERS OF TANK CONNECTIONS
tapped and threaded for 1-in. pipe connections, but no flanges or bosses were provided, so that some of the

connections leaked considerably. M. A. Saller in *Power* tells of stopping the leaks by the use of two locknuts and packing washers, as shown in the illustration. The washers were made of fairly hard packing and were flat on one side, while the other side was shaped to conform to the contour of the tank. The locknuts were then pulled up tight on each side, making an entirely satisfactory joint.

Working Dimensions of 300-Ton Revolving Shovel

The working dimensions of Bucyrus Model 225, 300-ton revolving shovel, now being used by the Oliver Iron



WORKING DIMENSIONS		
A	Dumping Radius	94'-6"
B	Height of Dump (Dipper Door open)	61'-0"
C	Level Floor Radius	59'-0"
D	Center to Center of Tracks	30'-0"
E	Radius of Boom	77'-0"
F	Height of Boom	76'-0"
G	Digging Radius at 8' Elevation	88'-0"
H	Height of Cut	72'-0"
I	Radius of Rear End	32'-0"
	Pitch of Boom	45°00'

WORKING DIMENSIONS OF 300-TON SHOVEL

Mining Co. and other concerns in removing the overburden from large orebodies on the Mesabi range of Minnesota, are shown in the diagram printed herewith.

Light for the Drafting Room

It often occurs that a room not originally intended for drafting purposes is used as such and it is also frequently situated on the wrong side of a building, causing annoyance and inconvenience on account of the direct rays of the afternoon sun falling upon the drafting table. This condition may be eliminated, without sacrificing any of the light, by tacking or pasting a single thickness of tracing paper over the offending window. The paper diffuses the light without detracting from its usefulness, and is easily and quickly applied.

Tailings from Zinc and Lead Concentrating Mills in Southwestern Missouri have been used extensively in road building in that section. These materials are spread on the road surface, where they are worked in by the traffic, making a serviceable road for light haulage.

Events and Economics of the War

The arrival of Secretary of War Baker in France, on a tour of military inspection and conference, has been announced. Major General Goethals, Edward R. Stettinius and Major General March have been added to the General Staff. New war honors have been instituted by the President, including a distinguished service cross, a distinguished service medal, war service chevrons and wound chevrons. The coal priority section of Fuel Administrator Garfield's "Monday closing" order, issued on Jan. 17, was suspended on Mar. 5, except in Pennsylvania, Maryland, West Virginia, Ohio and eastern Kentucky; a reduction of 30c. per ton in the price of anthracite, effective from March 1 to Sept. 1, has been ordered. The Senate passed the War Finance Corporation bill and adopted an amendment to the Urgent Deficiency bill to permit the Government to purchase outright all terminal facilities of the North German Lloyd and Hamburg American steamship lines in New York harbor. Senator La Follette was censured by the Wisconsin Legislature for obstructing the war. Sympathy of the United States for Russia was expressed by President Wilson in a message to the Congress of Soviets in Moscow.

Abroad, John Redmond, leader of the Irish Nationalists, died during the week. The British armed mercantile cruiser "Calgarian" was sunk, with a loss of 48 lives. It is reported that German troops have landed in Finland; that the Russians are moving their capital to Moscow; and that Rumania has signed a treaty of peace. Naples was bombed by Teuton aviators. American troops made three raids on the German lines in the Lorraine sector.

Requa Summarizes Oil Situation

After a three days' conference with representatives of the oil industry of the United States, Mark L. Requa, director of the oil division of the Federal Fuel Administration, announced that there was at the present time no expectation that the Government would take over the operation of the oil fields. Mr. Requa pointed out that there was no shortage of petroleum for immediate needs, but rather a lack of transportation facilities. He also pointed out that there was no reason for cutting off the supply of gasoline for pleasure vehicles, as gasoline was simply a byproduct of crude oil.

A reference to "pooling" all interests in the oil industry to win the war was summarized in the statement as follows:

"It is obvious that the oil facilities of the United States must be used in such a way as to produce the maximum benefit viewed from a national standpoint to meet the existing crisis.

"It has been demonstrated recently that it is impossible to take oil for any specific purpose without exerting a detrimental influence on some other branch of industry. The problem of what is least essential is an

extremely difficult one to determine, and I am somewhat of the opinion that the non-essential industry does not exist."

The priority list, the director said, was established for the reason that it was impossible because of transportation shortage to supply all consumers. When the supply is sufficient the priority list automatically ceases to operate. When a shortage does exist, Class 12, described officially as "all other classes," receives no oil until all lower numbered classes are supplied.

According to figures given out by Mr. Requa, total stocks of oil in the United States approximate 160,000,000 bbl., as of Jan. 1 last. Last year's production approximated 320,000,000 bbl., and there was a draft on stock of about 20,000,000 barrels.

Baruch Heads War Industries Board

The reorganization of the War Industries Board, under the chairmanship of Bernard M. Baruch, has been announced by President Wilson. Mr. Baruch succeeds Daniel Willard, who resigned several weeks ago, though the latter is still chairman of the Advisory Commission of the Council of National Defense. In a letter to Mr. Baruch, the President outlines the functions of the reorganized board as follows:

"(1) The creation of new facilities and the disclosing, if necessary the opening up, of new or additional sources of supply. (2) The conversion of existing facilities where necessary to new uses. (3) The studious conservation of resources and facilities by scientific, commercial and industrial economies. (4) Advice to the several purchasing agencies of the Government with regard to the prices to be paid. (5) The determination, wherever necessary, of priorities of production and of delivery and of the proportions of any given article to be made immediately accessible to the several purchasing agencies when the supply of that article is insufficient, either temporarily or permanently. (6) The making of purchases for the Allies.

"The board should be constituted as at present, and should retain, so far as necessary and so far as consistent with the character and purposes of the reorganization, its present advisory agencies, but the ultimate decision of all questions, except the determination of prices, should rest always with the chairman, the other members acting in a coöperative and advisory capacity.

"In the determination of priorities of production, when it is not possible to have the full supply of any article that is needed produced at once, the chairman should be assisted, and so far as practicable guided, by the present priorities organization or its equivalent.

"In the determination of priorities of delivery, when they must be determined, he should be assisted when necessary, in addition to the present advisory priorities organization, by the advice and coöperation of a committee constituted for the purpose and consisting of

official representatives of the Food Administration, the Fuel Administration, the Railway Administration, the Shipping Board, and the War Trade Board, in order that when a priority of delivery has been determined there may be common, consistent, and concerted action to carry it into effect.

"In the determination of prices the chairman should be governed by the advice of a committee consisting, besides himself, of the members of the board immediately charged with the study of raw materials and of manufactured products, of the labor member of the board, of the chairman of the Federal Trade Commission, the chairman of the Tariff Commission, and the Fuel Administrator.

The chairman should be constantly and systematically informed of all contracts, purchases, and deliveries, in order that he may have always before him a schematized analysis of the progress of business in the several supply divisions of the Government in all departments."

May Take Control of Lumber Industry

A bill empowering the President to take control of the lumber industry was reported favorably on Mar. 1 by the Senate Committee on Military Affairs. Under the measure, which was introduced on Jan. 8 by Senator Chamberlain, President Wilson may commandeer any or all standing timber needed for the Army and Navy for constructing airplanes or for the Shipping Board—or for any other department of the Government that needs timber or its products. Furthermore, the bill requires sawmill men to cut boards, etc., in sizes that may be prescribed by Executive order, under pain of fine and imprisonment for violation of the order. The significance of the measure is found in the serious situation regarding the production of war airplanes, which is retarded by the difficulty in obtaining the right sort and sizes of spruce. Trouble has also been encountered in getting lumber required for ships. The labor situation in many lumber camps has greatly affected the production of suitable timber.

Food a Mighty Weapon

"The sharp bread knife is wellnigh as effective as the bayonet to win the war," said Col. W. R. Grove, of the U. S. Quartermaster General's office, in an address at the annual convention of the National Canners' Association held recently in Boston.

"In a war where food is such a tremendous factor," he continued, "the clean plate also becomes a bombshell for the enemy. By the clean plate we mean the plate from which every bit of food has been consumed. It is calculated that if each soldier could reduce by one eighty-third the amount of food served him at each meal we could feed almost a whole division with the savings—which means another division in the trenches. The saving would amount to \$2,700,000 yearly. We are feeding the present American army better than any other American army ever was fed."

Colonel Grove estimated that it would take 3375 tons of food to furnish the three daily rations for the army of 1,500,000 men. He added some figures showing the requirements for one day as follows: One million five

hundred pounds of beef, equal to 3000 cattle; 225,000 lb. of bacon, 750 tons of potatoes, 40,000 lb. of prunes, 1500 bottles of lemon extract, 2750 bags of salt, 275,000 cans of condensed and evaporated milk, 3600 cans of corn, 24,000 cans of green peas, 2500 cans of stringless beans, 1800 cans of cabbage, 7500 cans of peaches, 3000 cans of pineapples, 1000 cans of pumpkin, 2200 cans of apricots, 100 cans of clam juice, 125 cans of lobsters, 225,000 cans of jam and preserves and 300 bottles of catsup.

All Strikes Blocking War Work Called Conspiracies

An Administration bill was passed on Mar. 6 by the House, declaring that all strikes called to obstruct war industries are conspiracies and subjecting the offender to 30 years' imprisonment and fine. A move to prohibit all war industries strikes made by Representative Cannon, of Illinois, was defeated by labor forces, who inserted a clause of their own specifically permitting what they termed bona fide strikes "to raise wages or better working conditions." This amendment was approved.

German Possession of Russian Oil Will Lengthen War

Petroleum men at the recent conference in New York with Mark L. Requa, head of the oil division of the U. S. Fuel Administration, gave their views regarding the benefits to accrue to Germany from possession of the Russian and Rumanian oil fields. They agreed that, despite the difficulties of transportation and the high cost of working the fields, Germany had been placed in a much better position to continue the war. According to trustworthy reports laid before the conference, Germany's weakest spot in military activities for some time had been in the military transport system, which the reports said was threatened with complete collapse owing to lack of oil for motor trains. With new supplies available, Germany would be quick to replenish stocks, whatever the cost. None of the oil men was inclined to minimize the gain to Germany of peace with Russia and Rumania.

Coal Crisis Feared by Operators

The Railroad Administration has been asked for increased transportation facilities by coal operators represented by the National Coal Association. The production of coal in January and February, it is asserted, was much less than in the corresponding months in 1916 and 1917 because of car shortage. This, together with the traffic congestion, had resulted by Feb. 23 in a loss in output of more than 31,000,000 tons of coal since Jan. 1 and in most demoralizing labor conditions in the mines.

"During this period," said the Association, "thousands of open-top coal cars were lying idle on some railroads, awaiting transportation to the mines. In the Philadelphia district alone there were between 3000 and 4000 open-top empties on hand awaiting movement. This condition was caused partly by extremely severe weather

conditions and partly by urgent necessity for the transportation of grain, which required preferential movement of thousands of empty box-cars westward for grain loading.

"It is impossible for the bituminous coal producers to meet the country's requirements of coal if cars to transport their product are not given them. For the first two months of the year they have been producing about 65% of possible output. Unless this percentage is materially increased by an increased car supply, there is no escaping the conclusion that the country will soon again find itself in the grip of a fuel shortage."

Wage Commission Makes Study of Living Costs

The most extensive investigation into living costs ever undertaken in this country has been made by the Railroad Wage Commission in its search for information on which to base recommendations for wage increases. Reports from newspapers were gathered at the commission's request by trained newspaper men, who were instructed to visit families with incomes of \$2000 and less, and ascertain how much they were spending for food and clothes now as compared with 1915. Itemized accounts were obtained as to what was done with the money received by the wage-earners. "The result was astonishing," Secretary Lane, chairman, said. "We found some families saving money on incomes of \$800 a year."

Elaborate charts of wages paid by railroads have been made, showing that in the United States approximately 1% of all railroad workers receive about \$30 a month, the percentage increasing as wages advance until 9½% are paid from \$61 to \$65 a month. When wages reach \$150 a month the men in each division, as the pay advances \$5, total less than 1% of the entire number. For the first time in history an accurate census of all railroad workers has been taken, showing that 1,980,000 men and women are employed in transportation.

Save the Daylight Now Wasted

The committee on daylight saving of the U. S. Chamber of Commerce recently opened its campaign to secure the passage of the Calder bill with the presentment to the members of Congress of a vast array of facts and figures, which were intended to show the benefits that lie in daylight saving.

By a saving of 190 hours out of a yearly average of 1320 a year requiring artificial illumination, as provided by the Calder bill, the committee claim there could be saved 660,000 tons of coal used in electricity for lighting and 144,000 used in gas for lighting. If the various other schemes advanced by the committee are adopted in imitation of the European system, a saving may be effected in both gas and electric lighting of 1,019,000 tons of coal. This is between Apr. 1 and Nov. 1. If an all-the-year-round rule were adopted the saving would total 1,061,000 tons. When the amount of coal used in other ways for industrial purposes is counted in, it is estimated that nearly 1,500,000 tons could be saved.

The committee asks the Congressmen to note especially that daylight saving has a direct bearing on the training of military forces, the speeding up of plants making war materials and on speeding up shipyards.

"It will relieve the strain of labor conditions at the time of greatest fatigue," the report suggests. "Working conditions will be improved, particularly in industries where accurate eyesight is essential, and materially cut down the number of industrial accidents. Statistics show that these accidents have most frequently occurred in the late afternoon when human efficiency is at low ebb. The lessened risk of accidents in transportation and local traffic handling, by moving the afternoon rush forward into daylight, is in itself more than sufficient justification for the passage of the measure."

One of the most practical arguments cited is that electric power companies will be able to increase their efficiency and be able to operate at lower cost by the removal of the top of the "peak" load. The average load used by a Chicago company is only 50% of the "peak," it is stated, and the cost of maintaining the surplus power necessary to carry the traffic during the heaviest hours represents one-fourth of the cost of the entire plant. Daylight would replace the "peak" load, the report says.

Civilians Wanted for Ordnance Work

Men having a high-school education, some shop training and the natural ability to adapt themselves to new work may qualify for a Government appointment in which, under Government instructors, they will receive the necessary training for the positions described below. Those who have the required technical training will be placed and advanced as quickly as their ability justifies. The positions are the following: Inspectors and assistant inspectors, field artillery ammunition steel; inspectors, artillery ammunition, cartridge cases, assembling, loading, forging, primers, detonators, shell and shrapnel machining; ballistic inspectors; metallurgical chemists and assistants; inspectors, powder and explosives; inspectors, cannon, forging operations; inspectors, gun carriages and parts; inspectors, gun fire control instruments; assistant inspectors, motor vehicles and artillery wheels; engineers and assistant engineers, for tests of ordnance materials; inspectors, ammunition packing boxes; machinists, accustomed to work 1-1000th inch.

These positions are under civil service regulations, but applicants will not be required to report for examination at any place. Applicant will be rated in accordance with education and general experience. No applications will be accepted from persons already in the Government service unless accompanied by the written assent of the head of the concern by which the applicant is employed. Papers will be rated promptly and certification made with least possible delay. Further information may be obtained from C. V. Meserole, special representative of the Ordnance Dept., U. S. A., Room 800, 79 Wall St., New York.

Brigadier-General Littell, in charge of building cantonments, told the Senate military committee that the 16 cantonments cost \$143,000,000, with an average contractor's fee of 2% to 3%. None was over 6% and maximum was \$250,000.

Industrial News from Washington

BY PAUL WOOTON, SPECIAL CORRESPONDENT

Mineral Control Bill Drafted

The President, members of the Cabinet and mineral specialists in Government service have been busy with a proposed bill "to provide further for the national security and defense by encouraging the production, conserving the supply and controlling the distribution of those ores, metals and minerals which formerly have been largely imported, or of which there is or may be an inadequate supply." The measure is considered of such importance that it has been laid before the President for him to judge for himself as to the advisability of urging such legislation at this time.

The proposed bill was given much impetus by the favor with which it was received by the committee of the American Institute of Mining Engineers. It is understood, however, that various changes are being proposed by Bernard M. Baruch, head of the raw materials division of the War Industries Board, and others. Representative Foster, chairman of the Committee on Mines and Mining, thinks that much time will elapse before it is introduced, as he intends to Coördinate the changes suggested before placing the bill on the House calendar. No effort will be made to have the bill considered, Dr. Foster states, until those interested have been given opportunity to appear at the hearings.

The bill carries an appropriation of \$50,000,000, to be available as a revolving fund. The bill will apply to antimony, arsenic, chromium, graphite, magnesite, manganese, mercury, molybdenum, platinum, pyrite, tungsten, tin, sulphur and the alloys and chemicals derived from them.

The proposed legislation follows the line of the bill on food control. Among other things, it authorizes the President "to enter into contracts for necessaries, for periods not exceeding two years, to purchase, to store, to provide storage facilities for and to sell necessaries at reasonable prices to be fixed by the President." In another section of the bill the President is authorized, on ascertaining that emergency exists, to stimulate production by guaranteeing prices to assure producers a reasonable profit.

To insure full publicity for expenditures under the bill, it provides that itemized statements covering all disbursements are to be made public each month.

Quicksilver Research Work in Progress at Berkeley, Calif.

Work at the Berkeley, Calif., station of the U. S. Bureau of Mines is confined at present to an investigation of the metallurgy of quicksilver, to work on the reaction of nitric acid on metal sulphides, and to experiments to determine the clarifying power of certain clays. A report is in preparation on fume and other condenser losses incidental to the treatment of quicksilver, and an effort is being made to eliminate sources of error in assaying ores of the metal. A special muffle

furnace has been built to experiment on roasting quicksilver ores. Samples of California quicksilver ore have been sent to Seattle for milling tests.

The work on the action of nitric acid on metal sulphides has been found to fall into two subdivisions. One has to do with the primary action of nitric acid on metal sulphides; the other with the reaction of various oxides of nitrogen on sulphur gases which result when metal sulphides are treated with the acid. Apparatus for this study has been set up.

State Distribution of War Minerals

The report made to Congress asking for \$250,000 for mineral investigations by the U. S. Bureau of Mines shows the principal deposits of war minerals, by states, as follows:

Alabama, graphite, pyrite; Arizona, manganese, tungsten, molybdenum; Arkansas, manganese; California, pyrite, chromite, mercury, magnesite, tungsten, manganese, molybdenum, potash, strontium; Colorado, tungsten, manganese, pyrite, molybdenum, sulphur; Georgia, pyrite, manganese; Illinois, coal, brasses; Indiana, coal, brasses; Louisiana, sulphur; Maine, pyrite; Maryland, chromite; Massachusetts, pyrite; Minnesota, manganese; Missouri, pyrite; Montana, manganese, arsenic; Nebraska, potash; Nevada, mercury, antimony, manganese, sulphur, tungsten; New Jersey, potash; New Mexico, manganese; New York, pyrite, graphite; North Carolina, tin, mica; Ohio, coal, brasses; Oklahoma, manganese; Oregon, chromite; Pennsylvania, chromite, pyrite, graphite; South Carolina, pyrite, chromite, mercury, magnesite, tungsten, manganese; Texas, graphite, mercury, sulphur, strontium; Utah, sulphur, manganese, arsenic; Virginia, tin, pyrite, manganese; Washington, magnesite; Wisconsin, pyrite; Wyoming, chromite, sulphur.

Tin Plate Export Further Restricted

Further restrictions have been placed upon the exportation of tin plate and of terne plate. Export licenses will be granted only for shipments to Canada, South and Central American countries, including Mexico and the West Indies, China and Japan, and then only when the plate is to be used for the following purposes:

(1) To manufacture containers for edibles for consumption by the people of nations at war with Germany or her allies. (2) To manufacture oil cans, provided that the plate has been ordered from the mill on or before Aug. 27, 1917. In this case there shall be no distinction made between purchases from manufacturers and purchases from others. (3) When the plate is to be shipped to any of the above-mentioned countries except Canada, it is to be used for purposes which shall contribute directly to the successful prosecution of the war. (4) When the plate is destined for Canada it is to be used for purposes for which tin plate or terne plate is now permitted to be used in the United States.

No export licenses will be granted for tin, pig tin, metallic tin, block tin, metallic tin pipe, except for such shipments as pass through the United States from England, in bond, for reexportation to other countries.

If satisfactory evidence is presented to the War Trade Board that the goods will be used in such a way as to contribute directly to the successful prosecution of the war, licenses may be granted for phosphorized tin, white metal, and other tin alloys, and empty tin containers.

Remember the Comfort Fund of the 27th Engineers.



We are backing this boy and the Government-

We are backing this boy and the Government. In particular, we are backing the mining regiment. Where do you stand? The 27th Engineers, the mining regiment, is made up of volunteers. When the call for recruits was sent throughout the mining camps last November, it had to be answered. If it had gone unnoticed, how would the men of the industry stand in public esteem today? You are held in higher regard this minute because mining men are to be represented by a special unit at the front. The men in the regiment are asking for nothing, but they most certainly have the strongest claim for your regard. That many appreciate this is proved by the readiness with which they have contributed to the Comfort Fund for the men, the name of which explains its purpose.

How is the money spent? Over \$500 of it went some time ago for athletic equipment, games, tobacco, etc., just for A Company. The same men were recently provided with some musical instruments to chase dull care away, and with various other articles that were badly needed. B Company will soon receive a similar outfit. And so the work will continue. This is but the beginning. Wherever and whenever it is needed, the money will be spent on the men or their dependents. Don't you want to be in on this, or are you going to leave it for the other fellow? Those whose contributions are listed here think the Fund is a good thing:

Engineering and Mining Journal.....	\$1000.00
New York Engineering Co.....	1000.00
A Friend, Nov. 23.....	5.00
H. H.	5.00
D. E. Charlton.....	5.00
H. W. Hardinge.....	1000.00
Frank N. Spencer.....	5.00
W. L. Coursen.....	5.00
J. H. Polhemus.....	5.00
J. H. Janeway.....	10.00
Albert D. Beers.....	10.00
J. E. Hayes.....	10.00
J. A. Van Mater.....	25.00
L. Vogelstein & Co.....	100.00
"Cuprite".....	10.00
R. H. Bassett (Hanna Ore Mining Co.).....	10.00
A Friend, Dec. 10.....	10.00
P. A. Mosman.....	10.00
American Zinc, Lead and Smelting Co.....	100.00
J. G. H.	5.00
Daniel Guggenheim.....	100.00
A. H. H.	5.00
Willard S. Morse.....	25.00
August Heckscher.....	100.00
Anaconda Copper Mining Co.....	1000.00
F. W. Bradley.....	100.00
Charles Le Vasseur.....	5.00
A Friend, Dec. 13.....	50.00
Freeland Jewett.....	10.00
Herman A. Wagner.....	5.00
Francis P. Sinn.....	10.00
R. C. Gosrow.....	5.00
D. C. Jackling.....	100.00
"V".....	10.00
J. H. Brickenstein.....	5.00
E. E. Northrup.....	5.00

Rogers, Mayer & Ball.....	50.00
Denver Technical Staff, American Metal Co., Ltd.....	30.00
A Friend, Jan. 9.....	100.00
E. B. Coolidge.....	10.00
J. V. N. Dorr.....	200.00
Pope Yeatman.....	50.00
W. H. Aldridge.....	50.00
C. E. Hart.....	5.00
Robert I. Kerr.....	5.00
Engineers of Washoe Smeltery, Anaconda Copper Mining Company.....	205.00
Harry C. Graham.....	25.00
Utah Copper, Nevada Consolidated, Ray Consolidated and Chino copper companies.....	1000.00
A Friend, Jan. 23.....	5.00
John Gillie.....	25.00
J. N. Houser.....	5.00
C. K. Lipman.....	5.00
Theodore Sternfeld.....	50.00
Clinton H. Crane.....	500.00
T. Wolfson.....	10.00
William H. Hampton.....	10.00
W. E. Merriss.....	10.00
J. Parke Channing.....	100.00
Miami Copper Co.....	250.00
J. H. Means.....	10.00
C. W. Goodale.....	25.00
P. G. Beckett.....	50.00
F. R. Foraker.....	25.00
Charles A. Chase.....	25.00
E. Fleming L'Engle.....	5.00
Calumet & Hecla Mining Co.....	250.00
H. G. Ferguson.....	18.00
Jay E. Van Gundy.....	10.00
Franklin Osborn.....	10.00
Oscar Lachmund.....	10.00
W. T. Swoyer.....	10.00
Interest.....	10.00
Quincy Mining Co.....	100.00
American Metal Co.....	250.00
William H. Fairbanks.....	25.00
D. E. Curry.....	5.00
W. R. Ingalls.....	50.00
H. A. Guess.....	25.00
J. Mc. C.....	5.00
Engineers' Club of Northern Minnesota.....	85.00
B. B. Thayer.....	50.00
R. H. Sales.....	25.00
Albert C. Burrage.....	100.00
Edward H. Clark.....	25.00
P. Rutherford.....	5.00
Adolph J. Martinson.....	2.00
Frank R. Edwards.....	5.00
C. H. Munro.....	100.00
E. E. McCarthy.....	25.00
J. L. Bruce.....	15.00
D. Ford McCormick.....	10.00
Louis D. Huntoon.....	5.00
P. G. Spillsbury.....	10.00
C. T. Brown.....	10.00
M. C. M.....	3.00
James F. McCarthy.....	50.00
United States Smelting, Refining and Mining Co.....	250.00
L. O. K.....	10.00
Herman A. Prosser.....	25.00
J. E. Johnson, Jr.....	5.00
Total.....	\$9343.00

Friends have given enough books to make it possible to send a case of 89 to B Company. The ladies of the Women's Auxiliary of the New York Section of the American Institute of Mining Engineers have volunteered to knit for the regiment. Why cannot the ladies do likewise in all mining camps? Clubs can be organized by the live wires in the various communities and their output sent to the Association of the 27th Engineers, with headquarters in the *Journal's* office, which will distribute it to the regiment, wherever it may chance to be.

Back up the mining regiment! Boost the Comfort Fund! Make your checks payable to W. R. Ingalls, treasurer. In view of the considerable detail work in the administration of this fund, acknowledgment of contributions is made only through publication in the *Journal*.

Gold Deposits in Inland Alaska were first found, according to the U. S. Geological Survey, in the Yukon-Tanana region. The earliest of the pioneer prospectors crossed the Chilkoot Pass in 1880 and began mining six years later. The town of Circle is one of the oldest white settlements on the Yukon. There are neither glaciers nor permanent snow in this vicinity. Fertile valleys and grassy slopes make possible the cultivation of many grains and vegetables during the short but warm season. The Yukon-Tanana region has produced gold to the value of \$100,000,000.

Metal Exports for January, 1918

A marked decrease in the amount of refined copper exported in January, 1918, as compared with the corresponding month of 1917, is shown by the official returns to the Bureau of Foreign and Domestic Commerce. Exports of unrefined copper, however, nearly doubled during January of this year. Great Britain received in January of this year less than half the quantity taken during the corresponding month of 1917.

The figures in detail, which have just become available, are as follows:

U. S. EXPORTS OF METAL IN JANUARY, 1918

Metal	January	
	1917 Pounds	1918 Pounds
Copper:		
Ore, contents.....	528,287	312,822
Concentrates, matte and regulus.....	116,500	48,060
Unrefined black, blister and converter.....	2,273,907	4,434,271
Refined, in ingots, bars and other forms.....	107,613,298	81,098,209
Lead in Pigs, Bars, etc.:		
From domestic ores.....	16,189,417	9,012,126
From foreign ores.....	1,282,263	6,210,713
To certain countries as follows:		
France.....	None	1,141,754
Italy.....	None	168,000
Russia.....	1,879,359	230,156
Sweden.....	112,031	None
United Kingdom.....	None	11,220,945
Canada.....	11,437,322	1,224,606
Argentina.....	78,400	528,120
China.....	2,200	457,836
Japan.....	1,636,802	None
Zinc:		
From domestic ores.....	29,156,436	19,078,929
From foreign ores.....	5,301,222	8,331,747
To certain countries as follows:		
France.....	14,414,624	11,479,058
Italy.....	1,507,691	835,081
Norway.....	201,444	None
Russia.....	1,624,134	None
United Kingdom.....	13,902,473	13,365,163
Canada.....	1,613,384	1,503,070
In sheets and strips.....	1,546,149	1,767,262
Dross.....	241,196	2,031,629

The figures show a decided decrease in exports of lead from domestic ores, but a greater proportional increase of exports of lead from foreign ores. The same is true with respect to zinc.

Fluorite for Optical Purposes*

Fluorite, or fluorspar, is used largely in the manufacture of steel, hydrofluoric acid and enamels. In addition, clear, colorless, or faintly colored specimens, such as occur sparingly with the crude material, are suitable for the manufacture of certain types of lenses and prisms employed in optical instruments. Optical fluorite of excellent quality has been found in southern Illinois, and no doubt it also exists in other localities. Fluorite bends light very slightly, disperses it faintly, and normally displays no double refraction. Owing to the reflection of light-rays from light or polished surfaces, and to its dispersion in passing through transparent or translucent substances, errors are frequently introduced which, for accurate computation and calculation, must be neutralized, and this is accomplished by means of a lense of fluorite placed between the lenses of glass. A more plentiful supply of optical fluorite should cheapen and improve lens construction. For optical purposes fluorite must contain a portion at least one-fourth inch in diameter free from flaws and practically colorless. Pieces bounded by plane surfaces are better than irregular masses.

The demand for optical fluorite is limited, but will increase if it can be produced in sufficient quantities at

*Abstract from Bulletin 38, State Geological Survey Division, University of Illinois.

a reasonable price. The proper material is most likely to be found as cubic crystals occupying the walls of small open veins or beds, particularly where the cavities are relatively numerous, indicating a slow crystallization, and consequently more perfect crystals. The value of optical fluorite is roughly \$1 per pound, while large, fine specimens may bring \$10 apiece. Some of the dealers in this mineral are: Bausch & Lomb, Rochester, N. Y.; Spencer Lens Co., Buffalo, N. Y.; Bureau of Standards, Washington, D. C., and Ward's Natural Science Establishment, Rochester, New York.

Metal and Ore Imports Show Decrease in January

Imports of metalliferous minerals during January show a marked decrease when compared with the figures of January, 1917. There were nearly 10,000,000 lb. less zinc in calamine and other ore brought into the United States in January, 1918, than in January, 1917; lead in ore shows a decrease of 4,000,000 lb.; copper in ore a similar decrease, while pyrites imports were cut in two. The detailed figures giving the imports for January, and for the purpose of comparison those of January, 1917, as taken from the early returns to the Bureau of Foreign and Domestic Commerce, follow:

	January, 1917	January, 1918
Zinc:		
Ore and calamine (zinc content), lb.....	14,549,559	4,712,100
From certain countries as follows:		
Spain.....	3,163,560	None
Canada.....	1,613,000	1,038,666
Mexico.....	8,527,999	3,675,434
Blocks, pigs or old.....	31,434	32,654
Zinc dust.....	44,912	None
Lead, lb.:		
Ore (lead content).....	6,143,712	2,194,898
Bullion (lead content).....	1,919,006	13,576,688
From certain countries, as follows:		
Canada.....	3,339,677	852,545
Mexico.....	4,668,799	16,721,109
Pigs, bars and old.....	856,965	5,215,476
Copper, lb.:		
Ore (copper content).....	9,935,429	6,421,103
Concentrates (copper content).....	2,971,454	2,787,500
From certain countries, as follows:		
Canada.....	2,532,582	1,736,979
Mexico.....	3,244,686	3,163,371
Cuba.....	2,413,060	950,384
Chile.....	3,548,638	3,133,249
Peru.....	979,665	27,584
Manganese, long tons.....	49,530	42,947
From certain countries, as follows:		
Brazil.....	40,200	35,800
Cuba.....	3,340	3,081
British India.....	2,775	3,000
Pyrites, long tons.....	85,770	41,166
From certain countries, as follows:		
Spain.....	78,948	38,607
Canada.....	2,127	2,559
Graphite, tons.....	4,556	1,611
Nickel, lb.:		
Ore (nickel content).....	5,357,486	5,162,399
Tin:		
Ore, long tons.....	1,752	130
Bars and pigs, etc., lb.....	14,367,378	12,572,727
From certain countries, as follows:		
United Kingdom.....	3,573,544	3,140,709
Straits Settlements.....	8,086,875	3,976,381
Dutch East Indies.....	2,549,491	3,675,224
Hong Kong.....	None	280,597
Australia.....	78,400	521,338
Platinum, Troy oz.:		
Unmanufactured.....	2,466	23,560
Ingots, bars, etc.....	1,562	389
Tungsten-bearing ore, long tons.....	705	745
From certain countries, as follows:		
Chile.....	431	258
Peru.....	178	269
Mica, unmanufactured, lb.....	48,031	92,726

Minor-Coinage Metals were purchased by the U. S. Mint in the fiscal year 1917 to the amount of 34,452,619 troy oz., at a cost of \$762,919. The various metals so purchased were: Ingot copper, 29,625,988 troy oz. (about 1,686,000 lb. avoirdupois); boron copper, 8750; silicon copper, 1524; nickel, 3,571,167 (203,000 lb., avoirdupois); tin, 354,638 (20,000 lb., avoirdupois); zinc, 890,210 (50,000 lb., avoirdupois); mutilated bronze and nickel coins, 343 troy ounces.

Editorials

Platinum in Russia and Colombia

LAST week we read in the Official Bulletin that supplies of platinum in the United States have been commandeered by the Government, this action manifestly reflecting a fear that there will be difficulty in obtaining all the platinum needed, considering that the supplies may not be forthcoming from Russia and that the main reliance must be on Colombia.

If the main supply must now be derived from Colombia, the way to increase it is to let the price increase so that the natives will be interested in getting more of the metal. The natives of Colombia have no patriotic feelings with respect to the United States; they cannot be bullied by the War Industries Board; they do not care if they be characterized as profiteers. In fact, they will not be profiteers, but just simple folk who must have a proper incentive to wash the more remote and expensive alluvial deposits that yield platinum.

The premise that no more platinum will be obtainable from Russia this year is not sound. Efforts should be made to obtain all the platinum from Colombia that is possible, but at the same time very careful attention should be given to the situation in Russia.

Normally, Russia produced over 90% and Colombia about 5% of the world's pre-war platinum. In 1917 the world's production was about one-third of the pre-war annual production, and the respective outputs of Russia and Colombia were about as 3 to 1. The stimulus due to the recent high prices had increased the annual pre-war output of Colombia from about 15,000 ounces to about 30,000 ounces.

We are reliably advised that Colombia cannot be counted on to increase its output largely unless a very high price be offered, for its platiniferous areas are limited, and practically all production is on the one-man-proposition scale by inefficient and lazy tropical laborers. Russia, on the other hand, has large proved platiniferous areas, and about 30 platinum dredges in that country can probably be operated this summer if immediate efforts be made to encourage production. These dredges have a comparatively low operating cost per ounce of platinum produced, and a price for platinum of about \$100 per ounce would almost surely be sufficient incentive to result in their being operated, if delivery of their product were accepted, say, at Ekaterinburg, the platinum center in the Ural Mountains.

The laborers employed on dredges, being men of superior intelligence, will probably be less infected with Bolshevik ideas than the general run of Russian workmen, and, not being numerous, they will not be so difficult to keep at work. In addition, the equivalent of \$100 per ounce paid in roubles (about Rs. 137 per zolotnik, making 10 rs. equal to \$1) would unquestionably stimulate the production of platinum by thousands of peasants in the Urals who will not have much to do this summer. The pre-war price for platinum at Ekaterinburg was about 10 rs. per zolotnik.

It is probable that 50,000 to 100,000 ounces can be produced in Russia in 1918 if steps be taken soon, but haste is absolutely necessary to accomplish this result. The dredging season in the Urals begins about Apr. 15, and as the dredges will need to be overhauled before beginning operations, owners must be approached soon if dredging is to be done in 1918. It is probable that the dredges will not be worked this summer, because of present and prospective inability of owners to market platinum, unless the operators can be guaranteed a sale for their product at Ekaterinburg. Of course, it is not certain that platinum can be brought out of Russia, but it seems worth while to make the effort, either through Archangel or via the Trans-Siberian Railroad.

There is another important aspect: Germany needs platinum too, and purchase by the Allies would probably prevent her getting any considerable amount. Platinum will surely be produced in Russia this year, and probably in considerable quantity, even if the dredges that are controlled by the Allies or interests friendly to us do not work, but if Germany stimulates production, as there is reason for anticipating her doing, she will get considerable platinum if the Allies do not move to prevent it. But it will be necessary to move soon.

Anaconda To Produce Ferromanganese

WITH the versatility that has become one of the characteristics of Anaconda, that enterprising company is making plans for the manufacture of ferromanganese at Great Falls, utilizing manganese ore from its own and other mines in Butte and electric power from the Montana Power Co. The War Industries Board appealed to Mr. Ryan to do what he could to promote the production of ferromanganese in the United States, and Mr. Ryan put his own staff on the job and committed the company to backing them up. Incidentally, it appeared that the manufacture of ferromanganese would probably be a profitable venture for the company.

The present plans contemplate a production of about 30,000 tons of ferromanganese per annum. This is a considerable output, considering that ferromanganese is worth about \$250 per ton, and that the domestic production in 1917 was about 328,000 tons (the imports being about 52,000). Production is expected to begin within the next six months, it having been found practicable to utilize existing buildings and machinery, the main parts of the new installation comprising only the furnaces and the electrical transformers.

While the electro-thermic production of ferromanganese is still a novelty, it is far beyond the experimental stage, inasmuch as electric furnaces are running regularly for this purpose at Anniston, Ala. The rhodochrosite ore of Butte has been smelted at Anniston and has been found to be admirably suited for this object.

This new development of Anaconda's at Great Falls is highly important in promising to the country a fairly early supply of a much-needed alloy, but industrially, to the Anaconda company, we fancy that it will be of even more far-reaching importance. It will mark the beginning of electric smelting at Great Falls, where there is a great hydro-electric power development, and, the start having been made, Anaconda will go into the production of many other things unless we are very much mistaken.

Let Mr. Baruch Be Saved from His Friends

MR. BARUCH, who has just been appointed director of the War Industries Board, may well appeal to be saved from his friends, and also from his press agents, especially Ralph Block, who contributed a fulsome piece about him to the *Tribune* last week.

Mr. Baruch may have bought many things for the Government very advantageously indeed, but some things he has not. However, nobody expects to obtain perfect batting.

Nevertheless, Mr. Baruch may feel properly mortified over the claim in his behalf that he persuaded the copper producers to sell him 45,000,000 lb. of copper at 16½c. when the market price was 35c., for Mr. Baruch knows better than anybody else, first that the aforesaid supply of copper resulted from the patriotic offer of John D. Ryan, on behalf of the copper producers; and, furthermore, that the major market for copper was not 35c. either at that time or at any other time; and, finally, that the producers were willing then to sell the Government copper at 25c. as an ordinary business transaction.

Nor do we think that Mr. Baruch would claim that months ago he saw scarcity in platinum looming up ahead and induced two platinum merchants to bring over 21,000 oz. from Russia. The true story of this platinum importation is to be found in the Bulletin of the Mining and Metallurgical Society of America for January, 1918. Mr. Block would have done better had he consulted this, rather than listened so long to fairy tales in Washington.

The Overman Bill

THE Overman bill giving the President full powers to centralize control in any way he sees fit may well be endorsed. It simply enables the President to redistribute the functions of the executive agencies, to transfer duties, powers, records, and personnel from one executive agency to another, and to employ such additional agencies as he may deem necessary.

Under the terms of this bill the President may even create a general staff to plan our industrial strategy, and as advisory to that staff a commission on economic policies. Such an economic commission is badly needed. If our economical policies be wrong, we are doomed to troubles. We ought to be sure that they are right.

When the President has such portentous matters of statecraft to consider as the projected entry of Japan into Siberia, the reply to Hertling's last speech, our relations with Spain, etc., how can he be expected to

attend to all things in domestic affairs, even such details as fixing the prices for copper and zinc?

We hope that with the new freedom that will come to him with the passage of the Overman bill he will create a general planning staff and an economic advisory commission.

Nobody wants to interfere with any internal reorganization that the War Department, or any of the other executive departments, sees fit to make. Let them improve themselves in such ways as their experience indicates, and let them function in such ways as their authority extends. But the War Department should recognize that its success or failure is correlated with what the Navy, the Shipping Board, Food Administration, Railway Directorate, etc., are doing, and that unless there be team-work there surely will be trouble. The President cannot effect this correlation, for he has too many other things to do. Therefore he should have a general staff between himself and the departments, boards, and commissions. And the general staff should know that if it violates the laws of economics it will create troubles more fundamental than anything else; wherefore it should have the best economic advice.

Without a general staff, the creation of new boards simply adds to the chaos. Suppose that somebody sees clearly some important thing that should be done, suppose that some department of our Allies wants it to be done, as things are at present does anybody know how to get it done? Not one time in a hundred.

Steam-Shovel Mining on the Mesabi Range

IN THIS issue we present the second of three installments of a paper dealing with the mining of iron ore by the lowest-cost method existant, from the most productive area of a region which has the greatest resources in reserve in America, if not in the world—the Giant or Mesabi range. This range of northern Minnesota hills is north and west of Duluth and roughly parallels the western shore of Lake Superior for nearly 100 miles. The orebodies lie along the southern slope in a series of truncated lenticular bedded deposits, individually underlying considerable areas of glacial-drift overburden, but having a relatively small thickness. Texturally the ores vary from a fine dust to hard granular boulders consisting of soft hydrated hematites and limonites, concentrated in troughs of impervious strata as precipitates from solution. The thickness of the overburden varies from 125 to 300 ft., and, according to the relative depth of the cover to the ore, stripping and mining by steam shovels or underground methods are used. In general, the ratio necessary to warrant the stripping expense is two yards of overburden to one yard or two tons of ore; and 150 ft. is about the maximum depth that is stripped on the Mesabi range.

In the first part of the article mention is made of the practice of sinking external shafts for the purpose of drainage. By so doing the reservoir of moisture held in the impervious troughs underlying the Mesabi deposits, which consist of layers of slate or "paint rock" interbedded with the so-called "iron formation," is drained in advance of excavation, thereby greatly facilitating operations. The iron formation is made up

of chert and ferric oxide, with various other iron-bearing minerals disseminated throughout, and by the leaching action of descending waters was the original source of the concentrated workable deposits. Geologically this formation occurs in the Biwabik or upper Huronian, a slate and quartzite forming the third series of the Algonkian of later pre-Cambrian sedimentaries.

The Lake Superior region lies in a basin extending over adjacent parts of Michigan, Wisconsin, Minnesota and Ontario, covering an area of 181,000 square miles, of which 3800 square miles is productive of iron ore. The altitude at the mines is about 1000 ft. above sea level and the winter climate is severe, as will be attested by the freezing of the ground to depths of eight feet. The Mesabi and other iron ranges of the region have been enormously productive. They are of exceedingly great interest on account of the variety of mining methods that have been found adaptable in the low-grade copper deposits of the West and the enormous tonnages of iron ore in reserve for future generations.

The Bonus System Applied to Mining

IN THE issue of Mar. 9th we presented a paper on the bonus system applied to mining. Ostensibly the object of any form of bonus is to create an incentive to the workman to extend his efforts and thereby increase both his employer's and his own earnings. The company's increment is expressed by the production of a job at a less cost than would have been incurred by the flat day's wage system, and the amount of increase varies directly with positive efforts of the workman and inversely with the price paid to him. The attending difficulty seems to lie in the equity of mutual profits.

In the effort to attain the lowest costs possible, companies often resort to a cut in bonus rates, which frequently, with good work, increase to proportions out of all bounds compared to the standard wage. Where, however, such a cut-rate practice is anticipated by the workman, the resulting decrease in effort-output is a natural consequence, and the purpose of the bonus system is thereby at once defeated. Conversely, if a workman knows that by deception he may be granted an increase in price per unit of work, the cost to the company becomes greater than it should be and the workman receives a high price without making the extra effort necessary to earn the bonus.

The solution in practice may be found expressed by various systems that are attended by more or less success. We are inclined to believe that in a mine the success of any bonus system depends less upon the system itself than upon the personality and good judgment of the executive staff. It is probable that the effort given by a workman increases more in proportion to his good will toward and personal esteem for the "old man" than to the merits of any paper-perfected system. However, all matters of this sort being equal, we believe that a whole price should be set for a whole job, and paid for at regular intervals according to the proportion completed, withholding a percentage of the earnings subject to forfeiture in case of non-completion. This system seems preferable to the method whereby a workman is put on a job of indefinite duration and paid at a specified rate per unit of job completed, with

rate subject to adjustment after short periods of trial.

In the case of a drift, what if the ground does change within a short distance? Let the system have that element of "sporting chance" that exists in all speculations or investments. The average miner is a good gambler, and it will be to his gain today and to the company's tomorrow, according to the operation of the natural laws of compensation, and the company has the banker's advantage.

Be an American Propagandist

THE patriotic advertiser who puts his patriotism into his copy is backing the Government and every boy in the service. Many of our advertisers in this issue have taken the opportunity to show the mining public where they stand. Many have used the cut that appears in this column, and others have devoted their entire space to the war. In one of his speeches President Wilson said we must match German efficiency with American efficiency, and that should apply to



propaganda as much as to anything else. Our advertisers talk to many thousands weekly through our pages, and on every occasion each one has a splendid chance to strike a blow against Kultur and to do his bit by fostering patriotic sentiment.

But let us who are not affected by the draft not deceive ourselves about doing our bit. How much does a man do when he does his bit? Is it the least that will get by? Or, if we have already done something, are we to let it go at that until the war is over? What are the little things we have been called upon to do compared to the sacrifice that many a man is making, whether conscript or volunteer, who places himself completely at the disposal of the country? Let us do all we can to back up the boys at the front and the Government.

U. S. Metals Refining Co.'s Laboratory at Chrome, N. J.

IN THE description by B. B. Hood of the new chemical laboratory at the Chrome plant of the United States Metals Refining Co., which appeared in the last issue, there are two especially interesting features, which, as far as we know, are novel. Mr. Hood says that all the electrolytic copper determinations made in the laboratory are done by women. The woman chemist or assayer is by no means new; one instantly recalls Mme. Curie, the discoverer of radium, and Carrie J. Everson, the pioneer in flotation. But this is the first case that has come to our attention where a large smelting or mining company has turned a definite part of its techni-

cal work over to women (aside from an occasional draughtsman). However, the change is not startling, as routine electrolytic determination, once systematized, is simple, and in a large plant where the work is so distributed that each worker has only few operations it can easily be effected.

The other feature is the type of balance table employed throughout the laboratory. It consists, according to Mr. Hood, of a 10-in. concrete slab, of varying length carried on tiled piers. This construction is said to reduce to negligible amounts all vibration that would otherwise be disturbing. The piers apparently do not pass through the floor, but rest directly on it. Such construction, if as effective as claimed, is superior to anything we have before seen.

The Journal Index

CONGESTION in our printing department has caused a most unfortunate delay in the publication of the Index to Vol. 104, but we are promised that the Index will be completed on March 15 and will be ready for distribution with the issue of March 23.

BY THE WAY

In the life of a mining engineer, there's many a slip twixt the desk and the trip.

A young mining engineer fresh from college was spending his first summer in the mines of northern Michigan. The first few weeks of his time were spent mostly in the company of an old "Cousin Jack" mining captain, from whom he gathered much that was not included in the course taken at his *Alma Mater*. While walking through an old drift on one of the upper levels one morning, a place where the timber was in remarkably good condition considering the length of time it had been standing, he struck his head against the caps several times before he woke up to the fact that it would be well to watch the back and duck occasionally. Wanting to air his increasing knowledge of mining terms, he turned to the old-timer and said, "The hanging is pretty low here, Captain." His companion walked along a bit before he gave any sign of having heard the remark; he stopped, reached into his hip pocket and drew forth a package of Peerless. Then took a generous pinch, placed it in the side of his mouth, rolled it around a little, settled it down in his cheek, spat at a spike-head protruding from an old tie, hit the mark, and said, "No, muh son; the 'anging's alright, but the foot's kind o' 'igh."

A correspondent of the *Evening Sun* offered the following, which each member of the Administration in Washington ought to cut out, paste in his hat, and read every day: "Sits enthroned the Law of Supply and Demand. Gentle in what she permits, firm in what she punishes. Her rule never changes: 'Price regulation creates a scarcity.' From the Corn Laws of England to the Usury Law of New York and down to the little

boy who wanted to eat his pie and have it too, she laughs at all and always has the last word. Her husband is named Commerce—he who always makes his own laws—and of whom Emerson said: 'The philosopher and lover of man have much harm to say of trade, but the historian will see that trade was the spirit of liberty.' She comes of great ancestry, this Queen, Supply and Demand; her mother was the Law of Gravitation; her father a stern old man called Survival of the Fittest, born in the year 2. What care they for such as break their laws, be it legislatures, governments or people? They put them all in the mill which grinds, grinds slowly but awful fine. Here comes her eldest son Experience. He 'keeps a dear school,' said Franklin. Her youngest is a funny little fellow named Gumption. Her daughter is the beautiful Liberty. They all live in a Great Stone Castle called the Fundamental Order of Things, their home, to which we are all invited but few accept. In the gardens by the castle there grow a very rare variety of flowers called Economics. A few in your buttonhole will save you much trouble, but they are out of fashion, and in fact are rather disliked by many today."

Chile recently passed through a colossal petroleum swindle based on alleged petroleum discoveries in the southern or Magellan territories of that republic. About two years ago the *Compañía Petróleo de Patagonia Consolidada* was organized in Santiago with a share capital of 10,000,000 pesos, in 1,000,000 shares of 10 pesos each, and has had "experts" engaged in boring for oil at Leña Dura, about four kilometers from Punta Arenas in the Strait of Magellan. On Nov. 7 great excitement was created on the Bolsas of Valparaiso and of Santiago. A series of telegrams from the workings, following each other in quick succession, gave notice in the names of one Sinclair, the "expert" in charge of the boring operations, and Burr, the local manager, at Punta Arenas, that oil-impregnated sands were being perforated and that shortly afterward the pool had been tapped, the boring having reached a depth of 2010 ft. Oil was surging upward, filling the well and preventing further progress; and this well was reported capable of producing at least 5000 bbl. daily, or words to that effect. "It now develops that 44 boxes of crude petroleum were shipped from Valparaiso," says the *South Pacific Mail*, and "this is alleged to have been injected into the pipes of a pump, working in one of the drill holes, to convince investigators that oil was actually being pumped." During the last two years the share barometer had been fluctuating between 50 centavos and 10 pesos and upward, according to the strength of the odor of mineral oils existing in the imagination of the parties principally interested. With the receipt of the telegrams, "Pategonians began soaring upward and changing hands with unprecedented rapidity. From 7½ to 14 pesos was a journey of a few hours only, a million or so of shares being handled in a few days. At last the bubble burst. The facts began to filter through the maze of exaggerated reports and the two 'experts' in charge of the drilling bolted into Argentina. They were arrested in Rio Gallegos and handed over to the Chilean authorities, charged with putting petroleum into the well instead of taking it out." Some of the Chilean officers of the company at Santiago and Punta Arenas have also been arrested.

NEW PUBLICATIONS

The Geology of the Moonta and Wallaroo Mining District. By R. Lockhart Jack. Pp. 135, illus. Bull. 6, Geological Survey of South Australia, Adelaide, South Australia.

Cost Accounting for Oil Producers. Clarence G. Smith. Pp. 123. Bull. 158, U. S. Bureau of Mines, Washington.

Labor Laws of California. Compiled by John P. McLaughlin, Commissioner. Pp. 268. Bureau of Labor Statistics, San Francisco, Calif.

Technical Analysis of Brass and the Non-Ferrous Alloys. By William B. Price and Richard K. Meade. 5½ x 7½, pp. 376, illus. John Wiley & Sons, Inc., New York.

The second edition of this useful little book presents in a compact form a number of analytical methods applicable to the determination of all of the ordinary metals. In Part III many examples of the analysis of alloys are given, in particular description of methods for analyzing manganese, chromium, vanadium and titanium alloys of copper. Part IV deals with the control and analysis of plating solutions.

Ore Mining Methods; Descriptions of Methods of Support in Extraction of Ore, Detailed Descriptions of Methods of Development of Mines, of Stopping and Mining in Narrow and Wide Veins and Bedded and Massive Deposits, Including Stull and Square-Set Mining, Filling and Caving Methods, Open-Cut Work and a Discussion of Costs of Mining. By Walter R. Crane. 6 x 9, pp. 277, illus.; \$3.50. John Wiley and Sons, New York.

The first edition of this book received a cordial reception, and the present volume, revised and enlarged, will no doubt satisfactorily fill an important need of students and mining men.

Iron Ore Occurrences in Canada. Vol. I. By E. Lindeman, M. E., and L. L. Bolton, B. A. Sc. Pp. 71, illus., with maps. Canadian Department of Mines, Ottawa, Government Printing Bureau, 1917.

This publication possesses special interest at present owing to the greatly increased demand for iron and steel created by war conditions. It embodies information on Canada's iron ore resources and contains descriptions of the principal iron mines, to which has been added as a supplement information concerning the Wabana Mines in Newfoundland. The arrangement is geographical, the grouping being by provinces and their subdivisions. In the investigations particular attention was given to the magnetometric surveying and mapping of deposits of magnetite. Magnetometric and topographical maps accompany the report, which is prefaced by an introductory summary by A. H. A. Robinson, B. A. Sc.

The Principles of Iron Founding. By Richard Moldenke. 6 x 9, pp. 517, illus. McGraw-Hill Book Co., New York.

This book is of special interest to the metallurgist who is in charge of the control work of an iron foundry. It is not a hand-book, but one in which the fundamental principles of iron-making and the closely related industries are so presented as to be of value to the foundryman in his daily work. A brief historical review of the subject is followed by a review of the relation of the foundry to manufacturing enterprise and the organization of a foundry. An outline of the metallurgy of iron and a discussion of the properties of cast iron follow. Somewhat over one-half of the book is given to the classification of Castings, Foundry Raw Materials, Technology of Combustion, Melting Processes, Mixture Making and Testing Cast Iron. In the appendix the Standard Specifications for Gray Iron Castings, the Methods for Sampling and Analysis of Pig and Cast Iron, Standard Methods for Laboratory Sampling and Analysis of Coke and Tentative Methods for Ultimate Analysis of Refractory Materials (American Society for Testing Materials) are given. The long experience of the author and his keen appreciation of the need of careful control in foundry practice make the book an important addition to the literature dealing with the subject covered.

Engineering Chemistry. A Manual of Quantitative Chemical Analysis for the Use of Students, Chemists and Engineers. By Thomas B. Stillman. 5½ x 8¾, pp. 760, illus. The Chemical Publishing Co., Easton, Penn.

There are many physical tests and chemical determinations that are necessary in the examination of materials and raw products used in engineering construction and in the operation of plants. In "Engineering Chemistry" a number of reliable methods have been carefully prepared and described for the use of engineers and chemists. Among the subjects treated are: Analysis of coal and coke, limestone, iron ore, pyrites; commercial sampling of iron ores; analysis of manganese, copper, lead and zinc ores; graphic method of calculating blast furnace charges; foundry chemistry; examination and analysis of steel; alloys; chemical and physical examination of portland cement; concrete; analysis of clay, kaolin, building stones; asphalt; methods of testing coal tar and refined tars; the examination of lubricating oils; fuel oils; ultimate analysis of oils; paint analysis; water and gas analysis; photometry, pyrometry and fuel analysis.

The Principles of Economic Geology. By William Harvey Emmons, Ph.D., 6 x 9, pp. 606, illus. McGraw-Hill Book Company, New York.

The author states in the preface that the volume is an attempt to present to advanced students of geology as briefly as practicable a perspective of the science of metalliferous and non-metalliferous deposits. It includes a series of lectures on economic geology which were offered during the last 10 years at the universities of Chicago and Minnesota. These have been expanded and descriptions of certain mining districts have been added. The work does not include a treatment of mineral fuels, an omission which the author declares to be justified by the development of the geologic branches in the universities. Coal deposits are treated at some length in the text-books of general geology. Petroleum geology is treated in several texts on oil which are no more comprehensive than is desirable in a thorough course in economic geology.

The wise restriction of the field by Dr. Emmons has produced a book which has the advantages of compactness and brevity, and his wide experience and thorough study make the work an especially valuable treatise not only to the student of economic geology but to the mining engineer as well. It is a book which deals with elements or principles, and sufficient exemplification has been given to make them clear. A thorough knowledge of the chemical and physical principles underlying economic geology has enabled the author to systematize his presentation in a commendable way.

The first chapter defines terms, and this is followed by a chapter on the classification of ore deposits. These comprise compact statements of the essential points. Chapters III to X, inclusive, are presented according to an excellent plan. There is first a number of brief paragraphs which give the facts concerning, Occurrence, Composition, Shape, Size and Texture. The general features of the type of deposit are then described. A liberal bibliography concludes the chapter.

Chapter XI describes Primary Oreshoots; Chap. XII, Formation of Ore Deposits; Chap. XIII, Faulting and Folding of the Deposits; Chap. XIV, Dynamic Metamorphism of Ore Deposits; Chap. XV, Superficial Alteration and Enrichment of the Deposits; Chap. XVI, Openings in Rocks; Chap. XVII, Structural Features of Openings in Rocks and of Epigenetic Deposits; Chap. XVIII, Metasomatic Processes; Chap. XIX, Mineral Associations in Veins and Wall-rock Alteration; Chap. XX, Metallographic Provinces and Metallogenic Epochs; Chap. XXI, Composition and Sources of Ascending Thermal Metalliferous Waters.

The remaining chapters deal specifically with Iron, Copper, Gold, Silver, Zinc and Lead, Miscellaneous Metalliferous Deposits and Deposits of the Non-metals.

Dr. Emmons has produced a well-balanced book in a field which presents a rich and varied scientific literature. While there are other valuable works on the subject of economic geology, this volume may justly be said to add to rather than to displace any one of them.

Personals

Have you contributed to the Association for the 27th Engineers?

There is a vacancy in a junior position on the editorial staff of the Engineering and Mining Journal, which is open to a young engineer of distinctly metallurgical education and experience. Applicants should address us in their own handwriting, stating their experience and giving their references. Preferential consideration will be given to those who are able to call in person, but nobody should call without previously making application in writing and awaiting an appointment.

W. de L. Benedict is on his way to California to be absent two or three months.

E. G. Spilsbury Engineering Co. has moved its offices in New York from 45 Broadway to 29 Broadway.

Hon. W. J. Hanna, of Toronto, has been elected president of the Imperial Oil Co., succeeding Walter C. Teagle.

H. S. Robinson, formerly on the staff of the Trethewey mine, Cobalt, Ont., is now with the 105th Engineers, Camp Sevier, South Carolina.

Thomas J. Chope, of Butte, has been appointed commissioner of the department of labor recently organized by the Anaconda Copper Mining Co.

John F. Bauchelle and F. M. Wichman have joined a partnership for the practice of mining and metallurgical engineering, with offices in the Walker Bank Bldg., Salt Lake City, Utah.

W. N. Tanner has been appointed engineer in charge of mechanical operations by the Anaconda Copper Mining Co.; W. N. Woodward, of Great Falls, will have charge of electrical operations.

M. Henri Jequier, metallurgist of the Société Minière et Metallurgique de Penarroya, and Dr. Auguste Hollard, consulting engineer, who are on a metallurgical tour of this country, visited the Washoe smelter of the Anaconda Copper Mining Co. on Feb. 22.

O. H. Reinhold, consulting engineer of the New Dominion Copper Co., at Globe, Ariz., recently paid professional visits to a prospect near Ray and to the New Dominion at Globe, while en route from California to Alabama, where he is spending several weeks in the iron, mica and graphite belts.

Evander B. Schley has been elected president of the Howe Sound Co., succeeding his father, the late Grant B. Schley. The company controls and operates the Britannia Copper Mining Co., in British Columbia. The following have been elected directors: H. M. Hanna, Jr., of M. A. Hanna & Co., Cleveland; Capt. William E. Gelsheisen, of H. J. Baker & Bro.; Charles E. Dunlap, of Berwind, White Coal Co.; and Nelson Robinson.

H. A. Brassert, who has been connected with the U. S. Steel Corporation since its organization, has resigned his position as assistant general superintendent of the Illinois Steel Co. at South Chicago, in order to devote himself to his personal interests. As vice president of the Miami Metals Co. and subsidiary companies, he will have charge of their operations in the production of ferromanganese. Mr. Brassert will also act as consulting engineer for Freyn & Co., engineers and contractors. He will associate himself with Francis H. Hardy and Chester D. Tripp, in the firm of Brassert, Hardy & Tripp, to act in a consulting and advisory capacity on commercial and operating problems in the iron and steel and affiliated industries. Mr. Brassert will remain in Chicago, with offices in the Peoples Gas Bldg. He will be succeeded as assistant general superintendent of South Works by George L. Danforth, Jr., heretofore superintendent of steel production at the works. J. I. Larimer, assistant general superintendent of the Joliet works of the Illinois Steel Co., will take the place vacated by Mr. Danforth.

Obituary

Henry Kehoe, mining engineer, died at Los Angeles, Calif., Feb. 6. He had experience in mining matters in many parts of the West, Canada and Mexico, and had been representative of several different American and Canadian mining companies during the last 25 years. For many years Mr. Kehoe made Spokane his home, removing to Arizona and Southern California in 1915.

Societies

National Association of Waste Material Dealers will hold its annual meeting at the Hotel Astor, New York, on Mar. 19 and 20. The metal division will hold its session at 2 p. m. Mar. 19. F. W. Reidenbach will preside.

American Society of Mechanical Engineers, New York Section, will hold a meeting on Mar. 19 at 29 W. 39th St., New York. Dwight D. Kimball will preside. "New York's Freight Handling Facilities" will be the subject of discussion. The following executive committee has been appointed: John H. Norris, chairman, engineer National Meter Co.; Willard C. Brinton, consulting engineer; W. Herman Greul, Otis Elevator Co.; William W. Macon, editor "Iron Age"; S. M. Marshall, consulting engineer, and Edwin J. Prindle.

Canadian Mining Institute elected the following officers at its Montreal convention on Mar. 6-8: President, D. B. Dowling, Ottawa; vice presidents, J. A. Dresser, Montreal; H. E. G. Haultain, Toronto, and O. E. S. Whiteside, Coleman, Alta.; councillors, Dr. Alfred Stansfield, Montreal; N. B. Fisher, Haileybury, Ont.; Reginald E. Hore, Toronto; E. P. Mathewson, Toronto; S. B. Wright, Deloro, Ont.; Jules Charbonnier, Blairmore, Alta.; W. P. Williams, Bellevue, Alta.; R. H. Stewart, Vancouver, B. C.; George Wilkinson, Victoria, B. C., and W. R. Wilson, Fernie, B. C. At a meeting of the iron and steel men on Mar. 7, called to consider the organization of an iron and steel section of the institute, there was great difference of opinion as to whether it was desirable to organize as a section of the institute or form a separate body. Dr. Alfred Stansfield, of McGill University, presided. A motion of F. H. MacDougall was finally adopted that the society be formed under the auspices of the institute and that provision be made for launching out as an independent organization should it be deemed necessary at any time. The following organizing committee was appointed: Robert Hobson, Hamilton; Col. Thomas Cantlev, Mark Workman, W. C. Franz, Dr. Alfred Stansfield, W. J. Janssen, H. H. Jacquays, J. A. Irwin, C. F. Bristol, Esmond Peck, G. H. Duggan, and P. L. Miller, of Montreal; F. H. MacDougall, Sydney, N. S.; F. Crockett, New Glasgow, N. S.; J. J. Hartley, Kingston; George W. Watts and William Ingalls, Toronto; J. G. Morrow, F. A. Sherman and W. M. Curry, Hamilton; Col. David Carnegie, Ottawa; Capt. David Kyle, Sault Ste. Marie; M. Deakins, Winnipeg; W. F. Robertson, Vancouver; and George McKenzie.

Industrial News

Lewis Searing, vice president and general manager of the Denver Engineering Works Co., makers of mining and milling machinery, has sold his half interest in the company to the Hardinge Conical Mill Co., of New York. He expects to take a few months' vacation before engaging in further activities.

Redwood Manufacturers Co., of San Francisco, has just completed in record time the building and laying of the five-mile hydro-electric power line in Spearfish Valley, South Dakota, for the Homestake Mining Co. The country traversed was difficult. About 25,900 ft. of 52-in. Remco continuous stave redwood pipe was laid on previously prepared grades, in just two months and one week. One mile of the line was laid in two 7 x 7 1/2-ft. tunnels through solid rock. Working two crews daily, a construction speed of 400 ft. per day was made through the tunnels.

Overstrom Manufacturing Co., San Francisco, Calif., announces that the exclusive right, privilege and license to manufacture and sell, in the United States and its possessions, the Overstrom concentrator (Overstrom Universal concentrating table), as covered by application for U. S. patent, Serial No. 132,387, filed Nov. 20, 1916, and the circular arc motion of the table, ruffles substantially parallel to the motion, laminated spring supports, etc., have been granted to George A. Scott, to begin at once in accordance with a contract between Gustave A. Overstrom, Charles V. Craig and George A. Scott. By the terms of this contract, the entire business, assets and obligations of the Overstrom Manufacturing Co., as of Jan. 1, 1918, are assigned to and assumed by George A. Scott, who will continue the business under the name of the Overstrom Manufacturing Co., with principal offices at 607 First National Bank

Bldg., San Francisco, Calif. It is therefore requested that all orders, remittances and inquiries be sent to the latter address, where collections of accounts may also be made.

Trade Catalogs

Graphite Mine Car Lubricants. United States Graphite Co., Saginaw, Mich. Booklet. Pp. 16; 3 1/2 x 6 in.; illustrated.

"What the Erie Is Doing" is the title of a new bulletin issued by the Ball Engine Co., Erie, Penn., which shows the application of the Erie steam shovel to various lines of work. Pp. 10; 8 1/2 x 11 in.; illustrated.

"85% Magnesia" Anniversary Advertising Portfolio, 1917. Magnesia Association of America. Pp. 32; 11 x 13 1/2 in.; illustrated. An assemblage of all the advertising matter regarding this insulator which has been appearing continuously during 1917 in many technical papers. It is a series of careful presentations of the nature and application of 85% magnesia as an insulation for steam pipes and boilers. The educational value of these advertisements in their sequence may be considered to entitle the book to a place in the files of engineers, architects, and extensive users of steam. If any interested reader has not received this portfolio, a copy will be sent him upon his writing to the secretary of the Magnesia Association of America, 702 Bulletin Bldg., Philadelphia, Pennsylvania.

New Patents

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

Aluminum, Treatment of Aluminous Compounds. Howard Spence and William Basil Llewellyn, Manchester, England, assignors to Peter Spence & Sons, Limit d., Manchester, England. (U. S. No. 1,256,605; Feb. 19, 1918.)

Ammonia, Production of, by Electric Discharge in Mixture of Hydrogen and Nitrogen. Alexander Classen, Aachen, Germany. (U. S. No. 1,256,875; Feb. 19, 1918.)

Concentration—Separation of Magnetic Iron Ore from its Associated Non-Magnetic or Feebly-Magnetic Minerals. Daniel M. Barringer, Wayne, Penn. (U. S. No. 1,256,972; Feb. 19, 1918.)

Quicksilver Ores—Continuous Retort for Treating. William H. Landers, New Almaden, Calif., assignor of one-half to Pacific Foundry Co., San Francisco, Calif. (U. S. No. 1,256,703; Feb. 19, 1918.)

Disk Crusher—Edgar B. Symons, Winnetka, Ill., assignor to Symons Brothers Co., Winnetka, Ill. (U. S. No. 1,256,843; Feb. 19, 1918.)

Gold Washing Machine for Saving Fine Gold. Edward Bagley, Vancouver, British Columbia, Canada. (U. S. No. 1,256,764, Feb. 19, 1918.)

Iron Sponge from Iron Ore, Production of. Alf Sinding-Larsen, Vestre Aker, near Christiania, Norway. (U. S. No. 1,256,939; Feb. 19, 1918.)

Miner's Lamp, Acetylene. James Brocker, Collinsville, Ill. (U. S. No. 1,256,770; Feb. 19, 1918.)

Miner's Lamp, Means of Carrying. Luis Smith, Caretta, W. Va. (U. S. No. 1,257,037; Feb. 19, 1918.)

Nitrogen Compounds of Metals, Process of Producing. Mathias Sem, Christiania, Norway, assignor to Det Norske Aktieselskab for elektrokemisk Industri, Norsk Industri-Hypotekbank, Christiania, Norway. (U. S. No. 1,256,935; Feb. 19, 1918.)

Ore Reduction by Action of High Tension (electric) Flame. Sigurd Westberg and Emil Edwin, Christiania, Norway. (U. S. No. 1,256,623; Feb. 19, 1918.)

Zinc-Lead Pigment. A Method of Producing Zinc Lead Pigments from Oxidized Zinc and Lead Ores. James A. Singmaster and Frank G. Breyer, Palmerton, Penn., assignors to New Jersey Zinc Co., New York, N. Y. (U. S. No. 1,257,136, Feb. 19, 1918.)

Zinc, Process of Extracting from Its Ores in an Electric Resistance Furnace. Edvin Andreas Johansson, Trollhättan, Sweden, assignor to Société Anonyme Metallurgique Procédes De Laval, Brussels, Belgium. (U. S. No. 1,256,802; Feb. 19, 1918.)

Editorial Correspondence

SAN FRANCISCO—Mar. 7

Pan-American Petroleum and Transport Co. dividend rate on common stock of a par value of \$50 has been raised from 87½c. to \$1.25 per quarter. This is an increase on the annual rate on the par value from 7% to 10%. Dividends are payable Apr. 10 to stockholders of record Mar. 15 and will be paid approximately one-half in cash and one-half in Liberty Loan 4% bonds. Preferred dividend of 7% is payable Apr. 1 to stock of record Mar. 15.

Union Oil Co. Meeting at Oleum on Feb. 26 re-elected Lyman Stewart chairman of the board of directors and W. L. Stewart, president. R. J. Keown was elected treasurer; he was assistant treasurer for several years. E. W. Clark was re-elected vice president, John McPeak, secretary, and R. D. Matthews, controller. Isaak Millbank was elected director to succeed John Garrigues, who has led the minority shareholders against the Stewart interests. There was no contest.

Snow and Rain Storms in those sections of the state where the greatest damage seemed imminent are reported, with heavy precipitation. In San Luis Obispo County, where cattle were dying for want of feed, there was a rainfall of about seven inches in one week. In Santa Barbara County the precipitation measured eleven inches. At Fresno about seven inches fell. At Bishop, Inyo County, the precipitation of rain in the first half of the week amounted to nearly two inches. The mountains were visited by a good snowfall. In all the southern counties there was sufficient rain and snow to guarantee water for both irrigation and mining. The storm also extended over the entire northern half of the state. In Amador County the seasonal precipitation was 9.85 inches. This is much less than the same period last year, but still it is a guarantee of safety, as in other parts of the state.

The Carson Hill Gold Mines, Inc., is a new organization which has optioned the mines of the Calaveras Consolidated Syndicate at Melones and Carson Hill, and also properties originally owned by James G. Fair, including the Morgan, which in the early days was one of the large producers in the Carson Hill district. The Union mine, also one of the famous properties owned by Senator Fair, is included in the deal. The recent development in this region, including properties in the Carson Hill and Melones districts, has been conducted by the Calaveras Consolidated, under the management of William J. Loring. The development of the Calaveras Consolidated property has been encouraging from the start, and the taking over of the other properties mentioned means the extension of the development methods to these properties in the belief that, combined, the various mines will constitute one of the best producing gold mines in the Mother Lode region of California.

Engels Copper Co. Production in 1917 showed 38% increase over 1916. Mines in Plumas County produced 6,166,487 lb. of copper. Gross earnings were \$1,307,123 and the profit balance, after deducting operating costs and depreciation and mine depletion, amounted to \$317,458, or 18% on the capital stock outstanding. There are outstanding 1,840,000 shares of the total authorized issue of 2,000,000 shares. The outstanding stock was increased during the year. The vital expenditures were: New mill, tramway, air compressors, machine shop, \$552,240; completion of Indian Valley R. R., \$179,000; total, \$731,240. These improvements are complete, which will enable the company to approximately double the production in 1918. Dividends paid in 1917 amounted to \$295,253. Officers and directors elected on Feb. 25 are: Henry Engels, president; F. Klamp, vice president; E. E. Paxton, general manager; O. G. Traphagen, J. F. Humburg and I. J. Truman, Jr., directors; L. A. Bell, secretary.

First Day's Recruiting 139th Engineers in Grass Valley resulted in an enlistment of 10 men. Possibly the fact that the regiment accepts men subject to draft may account for this large number on the first day. No doubt Nevada City will nearly equal that number, and the total from the

two districts it is expected will number 40 or 50 men. At the rate the miners are going into the Army there is likely to be a serious shortage of men for the mines, and in all districts it will be necessary to employ more old men than have heretofore been employed underground. The efficiency probably will be reduced and in many cases the older men who have been idle or who have been engaged in prospecting and developing their own claims have not kept pace with the advance in methods. But the older men are for the most part trained miners and readily fall into the habit of doing the thing that should be done. The engineers' regiment has obtained a number of men who would not have enlisted but would have waited for the draft. This is true largely on account of the men having families dependent upon them and their homes already established. But since they acquired at skilled labor, there is a disposition to make use of the knowledge they have to go to the front.

Borate Deposits in the Saratoga Beds occupying flats around Saratoga Springs, San Bernardino County, are being investigated by Hoyt S. Gale, of the U. S. Geological Survey. There are 25 men in the party. The beds are situated in the northern edge of the county at the southern extremity of Death Valley, the foot of Funeral Range. The beds extend along the north and east flank of the Avawatz Mountains for a distance of about six miles and in some places are about one mile in width, covering over 5600 acres. The wagon road from Daggatt to Death Valley passes along the extreme west end of the district; the road from Randburg to Saratoga Springs passes through the eastern portion of the beds. The Tonopah and Tidewater Ry. is on the eastern edge of the beds and is available at Dumont, about 20 miles south of Zabriskie. The nearest main line station is at Cruzero at the crossing of the San Pedro, Los Angeles & Salt Lake R.R. The Tonopah and Tidewater also crosses the Santa Fé Ry. at Ludlow.

BUTTE, MONT.—Mar. 7

Lectures on Mine Rescue Work by C. A. Allen, of the U. S. Bureau of Mines, and engineer in charge of Rescue car No. 5, stationed near the Leonard mine of the Anaconda company, have been started and will be delivered in a series, free to miners, for the purpose of educating them in the matter of caring for themselves and their fellow workmen in case of injury requiring immediate attention. The lectures are being delivered by physicians, engineers and miners connected with the department, and a diploma will be issued to those who attend the full course of five lectures and take part in the accompanying exercises.

Butte-Detroit Co. is Operating the Ophir mill and is now treating manganese ore from three different properties. The mill will not be up to capacity for several weeks, as improvements have to be made and new equipment installed. The Ophir mine has been unwatered to a depth of 500 ft., and mining is in progress. Manganese ore is being hoisted and as soon as flotation is installed silver-zinc ore will be mined and treated. The Butte-Detroit company has secured a license from the Minerals Separation company for the use of the process, and preparations are now well under way for the treatment of the silver-zinc ore. The Ophir mine is being worked at a depth of 1000 ft., but it is not intended at the present time to unwater the shaft below the 500 level, as all the ore required for some time is available between the surface and that level. The Ophir is rich in silver down to the 500 level, while around the 200 and 300 levels there are valuable bodies of manganese.

Creation of the Office of Labor Commissioner was announced by Anaconda on Feb. 22 and the appointment to the post of Thomas J. Chope, of Butte. It will be the special mission of this new department to establish a closer relationship between employers and employees, and to endeavor to settle all differences of policy by right rather than by might. Another purpose of the new department will be to keep in touch with the men and the condition of the miner's environment, so that greater

coöperation may be obtained. The selection of Mr. Chope for the position was natural on account of his activities in connection with Anaconda.

Anaconda's Operations at Lexington Mine have been resumed, and the company is going to rush the production of zinc. Two shifts are being worked and around 250 tons of ore per day are being hoisted. The Lexington is one of the old silver properties of the district and was worked for several years. Litigation arose with the old Boston and Montana company, and the result was a shut-down. Afterward the late Augustus Heinze secured the property and worked it for a few years. Several years ago the Anaconda company secured and reopened the mine. Last autumn it was closed down. During the time it was out of commission the machinery was thoroughly overhauled and put in first-class condition. While the property is still rich in silver, zinc production is important.

SALT LAKE CITY—Mar. 7

Control of the Daly West mine, at Park City, adjoining the Daly-Judge, has by the vote of its stockholders passed to the latter company, and H. Otto Hanke, president of the Daly-Judge, has been made president of the Daly West also. This valuable ground, which of late years has not been keeping up its past record of production, will be developed with renewed activity, and increased production is likely to result. Among other things, the Daly West mill is idle each year for several months owing to the location of its water supply, which during the winter season freezes regularly. The Daly-Judge has within the last year brought into operation an electrolytic zinc plant for the treatment of concentrates from its own mill. This plant has recently worked out some of the details of the process in use, and is producing a high-grade product. The Daly West ores vary little from those of the Daly-Judge, and the advantages of operation in connection with its more active neighbor can readily be appreciated.

SPOKANE, WASH.—Mar. 5

A 10-Ton Experimentation Plant for the reduction of ores will be placed in operation in Spokane soon by M. C. Knowles and associates of London. The plant will be equipped to test ores for smelting, and concentration, including flotation.

The First Flotation Unit in Oroville district, Stevens County, Wash., is under construction at Nighthawk by the Bender Metals and Milling Co., which will treat custom ores in the district. Arrangements have already been made for the ores of the Rich Bar and Caaba properties.

Reopening of the Northport Smelter by the Day interests has given a decided impetus to mining operations in that district. The plant is now employing 400 men, and its annual freight bill is close to the \$2,000,000 mark. Over 10,000 tons of coal and 40,000 tons of coke are consumed annually, and last year 45,000 tons of lead bullion were produced. The plant has three furnaces, with a capacity of 400,000 tons of charge per year. The ores treated come chiefly from the Cœur d'Alenes, in Idaho, and Republic, Washington.

An Unusually Difficult Piece of Engineering has just been completed by the Riblet Tramway Co., of Spokane, in the installation of a tram for the Laurier Mining Co., in the Laurier district. So rugged is the country that no towers could be erected and not even a telephone line installed, a traction rope being used for the latter purpose. The loading end of the 2900 ft. tram, which is operated by gravity, is 16 ft. higher than the discharge end. It has a daily capacity of 80 tons. The same company is now erecting a plant for the Valley Magnesite company at Valley. Installation will begin as soon as weather permits. Two trams were recently completed for the Elkora mines in the Jarbidge, district, Nevada, one being a half mile in length and the other three-quarters of a mile. Two miles of tramway for the Engels Copper Mining Co. at Engels, Calif., were placed in commission a few days ago. The plant has a capacity of 1200 tons in 24 hours.

WALLACE, IDAHO—Mar. 7

Labor Shortage Continues to be a serious matter in the operation of the mines of the Coeur d'Alene district. This applies particularly to miners, although there is no surplus of ordinary labor. The situation will no doubt be still worse after the next draft. The shortage is explained partly by the large number of men who have volunteered or have been drafted for war service, and partly by the attraction of high wages paid in the shipyards on the coast, which has drawn many men. There is another feature which, while highly commendable, increases the difficulty in getting men for the mines. The mining companies are discriminating more closely than ever in the selection of employees. No man suspected of pro-German taint need apply, and equally determined are the companies to keep the mines free from the criminal and seditious I. W. W. Men are no longer employed with no questions asked, the companies preferring to be short-handed rather than run the risk of getting men in the mines and mills whose purpose is to frame up strikes, practice sabotage.

HOUGHTON, MICH.—Mar. 6

The Michigan Mine Is not Producing Enough Copper to meet expenses of operation, notwithstanding the fact that the ore mined is higher in grade than previous average, and the stock pile ore contains probably 30 lb. per ton, aside from the mass. Underground openings are being extended with the idea of getting enough ore in sight to permit the operation of one head at the Michigan stamp mill, which has never been put into operation.

Isle Royale's Increased Production is coming from the southerly shafts and the grade of ore that is being hoisted is gratifying. Underground developments have proceeded to a point where the real results of the Calumet & Hecla's policy of underground expansion and increased production are becoming evident. Tonnage can increase from now on, and underground openings can easily be kept two years ahead. The first of the new motor-tram locomotives is in use. Others will be installed soon. None of these motors will be installed in the old mine, but all will be used at No. 4, 5 and 6 shafts and at No. 7 when it is deep enough. The cars used hold five tons and the locomotives haul two at a time, making a skip load so that one discharge is sufficient, thus facilitating speed in hoisting as well as speed in tramping.

North Kearsarge Is Now Main Producer for the Osceola Consolidated. Three shafts are working, Nos. 1, 3 and 4, No. 2 having been abandoned two years ago and the ground being mined and hoisted through other shafts. North Kearsarge constantly and regularly increased ore tonnages as South Kearsarge decreased. One shaft only is working at the old Osceola. Mill capacity is 4600 tons normally, which was fully maintained for the first 15 days of January, and then for a week there was an increase to a daily average of 4700 tons. For first time in two years Osceola Consolidated has all the men it needs. It takes one month to educate a new man to become an efficient trammer. The new men recently imported are better than secured at any time within the last year.

IRONTON, MINN.—Mar. 8

Cayuna Range Manganiferous Ore is being experimented upon for the production of spiegel by the experimental department of the Minnesota University school of mines. A 4-ton sample of ore was obtained from the Cuyuna Mille Lacs mine, at Iron-ton, and concentrating and other metallurgical tests are being conducted. With a small electric furnace and a charge of 30 lb. of this ore, spiegel containing 20 to 22% manganese was produced. Initial tests produced a much poorer grade, but later tests were more encouraging. Further attention will be given this furnace work as applied to making products from Cayuna range manganiferous iron ore. The Government is aiding the state in this work and is giving assistance to all states for the beneficiation of ores needed for the conduct of the war. The crude ore on which the test was made contained from 10 to 12% manganese.

JOPLIN, MO.—Mar. 7

Organization of Oklahoma Operators was completed at a recent meeting of the new Tri-State Safety and Sanitation Association, O. F. Brinton, manager Admiralty Zinc Co., was elected president. D. D. Muir, Jr., manager U. S. Smelting Co., was made first vice-president. Vice-presidents elected to represent various sections of the Oklahoma-Kansas field were: W. J. Von Borries, Ralph Tuthill, Temple Chapman, W. M. Merrill, Marshall Draper was elected secretary, and A. E. Bendelari, manager Eagle-Picher Lead Co., was made treasurer after he had declined to be con-

sidered as president. He felt that operators possibly would prefer to have at their head a man from some company not associated with the smelting end of the industry.

Indications of Increased Development operations here this spring are many. The Miami National Lead and Zinc Co. is remodeling the mill at the Hubbard mine, at Badger, Kan., and has bought the Betsy Jane mill, north of Bell Center, near Joplin, and is moving it to the old Kramer mine at Peacock. Neither of these mines has been operated for eight years. O. L. Parry, of Oklahoma City, is president of the Miami National company. David Sayre, of Joplin, is preparing to put drill rigs on a lease recently secured by him at Seneca, Mo. At this place the Okmulgee Mining Co., headed by J. H. McBrayer, of Okmulgee, Okla., has taken over an 800-acre lease obtained through the Chamber of Commerce of Seneca, and will begin drilling at once. Other companies are active here. In Oklahoma the Renfrow Mining Co. has been organized with \$140,000 capital and will develop big tract recently taken over by former Governor Renfrow and associates. C. W. Renfrow, Miami, Okla., president.

ELIZABETHTON, TENN.—Mar. 9

Developments of Manganese Deposits within 25 miles of this point comprise a number of small operations. A. H. McQueen, of Butler, Johnson County, shipped in 1917 some 40 cars of log-washed manganese ore. A. D. Reynolds is putting up a four-log washer at Valley Forge. Donnelly & Donnelly, of Mountain City, Johnson County, have completed and are operating a two-log washer on Doe River, two miles west of Mountain City, and are opening a property in Taylors Valley, Va., near the Tennessee line. The J. Ferd Wright Lumber Co. is operating a washer on the Laurel, four or five miles east of Mountain City, and preparing to put in other plants. Joe J. McQueen is operating a two-log washer three miles east of Butler, while Dr. C. S. Goss is just completing a two-log washer in the "Draught," six miles up the Watauga River from Butler. The Maxwell Manganese Co. has opened a property in Shady Valley, Johnson County, from which it washed with troughs and shipped two cars of manganese. Geo. E. Davis, of Bristol, Va., is washing in a trough in Shady Valley and has shipped four or five cars of manganese. The Maxwell Manganese Co. has opened a property on Powder Branch, eight miles from Elizabethton, and there washed a carload of good ore, which was shipped in November. Henry V. Maxwell is prospecting a property at Blue Springs and expects to equip it later. Meanwhile he contemplates a one-log washer at Hampton, beginning construction next week. W. H. Kemler, of Johnson City, has opened several properties on Gap Creek, Carter County, Tenn., and one or two on Scioto, not far from Unicoi City, Tenn. A. D. Reynolds has built and is operating a two-log washer at Cardens Bluff, and is shipping manganese, while other parties are opening a property on Little Dry Run, four miles east of Butler.

PHOENIX, ARIZ.—Mar. 8

The General Land Office at Washington has given out an opinion through Clay Tallman, commissioner, that it would seem that the failure to file notice of intention to hold a mining claim on or before Dec. 31, 1917, in no way affected the possessory title unless the said claim were relocated between that date and the actual date of filing. This is an important opinion, for it will affect many cases.

Oil Bearing Ground in the Chino Valley, in the northern part of Yavapai County, has recently received an examination by Milton A. Allen, mineral technologist of the Arizona State Bureau of Mines. Indications of oil have been known in this district since 1905. A company known as the Chino Valley Oil and Mining Co. put down a test well. Although there is no log record of this well, an affidavit made by J. I. Wiley states that oil sands containing a high paraffine base oil were found. As no casing was used below a depth of 1400 ft., the well was lost. Recently a number of new companies have been formed to take over locations and leases in the Chino Valley and many individuals have also taken up considerable ground. The Arizona Oil and Refining Co. has a derrick erected half a mile southeast of the well of the Chino Valley Oil and Mining Co. The Arizona del Rio and the United Chino Oil companies have also established themselves and contemplate sinking test wells. The nearest field in which oil occurs in the same geological series as that of the Chino Valley is in the San Juan field of Utah, which lies just north of the Arizona-Utah state line.

TORONTO—Mar. 8

A Reported Find of Silver near Doherty's Siding about 12 miles south of Timagani has created some interest among mining men and more than 50 claims have been staked in the neighborhood. The discovery vein is stated to be about 5 in. wide, carrying high-grade silver ore. Heavy snow interferes with prospecting at present, but the locality is likely to attract many prospectors early in the spring.

Meeting of Mine Managers' Association of Cobalt, recently held, adopted a resolution urging the Provincial Government to provide improved transportation to the Gowganda silver area. The present rate of transportation to Gowganda is \$1 per 100 lb., which considerably handicaps the production of the district. Owing to the stress of war-time conditions, the mine managers do not ask for the construction of a railway, but will be satisfied with a grade or macadamized road.

Molybdenum Property Near Kakabeka Falls, in the Port Arthur district, owned by Ottawa and Montreal capitalists, is to be developed by the Canadian government. Machinery required for the concentration of the ore has been ordered. The ore will be concentrated at Port Arthur and shipped east in a semi-refined condition. It is stated that a large amount of ore is in sight, which is valued at \$50 per ton at the mine, and its development is expected to build up a permanent mining industry in the neighborhood of Kakabeka Falls.

Government Aid in Peat Development in York and Simcoe counties, Ontario, was stated by Hon. G. Howard Ferguson, provincial Minister of Mines, to be receiving serious consideration. The sum of \$100,000 has been appropriated for carrying on an investigation and the services of the best specialist available in England have been secured for investigating new methods of manufacturing peat fuel. The deputations were warned, however, that under the most favorable circumstances peat fuel could not be depended upon to any extent for next winter. The government offers to provide the municipalities with 1,000,000 cords of wood which they can cut under government supervision in Algonquin Park to provide against fuel famine next year.

Greater Agricultural Production may be secured by increasing tile drainage systems. This subject formed the principal topic of discussion at the 21st annual convention of the Western Ontario Clay Workers' Association, held at London, Ont., Feb. 27 and 28, with an attendance of about 50 delegates. Practical addresses on this topic were delivered by Wm. McCready, of Lyons, and A. A. Hallatt, of Tilbury. It was pointed out that last year two-thirds of the tile producers were unable to operate to capacity for lack of labor and fuel, and a deputation was appointed to appeal to the Provincial Government to come to the relief of the industry by securing them adequate supplies of natural gas, coal and labor. The following officers were elected: President, C. S. Parker, London; first vice president, James Holmes, Alvinston; second vice president, Gilbert Armstrong Fletcher; secretary treasurer, Alfred Wehlann, Cairo.

The Temiskaming Mining Co., Ltd., at an adjourned shareholders' meeting, held in Toronto, Jan. 24, continued the fight between the Morgenstern interests and the administration, which resulted in a decisive victory for the latter. Sir Henry Pellatt held proxies which gave him control of the meeting, and when the Morgenstern party introduced a series of resolutions with the object of ousting the present board and changing the policy of the company, they were defeated. The board then secured the adoption of resolutions favoring the payment of dividends at the discretion of the directors, but providing that no dividend should be declared before the annual meeting, Feb. 4, and approving of the action taken by the company on the Hohnauer property. Sir Henry Pellatt announced that he would not accept the presidency of the company or a place on the board of directors, and placed his proxies at the disposal of President Culver.

RIO DE JANIERO—Feb. 15

Electric Smelting of Manganese-Iron Ore in Brazil is being contemplated. A recent concession covering the proposed operations has been granted to a Brazilian syndicate, and the representative, Jonas Pompeia, is now in the United States investigating methods and equipment. The question of electric smelting in Brazil was recently investigated by the government and a monograph on the subject published. The first plant site will probably be in the state of Minas Geraes, in the vicinity of the manganese deposits, where there is abundant water power.

The Mining News

ALABAMA

Jefferson County

MADAGASCAR GRAPHITE CO. (Birmingham)—Organized with an authorized capital of \$200,000, with headquarters in Birmingham. Officers are I. E. Boyette, president and treasurer; W. S. Douglas, vice-president, and C. A. Avant, secretary.

ARIZONA

Greenlee County

ARIZONA COPPER CO.—Under prevailing conditions, the preparation of accounts for the year to Sept. 30, 1917, has been unavoidably delayed. The directors expect to announce the dividend to be recommended at the annual meeting, which will be held as early in March as possible.

Yavapai County

TIP TOP MINE (Crown King)—Under option by an Arizona-Pittsburg syndicate. The erection of a mill is proposed.

CON. ARIZONA S. CO. (Humboldt)—Expect to drill extensively and sink new shaft at Blue Bell mine this summer.

SILVER MUSEUM (Crown King)—In Tip Top district. Being developed by a Buffalo company. H. O. Howard is manager.

ARKANSAS

Baxter County

LONG SHOT (Mountain Home)—Driving prospect tunnel on lead outcrop on Trimble Flat, in north part of county.

Boone County

BEN HARRISON (Zinc)—Opening up lead deposit. Owners, J. W. Baxter and associates.

Marion County

TEMPLE MINING CO. (Buffalo)—Operating on Anna May zinc mine. Preparing to put new mill in operation.

SILVER HOLLOW (Rush)—Started up this week after two months' shutdown due to freezing weather. Working on sulphide orebody. Shipping from Buffalo.

CALIFORNIA

Butte County

BUTTE CONSOLIDATED G. AND S. (Forbestown)—G. H. Homer, president, and H. C. Freeman, secretary, will open offices in Oroville. Reported that this company has developed veins in the Hunter Hill claim carrying ore similar to that of the Gold Bank mine. In addition to the Hunter Hill, holdings include Mammon Queen, Fisher, Fisher East and West Extensions, Tolles, War Eagle, Butte and Grass. It is stated that well-defined veins have been disclosed in four of these claims.

El Dorado County

EL DORADO MINE AND MINERALS CO. (Sacramento)—New corporation, reported to have optioned large lime deposits in Shingle Springs district. Capitalized for \$100,000 by Robert H. Schwab, A. B. Warner, Emerson W. Read, George Peltier and associates. Large amount of prospecting said to have been done, showing high percentage of lime at depths by diamond drill at 300 ft. A steam shovel is grading for railroad spur at easier grade than the Placerville branch of the S. P. R.R. Property to be equipped with modern machinery.

TEDDY BEAR AND HOT SPUR (Placerville)—Property situated seven miles south of the Church-Union; being developed by William W. Miller and John W. Cover and associates of Seattle. Large underground hoist station being cut on Teddy Bear in the breast of the tunnel at the intersection of the vein at 135 ft. below the surface for installation of hoist and pump to be used in sinking the incline on the vein to a depth of 350 ft. Greatest part of the machinery for an air compressor is on the ground.

Mariposa County

RUTH PIERCE (Mariposa)—Development progressing favorably; 35 men on payroll; large proportion of the ore milled is high grade and the mill is running steadily.

MOUNTAIN KING (Mountain King)—The 1400-ft. shaft will be deepened 600 ft..

and extensive development in drifts and crosscuts is planned. Good ore continues to be extracted from the mine, and the mill is running to capacity.

MOUNT GAINES (Mariposa)—Installation of 100-hp. electric hoist completed and improvements made in the mill effecting lower working cost. Electric equipment also installed at the Champion group and management is preparing to operate on broader lines.

Mono County

TANAWAH (Masonic)—Property optioned by E. Chapin Gard, of San Francisco, and Charles H. Ernst, of Pacific Grove. M. A. McClain is the owner. The property embraces 31 claims and is equipped with a 10-stamp mill and cyanide plant; developed by a tunnel 2000 ft. long, which is said to have cut several ledges showing good ore. Reported that equipment will be improved. The same men have also optioned the Star and Great Western and are opening the Mount Petterson, which will probably be consolidated with the Tanawah.

Nevada County

ALLISON RANCH (Grass Valley)—Vigorous work progressing at several points from the 200 to the 1700 level. The new vein discovered a few weeks ago on the 200 level is developing satisfactorily, and the main orebody is producing steady tonnage of payable ore. Unwatering of the shaft is progressing.

CHAMPION (Nevada City)—Reported that this group of mines is producing the largest tonnage of good ore since ownership by the North Star Mines Co. Development of new ground in the deep levels of the Providence shaft has largely increased the ore-bearing area. The improved mill is said to be making a closer extraction and operating costs are lower.

EMPIRE (Grass Valley)—To build a restraining reservoir to impound mill tailings and prevent their flowing into Wolf Creek. Large concrete dam being constructed across a canyon, and it is estimated that sufficient capacity will be thus provided to accommodate the waste for 25 years. The 60-stamp mill is running at capacity, and new areas of good ground are reported below the 4000-ft. level. The Pennsylvania is also said to be producing well, the work being carried on through the Empire shaft.

Shasta County

EL DORADO (Tower House)—Bar bullion shipped to the mint; result of hand-mortaring. Property will be developed with a 2-stamp mill. Mine situated on contact of slate and porphyry; large ledge of low-grade and some high-grade ore.

Siskiyou County

CUB BEAR (Etna)—Construction of mill temporarily suspended on account of severe snow storms. J. J. Luce, general manager of the Siskiyou Syndicate, owner of the property, reports three feet of snow at the mine, which will furnish a large supply of water in the spring.

ORLEANS BAR DISTRICT reported prospect of short mining season owing to lack of snow and rain in the early part of the year. But since then there has been a heavy precipitation of snow and rain all over the state, so that the prospects are good for Orleans Bar placer mines as well as other districts in the state.

COLORADO

Boulder County

POTOSI (Caribou)—Development work has opened good-grade silver ore in this old property. Success here has inspired considerable other work in district.

Clear Creek County

TEDDY BEAR (Lawson)—High-grade silver-lead ore opened recently. Property operated by lessees.

IMPERIAL (Georgetown)—This East Argentine property will be reopened and capacity of mill increased.

BONANZA (Idaho Springs)—Company recently formed to operate this group on

Albro Mountain. Crosscut tunnel will be driven further to cut series of veins.

PRIMOS CHEM. CO. (Empire)—Molybdenum milling plant at Camp Urad nearing completion. Flotation probable. Capacity, 250 tons daily. Enough ore broken in mine now to insure continuous operation.

Gilpin County

CASHIER G. M. CO. (Central City)—New transformers and all machinery in new mill ready for operation. In Pittsburg workings, old 300, 400 and 500 levels cleaned out and retimbered. Considerable milling ore, as property originally worked for shipping plant only. Mecker shaft retimbered to 320 level; incline equipped with counterbalanced tramway from shaft to mill. Golden Wedge to be worked through Pittsburg shaft.

Ouray County

WHEEL OF FORTUNE (Ouray)—To be reopened in spring, and operated along with Revenue properties.

BIMETALLIC (Ouray)—Shipments to be resumed. Ore is copper-silver carrying considerable gold.

WANAKA (Ouray)—To mine pyrite from old working for shipment to acid plant in the central Mississippi region. Intend to mine and sort to grade of 50% sulphur. Expected output, 150 to 250 tons daily. Company is being reorganized. Interest in smeltery at Ouray has been transferred to Thomas W. Crawford and associates, of Denver, who are making negotiations for smelting the ores from the Rico district.

Pueblo County

NORCROSS CHEM. CO. (Pueblo)—Installing a chemical plant near Pueblo. Part of installation to include apparatus for burning 50 tons of Texas and Louisiana brimstone daily to produce the required sulphuric acid. The Kalberry Corporation, of New York, is in charge of the engineering construction.

Saguache County

RAWLEY (Bonanza)—Ground being broken at Shirley, a station on D. & R. G. R.R., for foundations of mill. Seven-mile tramway being built to connect mine at Bonanza.

San Miguel County

LEWIS (Telluride)—Mill operating full time. Flotation making good recovery.

SILVER BELL (Ophir Loop)—Good grade copper-lead ore being shipped from upper levels by lessees.

TOMBOY (Telluride)—Fire on night of Feb. 10 completely destroyed Cincinnati bunk house, timber shed, blacksmith and machine shops. Origin unknown. Damage \$4000, covered by insurance.

BLACK BEAR (Telluride)—Winze to be sunk to 200 ft. below No. 5 or lowest level, and then lateral workings to be driven. Large tonnage of lead-zinc ore developed, and regular production of 150 tons daily.

Summit County

GOVERNOR (Breckenridge)—Mine reopened by lessees; sinking winze from main tunnel level.

JUMBO (Breckenridge)—To be reopened for zinc ores left in old workings at time when of no commercial value.

IRON MASK (Breckenridge)—High-grade lead-silver ore containing gold opened in winze from main adit level. Pyrite and lead-carbonate ores being shipped.

AMERICAN METAL CO. (Buffer)—First unit of molybdenum concentrator ready for operation. Capacity, 250 tons; to be increased to 500 daily when weather permits. Mill connected with crushing plant at mine by 5000-ft. tramway. Over 5000 ft. of development work shows ore, and progressing at rate of 1000 ft. per month; 185 men now employed.

Teller County

QUEEN BESS (Cripple Creek)—This Tenderfoot Hill property making shipments of \$40 gold ore.

KEENER TUNNEL (Cripple Creek)—Entire dump of this Globe Hill mine to be shipped to Portland mill for treatment.

CATHERINE (Cripple Creek)—Operating Last Dollar mine on Bull Hill under lease and bond. Development on 1500 level in low-grade ore.

AJAX (Cripple Creek)—Operated by lessees from Caroline company. Shipping grade ore opened in block 3 at depth of 100 ft. Shipments begun.

FOREST QUEEN (Cripple Creek)—High-grade ore being shipped by lessee Gaylord from shoot opened on 600 level. Good-grade ore also shipped from 700 level.

EL PASO EXTENSION (Cripple Creek)—Operating Index mine under bond and lease; to begin shipping soon. Good-grade ore opened in 150 winze from 900 level. Sub-lessees working on 2nd, 3rd and 4th levels of property.

MICHIGAN Copper

ISLE ROYALE (Houghton)—Increasing daily tonnage to 3100.

CALUMET AND HECLA (Calumet)—Daily tonnage about 1440 for February.

CENTENNIAL (Centennial)—Shipping 630 to 675 tons per day.

MASS CONSOLIDATED (Mass City)—Tonnage fallen off from 1000 to 650 daily owing to crusher troubles.

NEW BALTIC (Houghton)—Stopped raise from 275 level in good grade copper ore; Feb. 28 resumed shaft sinking.

NEW ARCADIAN (Houghton)—Passed through new unidentified lode; width 8 ft., three first feet carried rich copper; No. 8 conglomerate should be reached soon.

MICHIGAN (Houghton)—Now has copper ore averaging as high as 24 lb. per ton. Limited shipments to Winona mill. Ore from Butler lode.

FRANKLIN (Houghton)—No. 2 shaft down to 18th level where plat will be made. Ore shipments averaging 1200 tons daily of general average grade.

SENECA (Houghton)—New vertical shaft down about 60 ft.; drill steel, 12 weeks on road from Pittsburgh, not arrived; 10 men on each of three shifts.

AHMEEK (Ahmeek)—112,000 tons of own rock milled in February in 24 working days. Yield 19.4 lb. per ton. Present rate 4300 tons per day.

NEW ARCADIAN (Houghton)—Plans a drift along the amygdaloid at 1750 ft. depth, where a lateral is running toward No. 6 conglomerate.

COPPER RANGE (Painesdale)—Completed additions and improvements at Baltic mill for regrinding tailings; now changing old plant to conform to new. Using Manganoid balls in Hardinge mills.

BEAR LAKE POOL (Calumet)—Sixth hole found felsite conglomerate. Mineralized holes Nos. 3 and 4; but little copper in Nos. 2 and 5. Results in No. 6 not announced.

MAYFLOWER-OLD COLONY (Houghton)—Shaft now down 240 ft. and sinking rapidly. Surface plant completed. Shaft depth necessary, 2100 ft. to hit lode, from diamond drill exploration data.

FEDERAL SYNDICATE (Calumet)—First hole at Sec. 3-56-34 down 60 ft. in overburden; should cut ledge any time; one mile from Keweenaw waterway, formerly Portage Lake canal.

WOLVERINE (Houghton)—Now trying mules underground. Two now in use; more coming later. Also trying out underground shovel operated by compressed air. Fills a car in 2½ minutes. Experiments to date indicate practicability of the shovel and other mines interested.

MINNESOTA Mesabi Range

OLIVER IRON M. CO. (Mesabi)—Lease on Graham open-pit mine permanently relinquished. Operations abandoned Jan. 1.

MISSOURI Joplin District

ADMIRALTY ZINC (Douthat, Okla.)—Moving Queen Esther mill from Webb City to lease south of Baxter Springs, Kan.

KENTEX (Miami, Okla.)—Preparing to build mill on developed lease near Quapaw. S. C. Kennedy is manager.

MINT (Miami, Okla.)—Plans building mill on lease north of Picher, where five drill holes show good ore. Julius Labsap is manager.

VYANDOTTE (Joplin)—Preparing to build mill on silicate formation south of

Seneca, portion of field heretofore neglected. A. W. Estes is manager.

BETHLEHEM ZINC (Quapaw, Okla.)—Sinking shaft at old Hannibal-St. Joe mine, and according to developments will tear down old mill and rebuild. Company has 160 acres under lease and sub-lease. Tom Wade, of Marlow, Okla., is president.

TENNESSEE (Joplin)—Has opened up north shaft of Klondike property and making rich recovery. Soft ground; timbering necessary. W. F. Fox has resigned superintendency to go to war. R. H. Allen is manager and part owner.

LITTLE MARTHA (Joplin)—Lost compressors, hoists, boiler, blacksmith shop, garage, change house, pump and other equipment in fire on Mar. 5. Unknown origin. Mine good producer and plant to be reequipped.

KELTNER (Picher, Okla.)—Building mill east of Picher, where development in one shaft now to ore level is promising. Dump shows 24% blende and 6% galena. Second shaft being sunk. Plant to be well equipped for saving fines, having complete sludge plant, with Dorr thickener and two frothing machines.

ST. REGIS (Joplin)—Moved 600-ton derrick on rollers about 50 yd. to new shaft at mine near Joplin. Believe saved several hundred dollars over razing and rebuilding. New shaft showing well in ore. Excellent strike also in shaft near Montreal mine, at Douthat, Okla. E. R. McClelland, Kansas City, is president.

MONTANA

BARNES KING DEVELOPMENT CO. (Kendall)—In January North Moccasin treated 1984 tons of ore, assaying \$7.12 per ton, producing bullion valued at \$14,839. Piegan-Gloster and Shannon in Lewis and Clark County, treated 4572 tons of ore, producing bullion valued at \$70,607. Gloster shipped 1496 tons, assaying \$6.44, and Shannon 3049 tons, assaying \$15.73 per ton.

Silverbow County

BUTTE AND ZENITH CITY (Butte)—Has suspended operations as result of unsatisfactory development work. Shaft was sunk to 1500 level.

ANACONDA (Butte)—Lexington mine resumed operations with crew of 250 men. Mine is one of company's foremost zinc producers. Between 250 and 300 tons a day are expected to be produced.

NEVADA

Nye County

TONOPAH ORE PRODUCTION for week ending Mar. 2, 1918, amounted to 10,581 tons, of an estimated value of \$179,877. Producers: Tonopah Belmont, 2400 tons; Tonopah Mining, 3800 tons, Tonopah Extension, 2012 tons; Jim Butler, 479 tons; West End, 1295 tons; MacNamara, 540 tons; miscellaneous, 55 tons. The tonnage and bullion production of the Tonopah Extension for January was: 8877 tons milled; 862.2 oz. gold; 87,320 oz. silver; net profit, \$13,459.

MANHATTAN CONSOLIDATED (Manhattan)—Cutting station at 500 ft. point in shaft.

UNION AMALGAMATED (Manhattan)—Shaft lowered three rounds below the level for sump. One shift per day replacing rails and pipe in the shaft; but three shifts are now at work in the shaft bottom.

WHITE CAPS EXTENSION (Manhattan)—Limestone now crosscut 27 ft. from hanging wall. Block probably 100 ft. thick and oxidized stringers appear. No ore expected until footwall of limestone is reached.

WHITE CAPS (Manhattan)—Development of new section of east orebody. Connection made to the second level. New ore 30 ft. between walls of good mill grade and partially oxidized. To be mined by shrinkage system.

Storey County

ALPHA AND EXCHEQUER (Gold Hill)—Joint west crosscut advanced 10 ft. through porphyry and quartz; total distance 110 ft.

CALEDONIA (Gold Hill)—Work of repair in shaft and main drifts and removing pipe, track and other material from unused portions of mine was begun.

MEXICAN (Virginia)—North lateral drift on 2300 extended 15 ft.; face in porphyry and stringers of quartz. Mill crushed 351 tons Union ore, average assay value \$29.93 per ton; 68 tons Union wedge rock sampling \$8.82 per ton; 111 tons Ophir ore sampling \$11.19 per ton.

UTAH

Juab County

TINTIC SHIPMENTS for week ended Feb. 22 amounted to 192 cars.

IRON BLOSSOM (Silver City)—No. 1 shaft approaching 2200 level objective point, and some pumping necessary. Permanent water level probably below 2200 ft.

TINTIC STANDARD (Eureka)—New blower of capacity 35,000 cu. ft. of air per minute installed on 1300 level. Shipped two cars daily week ended Feb. 22. Wagon road somewhat heavy from mud.

Salt Lake County

MICHIGAN-UTAH (Alta)—Output for 1917, 12,014 tons, as compared with 3319 tons in 1915 and 6991 tons in 1916. Metal content of ore in 1917 was 227 oz. gold, 148,317 oz. silver, 384,906 lb. copper and 1,865,379 lb. lead.

Summit County

PARK CITY SHIPMENTS week ended Feb. 22 amounted to 4,818,080 lb. of ore and concentrates.

ONTARIO (Park City)—Shipping large tonnage of second-class ore. Shipments, 1,830,000 lb. week ended Feb. 22, heading list of Park City shippers. Indications on 1600 level promising.

Uintah County

UTAH OIL SHALE (Salt Lake)—Company owning large acreage of oil shale land in Uintah Basin organized. J. R. Murdock is president and Jesse Knight vice president.

VIRGINIA

Augusta County

CRIMORA MANGANESE CORPORATION (Crimora)—The larger mill, remodeled with new-type disintegrator, McLanahan-Stone and Woodbury jigs, is being tuned up; capacity of 50 tons per day of washed ore expected to be reached. Smaller mill again operating with coal fuel; after shutdown last summer, it operated during last quarter of 1917 with wood fuel. The 2-cu.yd. dragline excavator for the larger mill is to be supplemented with increased tramming facilities and a steam shovel to bring mining capacity up to 1200 cu.yd. daily. W. L. Hogg, superintendent.

CANADA

British Columbia

CONSOLIDATED M. & S. CO. (Trail)—May erect a new concentration plant at Nelson; but no definite decision expected immediately.

CANADA COPPER CORPORATION (Princeton)—Speeding advance of 9 x 11-ft. main haulage tunnel, which will underlie outcrop at 1000 ft. Present length over 3000 feet.

Ontario

DAVIDSON (Fort Matachewan)—Taken over by Otisse interests.

NEWRAY (Porcupine)—Work by the Crown Reserve and Dominion Reduction companies on this property has been stopped.

TECK-HUGHES (Kirkland Lake)—During January the mill ran 80% of possible time, and treated 2177 tons, of an average value of \$8.62 per ton.

CHAMBERS - FERLAND (Cobalt)—Drifting on body recently found advanced 35 ft.; and face still in ore-vein maintains width of 4 to 5 in. and stated to have high silver content.

FISHER (Kirkland Lake)—Three veins uncovered, showing good gold content. Shaft down 22 ft. Crosscutting to be done at 50 and 100 ft. levels.

GUS FRANKER (Porcupine)—Three claims sold by L. G. Harris to Canadian and New York interests, which are organizing a company known as the Beaumont Gold Mines. Property situated west of North Davidson.

VENEZUELA

MAGNESITE PRODUCTS CORP. (New York)—To begin operations soon on island of Margarita. Recently acquired control from American company previously operating. Charles E. Doddridge is president.

AUSTRALIA

Tasmania

ELECTROLYTIC ZINC CO. (Risdon)—Completed erection of its 10-ton plant near Hobart. Expect daily capacity of 15 tons. H. W. Gepp is general manager.

New South Wales

BARRIER ROASTING CO. (Broken Hill)—Erecting works for treatment of zinc concentrates prior to shipment to Electrolytic Zinc Co.'s works.

The Market Report

SILVER AND STERLING EXCHANGE

Mar.	Sterling Exchange	Silver		Mar.	Sterling Exchange	Silver	
		New York, Cents	London, Pence			New York, Cents	London, Pence
7	4.752	8 1/2	42 1/2	11	4.7525	86	42 1/2
8	4.7525	8 1/2	42 1/2	12	4.7525	86 1/2	43
9	4.7525	8 1/2	42 1/2	13	4.7525	86 1/2	43

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

Mar.	Copper		Tin		Lead		Zinc
	Electrolytic	Spot	N. Y.	St. L.	N. Y.	St. L.	St. L.
7	*23 1/2	†	7 1/2	7.15			7 1/2
8	*23 1/2	†	7 1/2	@7.20			
9	*23 1/2	†	7 1/2	@7.20			
11	*23 1/2	†	7 1/2	7.15			7 45
12	*23 1/2	†	7 1/2	@7.17 1/2			@7.47 1/2
13	*23 1/2	†	7 1/2	7.15			7.40
				@7.17 1/2			7.37 1/2
				@7.17 1/2			@7.40

*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 17.5c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 13c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

Mar.	Copper		Tin		Lead	Zinc
	Standard	Electrolytic	Spot	3 Mos.		
7	110	110	125	319	316	29 1/2
8	110	110	125	319	316	29 1/2
9						
11	110	110	125	320	317	29 1/2
12	110	110	125	322	320	29 1/2
13	110	110	125	322	320	29 1/2

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at \$4.7515, £29 1/2 = 6.2576c.; £54 = 11.4543c.; £110 = 23.3333c.; £125 = 26.5151c.; £260 = 55.1513c.; £280 = 59.3937c.; £300 = 63.6362c. Variations, £1 = 0.2121205c.

Metal Markets

NEW YORK—Mar. 13, 1918

Again the metal markets were devoid of features of interest. With the fixed price for copper, the absence of any supply of Straits tin, and the deadly dullness in spelter, there is not much to be said.

Copper—The refiners are limping along at greatly reduced capacity owing to a multiplicity of troubles. The present

monthly production is not more than two-thirds the average rate in 1917.

Copper Sheets are quoted at 31 1/2c. per lb., f.o.b. mill, for hot rolled, and 1c. higher for cold rolled. Copper wire is quoted at 26 1/2c. f.o.b. mill, carload lots.

Tin—There is still no supply of spot Straits. Without any doubt, \$1 per lb. would be paid if any were to be had. The chief feature of interest this week was the interruption of prompt cable service to the East, making it difficult to do business for tin in that quarter; wherefore Chinese and Banka tins for future delivery rose in this market.

With Jan. 9, 1918, we ceased quoting the spot market in Straits tin, for the reason that there was then a complete disappearance of supply and no longer any market. Persons who are interested in tin have asked us, however, to name an average price for January for statistical and settlement purposes, with the understanding that such a declaration is necessarily arbitrary. We have obtained a good deal of information respecting the transactions of the jobbers who still had supplies and were able to furnish tin in lots of less than five tons, and we obtained collateral evidence from transactions in classes of tin other than Straits. As a result of this inquiry, for statistical purposes we adopt 85 1/2c. as the average spot price for Straits tin in New York in January, 1918.

Lead—A moderate tonnage of business was done at 7 1/2c., New York, and from 7.20c. down to 7.15c., St. Louis. Since Saturday, the St. Louis market has exhibited an easier tone.

Zinc—In the early part of the week a moderate volume of business was done at 7 1/2c. In the latter part there was more business, but at reduced prices.

Zinc Sheets—\$15 per 100 lb., unchanged.

Other Metals

Aluminum—No price other than the Government price of 32c. per lb. for lots of 50 tons or more quoted. Sales and inquiries are few. Practically no market since Government price was fixed.

Antimony—The market is easier, although there were some large Government inquiries. Otherwise, there was very little demand. There is much antimony for sale, wherefore the softness of the market. We quote spot at 13 1/2c., and futures, at 12c., c.i.f., in bond.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at \$3.35 per lb. for wholesale lots—500 lb. and over. The market is quiet.

Cadmium—This metal is quoted at \$1.40 @1.75 per lb., depending on the quantity.

Nickel—Steady at 50c. per lb., premium of 5c. per lb. for electrolytic.

Quicksilver—Easier at \$115@125, the latter being the asking price of the producers' agents. There are said to be no large stocks of the metal on hand, but the market is rather unsettled out of fear of Governmental interference. San Francisco reports, by telegraph, \$117.50.

Wah Chang Mining and Smelting Company, Ltd., a corporation of China, announces that the exclusive right to sell antimony, tin, tungsten, zinc, lead and other products of the Wah Chang Mining and Smelting Company, Ltd., in the United States, has been given to the Wah Chang Trading Corporation, a corporation of the State of New York. It is expected that this change will offer opportunities for better service to its customers.

Gold, Silver and Platinum

Gold—The Federal Reserve Board reported March 8, that in the four weeks ending Feb. 15 exports of gold amounted to \$2,977,000, chiefly to Mexico, Venezuela, and Central America. Imports were \$3,103,000, mainly from Canada, Mexico, and Central and South America. Since last July 13, net gold exports have been \$116,059,000, but they have been dwindling

steadily for several months under the influence of the exports license rule and the efforts to conserve the gold supply in this country by discouraging foreign shipments.

The reserve board explained that it does not look with favor on proposals by importers to have Federal Reserve banks engage actively in foreign exchange business or to provide some other Governmental mechanism for furnishing foreign exchange.

Negotiations still are being conducted with foreign governments looking to regulation of exchange rates. Agreements of this nature with India and Argentina recently were announced.

The general stock of money in the U. S. on March 1 totaled \$6,351,548,056; of this sum, \$3,041,643,270 was in gold coin and bullion, \$568,269,513 in standard silver dollars, and \$222,805,182 in subsidiary silver.

Silver—Owing to the demand from San Francisco for China, silver has been ruling higher. This demand is likely to continue for several weeks, according to the most recent advices. Offerings are rather limited; shipments last week to London were about 645,000 ounces.

Mexican dollars at New York: Mar. 7, 68; Mar. 8, 68 1/2; Mar. 9, 68 1/2; Mar. 11, 69; Mar. 12, 69 1/2; Mar. 13, 69 1/2.

Platinum—Quoted nominally at \$108, but sales are made conditional upon Governmental release. The nominal price in London is £20.

Palladium—Unchanged at \$140.

Zinc and Lead Ore Markets

Joplin, Mo., Mar. 9—Blende, per ton, high, \$66.56; basis 60% Zn, premium, \$65 @ \$62.50; medium to low, \$60 @ \$50; average basis, \$57.50; calamine, per ton, 40% Zn, \$40 @ \$38. Average selling prices: Blende \$56.51; calamine, \$40.03; all ores, \$55.60 per ton.

Lead: high, \$91.45; basis 80% Pb, \$88 @ \$86; average selling price, all grades of lead, \$86.57 per ton.

Shipments the week: Blende, 8500; calamine, 336; lead, 1702 tons. Value, all ores the week, \$639,060.

One smelting company reports 120 carloads of ore in transit. This company loaded out a trainload of seventeen cars the week. Other smelting companies have been following this practice for several weeks. Shippers report cars coming a little more freely each week. Buying, however, lacks sufficient competition to make a strong market.

Platteville, Wis., Mar. 9—(By Telegraph) —Blende, basis 60% Zn, \$61 base for premium grade down to \$57 base for second grade. Lead ore, basis 80% Pb, \$85 per ton. Shipments reported for the week are: 2153 tons blende, 200 tons galena and 1126 tons of sulphur ore. For the year to date the totals are: 20,888 tons blende, 923 tons galena and 5970 tons of sulphur ore. During the week 3185 tons blende were shipped to separating plants.

Other Ores

Antimony Ore—There is said to be buyers in the market at around \$1.75 per unit.

Manganese Ore—Metallurgical ore is unchanged at \$1.20 @ 1.30 per unit of 48 o/o grade and upward.

Molybdenum Ore—Market demoralized owing to principal buyers having withdrawn, while there are considerable supplies on the way. No sales were reported, and the offerings of sellers were so much at sixes and sevens that no quotations can be established.

Pyrites—Spanish lump is quoted at 16 to 17c. per unit, on basis of 10s. ocean freight, buyer to pay express freight and war risk, except that, depending on conditions, concession of 2% of war risk may be allowed. Ship tonnage promises to grow scarcer.

Tungsten Ore—High-grade scheelite was sold for spot delivery at \$24 @ 24.50 per unit. Wolframite was unchanged at \$20 @ 24, according to grade.

Lake Superior Iron Ore—In January many reservations, practically contracts, were made for Lake Superior ore for the coming shipping season; and there has been some further activity in the last fortnight. Prices are on the 1917 schedule, based on \$5.05 for Mesabi non-bessemer at Lake Erie dock. Prices are subject to revision by Mar. 31, but it is improbable any change will be made. Stocks on Lake Erie docks Mar. 1 were 9,515,221 tons, against 10,689,592 tons Feb. 1 and 8,449,839 tons Mar. 1, 1917. Light shipments have been due to traffic conditions, and ore interests regret that so large an accumulation awaits the resumption of Lake shipments.

Iron Trade Review

PITTSBURGH—Mar. 12

The news since the last report indicates a larger current output and denotes a still larger possible output in the near future. At the same time there is no material increase in the demand and there is an increased possibility that within a month or two supply will exceed requirements in several branches of the finished-steel trade. Meanwhile the producers are hoping that the War Industries Board will decide to extend the present set prices after Mar. 31 and to the end of the year. At the same time it is recognized that competitive conditions may develop in some products whereby open market prices will decline below the set levels.

The Institute reports 2,289,901 gross tons of steel ingots as produced in February by 29 companies which in 1916 made 88.14% of the industry's entire output. This would indicate a rate of production for the industry in February of 33,500,000 tons per annum, a large increase over the rate in January, and as production in the early part of February was especially light, the present rate of production is probably 37,000,000 or 38,000,000 tons. An important fact is that ingots have been accumulating lately, it being impossible, on account of traffic conditions, to roll and ship all the finished steel that could be produced from the ingots. As transportation conditions improve it will be possible to increase shipments.

Since the first of the year shipments of finished steel have been limited by ability to ship rather than ability to produce. In addition to the accumulation of ingots there has been a little accumulation of pig iron. This week car supplies in the Connellsville coke region are by far the largest since last October and a further increase in pig iron production is thus pre-empted. With these factors in operation, there are fewer who expect steel to continue scarce.

Pig Iron—There has been no material increase in pig-iron production in the last fortnight, but a further increase is expected in a week or two as a result of the heavier coke shipments promised for this week. Furnaces are meeting the demands of regular customers in nearly all cases. The market is quiet with a few sales of prompt carloads and a little contracting for the second half subject to price adjustment on unshipped tonnages in case the Government prices are altered. The market remains quotable at the set prices: Bessemer, \$36.30; foundry and basic, \$33; malleable, \$33.50; forge, \$32, i.o.b. furnaces, freight from Valleys to Pittsburgh being 95c.

Steel—There continues to be considerable enquiry for soft steel billets and sheet bars, with mills unwilling to quote. Shell-discard steel remains in fairly plentiful supply, with few takers. Set prices for soft steel remain as follows: Billets, \$47.50; small billets, \$51; slabs, \$50; sheet bars, \$51; rods, \$57.

Ferroalloys

Ferromanganese—The market is very firm, with no sellers quoting under \$250, delivered. Producers are well sold up for the next four months and are believed to have enough ore on hand to produce all the alloy they have sold for this year's delivery.

Coke

Connellsville Coke—Car supplies on the Monongahela R.R. were 80% of ratings yesterday and 70% today, by far the best supplies since October. Last week averaged only 43%. The producers will probably ship a considerable tonnage of coke that has accumulated in the last few weeks. Coke loaded in Peoria & Lake Erie cars is usually readily obtainable in the open market, though coke in other cars remains scarce. The set prices rule: Furnace, \$6; foundry, \$7; crushed, over 1-in., \$7.30, per net ton at ovens.

STOCK QUOTATIONS

N. Y. EXCH.†	Mar. 12	BOSTON EXCH.*	Mar. 12
Alaska Gold M.	1	Adventure	1
Alaska Juneau	80	Almeek	90
Am. Sm. & Ref. com.	106	Altonah	25
Am. Sm. & Ref. pf.	92	Allouan	52
Am. Sm. Sec. pf., A	92	Ariz. Com., cfs.	13
Am. Zinc	45	Arnold	20
Am. Zinc, pf.	45	Bonanza	20
Anaconda	63	Butte-Balkiava	25
Batopilas Min.	1	La Saluda	3
Bethlehem Steel	92	Calumet & Hecla	430
Bethlehem Steel, pf.	80	Centennial	13
Butte & Superior	22	Copper Range	45
Butte Cop. & Zinc	10	Daly West	1
Cerro Pasco	30	Dav. Daly	1
Chile Cop.	16	Fast Butte	6
Chino	41	Franklin	6
Colo. Fuel & Iron	38	Granby	77
Crucible Steel	63	Hancock	8
Crucible Steel, pf.	89	Hedley	12
Dome Mines	8	Hettrick	15
Federal M. & S.	11	Indiana	1.85
Federal M. & S. pf.	30	Isle Royale	21
Great Nor., ore ctf.	28	Keweenaw	1
Greene Cananea	40	Lake	6
Gulf States Steel	80	Mason Valley	5
Homestake	80	Mass.	6
Inspiration Con.	44	Mayflower	1
International Nickel	29	Michigan	2
Kennecott	32	Mohawk	63
Lackawanna Steel	73	New Archdian	2
Mexican Petrol.	96	New Idria	17
Miami Copper	31	North Butte	15
Nat'l Lead, com.	54	North Lake	25
National Lead, pf.	100	Oldway	1
Nev. Consol.	18	Old Dominion	40
Ontario Min.	7	Oscoda	59
Ray Con.	23	Quincy	72
Republic & S. com.	79	St. Mary's M. L.	53
Republic L. & S. pf.	97	Santa Fe	1
Sloss-Sheffield	55	Seneca	11
Tennessee C. & C.	16	Shannon	5
U. S. Steel, com.	90	Shattuck-Ariz.	16
U. S. Steel, pf.	109	So. Lake	1
Utah Copper	79	So. Utah	15
Va. Iron C. & C.	65	Superior	4

N. Y. CURB†	Mar. 12	BOSTON CURB* Mar. 12	
Big Ledge	1	Alaska Mines Corp.	12
Butte & N. Y.	.75	Bingham Mines	19
Butte Detroit	1	Boston Ely	70
Caledonia	.48	Butte & Mont.	64
Calumet & Jerome	1	Butte & Lon'g Dev.	14
Can. Cop. Corp.	2	Calaveras	1
Carlin	12	Calumet-Corbin	1.01
Cashboy	2	Chief Con.	2
Con. Ariz. Sm.	2	Crown Reserve	10
Con. Coppermines	5	Crystal Cop.	41
Con. Nev.-Utah	1	Eagle & Blue Bell	2
Emma Con.	2	Gila Copper	17
First Nat. Cop.	2	Houghton Copper	1.75
Goldfield	1	Intermountain	1.70
Goldfield Merger	.04	Iron Cap. Com.	17
Greenmonster	4	Mexican Metals	47
Hecla Min.	4	Mines of America	1
Howe Sound	4	Molybdenum	.05
Jerome Verde	4	Nat. Zinc & Lead	27
Kerr Lake	5.30	Nevada-Douglas	.90
Louisiana	1.50	New Cornelia	16
Magma	.37	Oneco	.20
Majestic	.29	Pacific Mines	1.35
Marsh	.07	Rex	.10
McKee-Dar-Sa.	11	Yukon Gold	1
Milford	1.12		
Mohican	1.25		
Mother Lode	.39		
N. Y. & Hond.	112		
Nipissing Mines	8.45		
Nixon Nevada	1		
Ohio Cop.	1		
Rawley	12		
Ray Hercules	4		
Richmond	1.60		
Rochester Mines	34		
St. Joseph Lead.	15		
Standard S. L.	40		
Stewart	25		
Success	10		
Tonopah	3		
Tonopah Ex.	1		
Tribulation	3.12		
Troy Arizona	18		
United Cop.	40		
United Verde Ext.	22		
United Zinc	12		
Utica Mines	1.08		

SAN FRAN.*	Mar. 12	SALT LAKE* Mar. 11	
Alta	.03	Bannack	1.26
Andes	.08	Cardiff	3.75
Best & Belcher	.03	Colorado Mining	.08
Caledonia	.05	Daly	1.40
Challenge Con.	1.03	Daly-Judge	6.00
Confidence	.04	Empire Copper	11.10
Con. Virginia	.29	Gold Chain	.08
Gould & Curry	.01	Grand Central	.35
Hale & Norcross	.02	Iron Blossom	4.45
Jack-Cr. Ft.	.07	Lower Mammoth	1.03
Mexican	1.60	May Day	.02
Ophir	.12	Moscow	1.02
Overman	.02	Prince Con.	.52
Sierra Nevada	.16	Rico Milling Con.	1.16
Union Con.	.96	Silver-King Coal'n.	2.67
Utah Con.	1.01	Silver King Con.	2.25
Belmont	3.20	Sioux Con.	.02
Jim Butler	.64	So. Hecla	.50
MacAmara	.13	Tintal Standard	11.35
Midway	.08	Uncle Sam	1.01
Mont.-Tonopah	.13	Walker Cop.	.50
North Star	.05	Wilbert	.08
Rescue Eula	.08	Yankee	.05
West End Con.	.79		
Atlas	.04		
Booth	.04		
Comb. Frac.	1.02		
D'field Daisy	1.02		
Florence	.13		
Junco Extension	.14		
Kewanas	.07		
Nevada Hills	.07		
Nevada Packard	1.25		
Round Mountain	.40		
Silver Pk.	.04		
White Cap	4.80		
Big Jim	1.75		
United Eastern	4.62		

TORONTO* Mar. 11	
Adanac	.09
Balloy	1.05
Beaver Con.	.26
Chambers Ferland.	.09
Coniagas	3.25
Hargraves	.06
La Rose	3.11
Peterson Lake	.09
Temiskaming	.26
Wettlaufer-Lor.	.04
Davidson	.34
July 45	.09
Dome Lake	.23
Hollinger	5.00
McIntyre	1.38
Newray	.21
Porcu. Crown	.18
Teck-Hughes	.50
Vipond	.25
West Dome	.11

STOCK QUOTATIONS—Continued

COLO. SPRINGS Mar. 11	LONDON	Feb. 22	
Cresson Con.	4.93	Alaska G. F.	20 10s 6d
Doctor Jack Pot.	.03	Burma Corp.	4 7 6
Elkton Con.	.04	Cam & Motor.	0 1 6
El Paso	.14	Camp Bird.	0 8 0
Gold Sovereign	1.02	El Oro	0 9 3
Golden Cycle	1.72	Esperanza	0 9 3
Granite	.40	Mexican Mines	5 12 6
Isabella	.06	Min. Corp. Can.	0 17 3
Mary McKinney	.06	Nechi pd.	0 10 0
Portland	1.05	Oroville	0 18 6
United Gold M.	.15	Santa Gert'dis.	0 13 3
Vindicator	.34	Tomboy	0 18 9

* Bid prices. † Closing prices. ‡ Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1916	1917	1918	1916	1917	1918
Jan.	56.775	75.630	88.702	26.960	36.652	44.356
Feb.	56.755	77.585	85.716	26.975	37.742	42.792
Mar.	57.935	73.861	87.597	27.597	36.410	44.356
Apr.	64.415	73.875	80.662	36.963	35.477	37.940
May	74.269	74.745	81.060	39.065	39.065	39.065
June	85.024	76.971	80.000	40.110	40.110	40.110
July	62.940	79.010	81.498	43.418	43.418	43.418
Aug.	66.083	85.407	82.584	50.920	50.920	50.920
Sept.	68.515	100.740	82.361	44.324	44.324	44.324
Oct.	67.855	87.332	84.192	43.584	43.584	43.584
Nov.	71.604	85.891	86.410	43.052	43.052	43.052
Dec.	76.765	85.960	81.315	40.851	40.851	40.851
Year	65.661	81.417	81.315	40.851	40.851	40.851

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

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

Tin	New York		London	
	1917	1918	1917	1918
	January	44.175	(a)	196.813
February	51.420	(a)	198.974	311.526
March	54.388	(a)	207.443	311.526
April	55.910	(a)	220.171	311.526
May	63.173	(a)	245.114	311.526
June	62.053	(a)	242.083	311.526
July	62.570	(a)	242.181	311.526
August	62.681	(a)	243.978	311.526
September	61.542	(a)	244.038	311.526
October	61.851	(a)	247.467	311.526
November	74.770	(a)	274.467	311.526
December	87.120	(a)	298.556	311.526
Av. year	61.802	(a)	237.563	311.526

(a) No average computed.

Lead	New York		St. Louis		London	
	1917	1918	1917	1918	1917	1918
	January	7.626	6.782	7.530	6.684	30.500
February	8.636	6.973	8.595	6.899	30.500	29.500
March	9.199	9.120	9.120	30.500	30.500	29.500
April	9.288	9.158	9.158	30.500	30.500	29.500
May	10.207	10.202	10.202	30.500	30.500	29.500
June	11.171	11.122	11.122	30.500	30.500	29.500
July	10.710	10.644	10.644	30.500	30.500	29.500
August	10.594	10.518	10.518	30.500	30.500	29.500
September	8.680	8.611	8.611	30.500	30.500	29.500
October	6.710	6.650	6.650	30.500	30.500	29.500
November	6.249	6.187	6.187	30.500	30.500	29.500
December	6.375	6.312	6.312	30.500	30.500	29.500
Year	8.787	8.721	8.721	30.500	30.500	29.500

Spelter	New York		St. Louis		London	
	1917	1918	1917	1918	1917	1918
	January	9.619	7.836	9.449	7.661	48.329
February	10.045	7.814	9.875	7.6		