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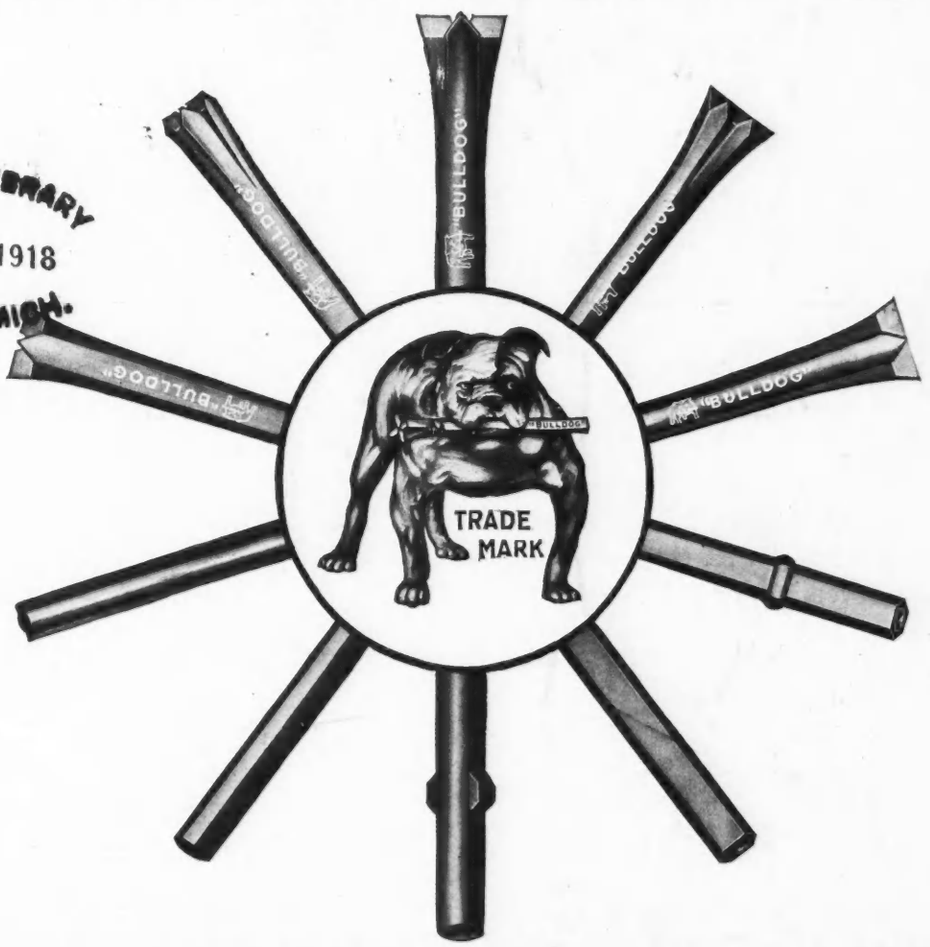

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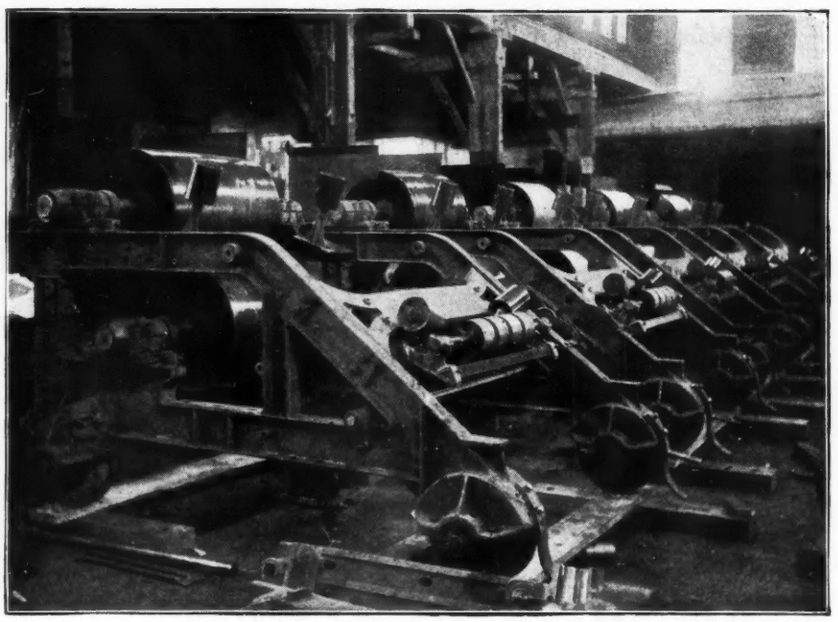

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WALTER RENTON INGALLS, *Editor*

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*Illustrated article

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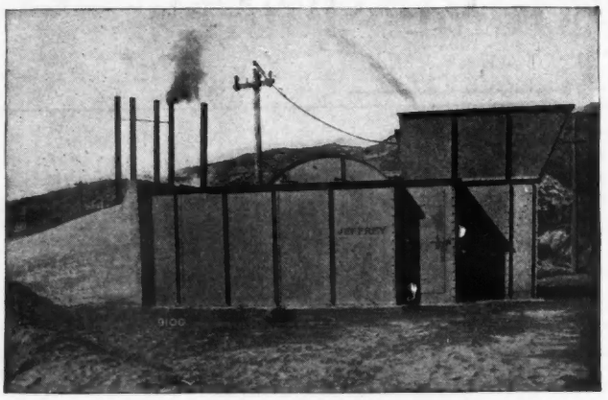

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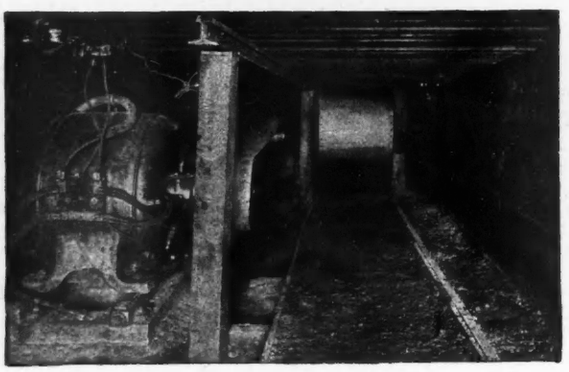

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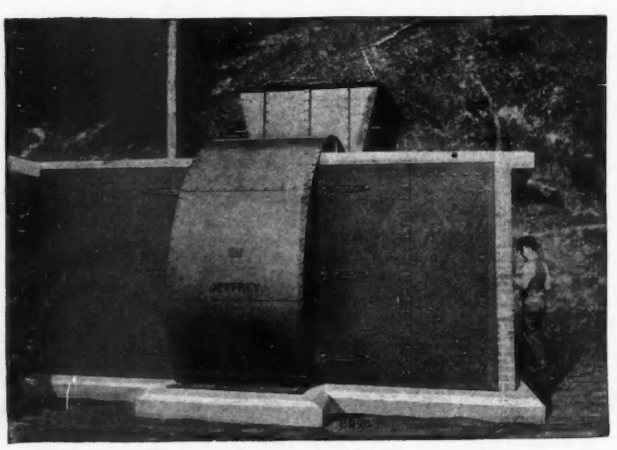

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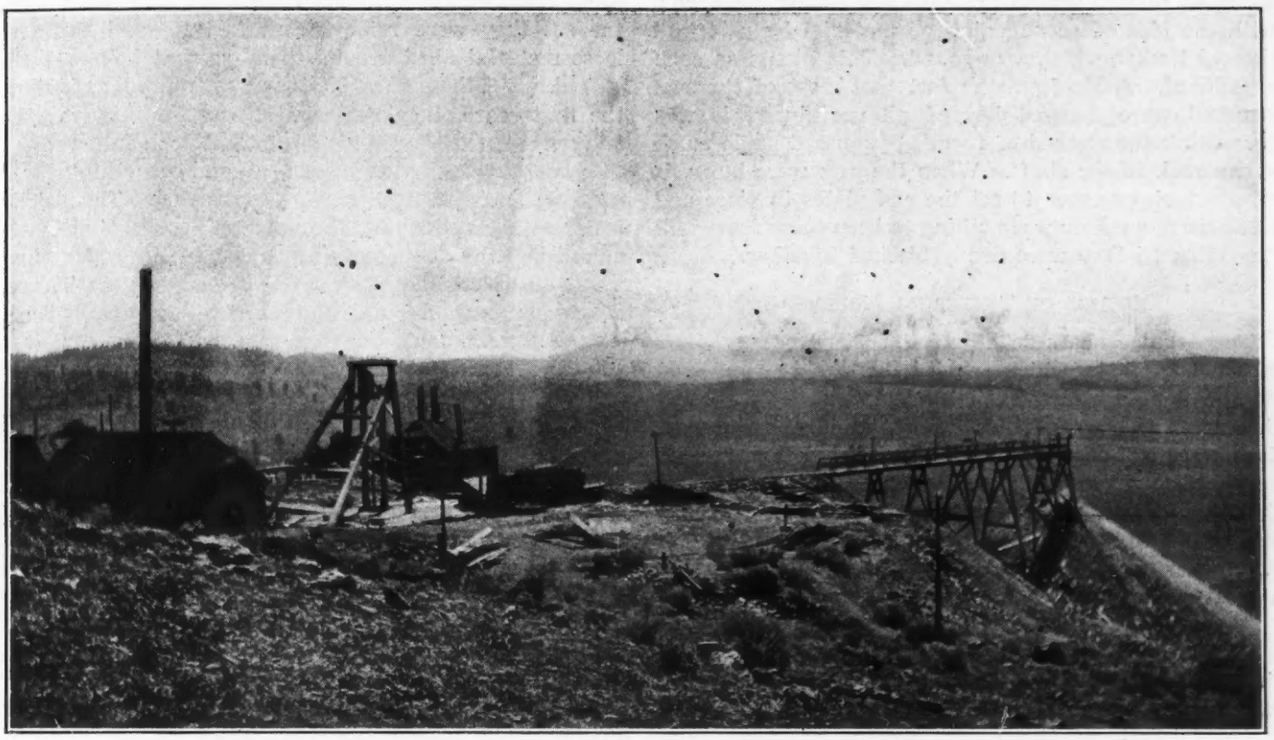

GOLDEN EAGLE MINE SHAFT AND HOIST HOUSE, WITH MILL IN BACKGROUND

Reopening the Golden Eagle Shaft

BY F. DEAN BRADLEY*

The shaft at the Golden Eagle mine at Haydenhill, Calif., was reopened early in 1917 after being neglected since 1912. Caving had occurred throughout the greater part of its depth, and the old timber was practically worthless. Retimbering was done with few mishaps and at low cost.

AFTER several years of idleness, the Golden Eagle mine at Haydenhill, Calif., was reopened[1] in 1917. Up to 1915, repair work had been done on the levels to keep them open, but the shaft had been neglected except for such work as was imperatively needed. The mine was under water to about the 600 level. The sump was a little below the 800 level. The workings were open during the summer of 1916 to a point below the 300 level, but had been closed for a year or more between the fourth and fifth levels, to what extent it was not known.

The exceedingly wet winter and spring of 1916 and 1917 created serious difficulties underground, as well as on the surface. When the reopening of the mine was undertaken, in the late spring of 1917, it was found that further caving had taken place around the 100 level, although the shaft was still open. Bulkheads had been built across the manway compartment on all levels, and in both compartments on the 400 level, before the mine closed down. Other than these few facts, little was known of the real condition of the shaft.

The old timbers near the surface were badly out of line, but an average was established with a plumb line, and the new collar and headframe were set to that. The collar was about 16 ft. above the natural slope of the ground, so that removal and replacement of the superstructure were comparatively easy. Examination of available sets gave evidence that most of the timber above the water level would have to be renewed, and, as it would be necessary to use green timbers throughout, it was decided to make them as light as possible by cutting the size to 8 x 8 in. whenever an entirely new

*With National Metals and Chemical Co., San Francisco, Calif.

[1]The mine has been closed since this article was written.

set was placed, instead of the 8 x 10 in. formerly used.

The old sets[2] were framed with a dovetail, the wall plates extending about six inches beyond the end plate, forming a joint like that commonly used for the divider in the ordinary method of framing. The post daps were only ½ in. deep, which was found unsatisfactory as work proceeded. Many of the old posts had slipped out of their pockets because of the shallowness of the latter. Framing of the new sets was started in the same way, with the idea of economizing on material by using all the old timber which was sound. This plan was soon abondoned. Aside from the fact that most of the sets removed were decayed beyond all usefulness, it was found that the method of framing proposed made much extra work in the shaft. When the sets were hung, it always took two men to set the end plates in place and block them, as there was nothing to keep them from falling out until they were firmly blocked together.

Method of Timbering Modified

The regular shaft set,[3] having a horn on each end of all four plates, which enabled them to be supported by the hanging rods until blocked, was adopted and thereafter the work moved more rapidly. The post daps were cut one inch deep, and, behind the lagging, keyboards of 2 x 8-in. timber were used. It was thought that this would give the same strength in timber as the sets of 8 x 10-in. stuff, except that the lagging stood in two inches nearer the shaft on all four sides and saved a great deal of unnecessary trimming, where the ground had squeezed in or the new line crowded the wall.

In all cases where the ground had caved, the old timbers were utilized for filling, so that no pressure came against the lagging. This was found to be a serious defect in the old timbering. Sawed 2-in. lumber was substituted for the split lagging formerly used; the latter was about six inches wide and of variable thickness, blocks or wedges being required for each piece, and could not be used after adopting the key board. There were several thousand of these cut during former operations, and it caused much regret at first that they could not be used, but they subsequently became valuable, as will be shown.

Delicate Problem Encountered Near 100 Level

Most of the timber, though badly decayed, stood firmly in place, and, in the beginning, the working platform was put on the set below that which the men were removing. All went well until near the 100-level station. A reconnaissance had been made of this section, a bulkhead placed on both sides of the shaft, and other measures taken to prevent serious accident, should more caving occur. The inspection showed two sets out above the level and 10 or 12 tons of rock on the bulkhead in the manway. The station timbers were sound and the station was open.

The problem was considered delicate but not impossible. The only way it could be safely approached was by proceeding from the top. There was no way to dispose of the waste in the manway, and any disturbance of it there might start a run from above. The station was only half the width of the shaft, the other side being bulkheaded and filled. The fallen timbers had lodged crosswise in the shaft, so that the mass appeared substantial and not likely to fall out unless disturbed. Safety ropes were provided for the men in case any movement took place.

About 4:30 o'clock in the afternoon of the day when the top of the cave was reached, the platform, on which two men were standing, suddenly settled and dropped them about two feet onto the muck. At the same time, the set they were removing pushed in, and the soft loose material filled around them, so that help was required to get them out. Neither was injured, and, after the first scare, they returned to work. This was the only warning that was given of what soon followed.

There was no further movement, and everything stood well until after the men were extricated. The debris had been cleaned down, the bulk of the old timber removed and the new secured by the hanging rods, when about 10 o'clock in the evening, as suddenly as before, the whole mass of rock, timbers and supports beneath the men went down, leaving the shaft open for over 100 ft. below. One man was standing on a wall plate and the other grasped a safety rope when he felt the platform moving, but no one was injured. This was the nearest approach to a serious accident that occurred during the entire progress of the shaft work.

An examination of the damage showed the shaft to be stripped clean of timber to within about 30 ft. of the 220 level, where the fallen material had lodged. The station at the 100 level remained open, although all the timber in the shaft at this point was gone. A large hole had opened on the west end of the shaft, where the cave had started, but probably not over 30 tons of rock had come out. The weight of this on the bulkhead, however, had been sufficient to break the old timbers supporting it, and those below, being half rotten, could not stand the impact when they fell. None of the new timber had been disturbed.

Shaft Caved From 500 to 300 Level

A swinging platform was then suspended from the solid sets above, a few more sets of hanging rods were installed, and work proceeded as before. From this point to the 220 level a set was placed every shift. It was necessary to crib from the 220-level station to about 20 ft. above it, as the station supports were gone. This landing was caught up and reopened, and work was resumed in the shaft on the somewhat perilous footing offered by the caved material. Every precaution was taken to safeguard the men in case the material should break through into the open shaft. The miners relaxed their tension, however, as the work proceeded on down past the 300, to 400, and, at last, the 530 level, before any sign of timber in place appeared. It subsequently developed that the caving had started at the fifth level and had continued upward, a section at a time, until it was well above the 300 level. This was determined by the occurrence of the caved material in layers of timber, large boulders and fine rock, in their respective orders, followed by succeeding series lying in the same way.

After passing the 220 level, the whole north side of the shaft became loose, so that blocking would not hold. Until the 300 level was reached, the old timber mixed with the rock served to hold it in place long enough to

[2]This type of set, shown in Storms' "Timbering," being used at the Argonaut shaft.

[3]See Storms' "Timbering," p. 79.

permit placing stulls between the solid ends to block against. There was enough solid ground at the 300 level to hold bearers, and the timber was well anchored there. From that point, however, the ground grew heavier and contained less old timber to bind it. About eight sets below, the cave opened out to include both ends, leaving only one solid wall on the south side. Here was encountered the first real difficulty.

Ground Too Heavy for Shaft Sets Used

Six sets of hanging rods had been in use from the 100 level down. As is the usual practice, the top one was removed as each new timber set was swung. New material was ordered, but was delayed in reaching the mine. Every bolt or scrap that could be welded to make a rod of sufficient length was used to make hanging rods. Forepoling had been resorted to as soon as the loose material would no longer stand, and the angle

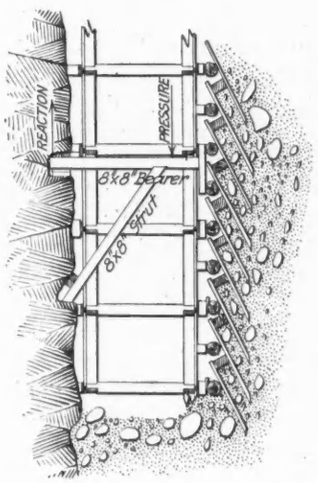

FIG. 1

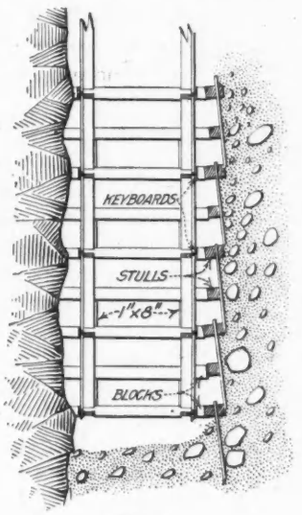

FIG. 2

taken by the spiling into the caved rock apparently allowed enough surface to be exposed to downward pressure to throw a heavy vertical strain on the stulls, which, in turn, communicated their forces through the blocking to the timber sets. These were taking weight to such extent that the washers on the top rods were cutting deeply into the wall plates. It was apparent that no more rods could be moved. On the other hand, there was no place an ordinary bearing timber could be set. To stop work and wait for material for hanging rods would cause the loss of most of the crew, which had been secured with considerable difficulty. The situation called for emergency treatment.

Cantilever Bearer Set Remedies Trouble

In former years I had had experience in bridge work, and believed that a cantilever could be employed in this case. The rock of the south wall, as stated above, was solid and stood almost vertically. In this two hitches were cut, the lower to take an angular strut from above; the upper in the form of a niche with top and bottom bearing (Fig. 1). A horizontal bearer was inserted in the latter, the strut meeting it about 12 in. inside the north wall plate so as to form an overhang and transmit the pressure from the north side in such a manner that the south end reaction would be upward against the top of the rock niche. The north end of the bearer was then blocked to the stulls, whose side pressure naturally prevented its revolution about the inclined strut.

As it was necessary to go several feet above the lowest set to find solid bearings, it was not possible to line these braces with the timbers, so two of them were placed inside the end plate and divider in the manway compartment. The braces in no way interfered with the operation of sinking, and, when solid bearings were at last secured on both sides of the shaft, they were removed so as not to obstruct the passage for air pipe or other equipment. The settling on the north side stopped immediately after these braces were blocked, and it was possible to take out the hanging rods for the sets below. The arrival of the iron later obviated the necessity for resorting to this treatment again.

From the 400 level, where the last bearing timbers were placed, to the 530 level there was little solid rock. In places, all four sides of the shaft were loose and had to be spiled all around. Where this was necessary the outside lagging was reinforced half way by an additional stull, or bridge, which, in turn, had to be supported by the shaft sets. To overcome undue pressure on the sides of the posts at these points, additional reinforcement was jumped in between the end plates of the two sets (Fig. 2).

In order that the supply of dry split lagging, which was adopted for spiling, might not be exhausted, the spiling was driven with two- or three-inch spacing, except where the rock was too fine. This, of course, necessitated lagging the shaft timbers to secure the shaft against falling rocks, so a modification of the ordinary method of bridging was made. This is shown in Fig. 2, where it appears that the spiling bear against an outer bridge instead of against the wall plate, as would be the case if they had been placed tightly together. The saving in spiling as compared with Fig. 1 is noteworthy.

Few Accidents Mar Work's Progress

No stoping had been done below the 530 level, and the ledge was far enough from the shaft to cause no damage from sloughing, so from here to the water level, a distance of 565 ft., the work became more or less of a routine order. Timber in place was found one set above the water, where a mass of loose timber was lodged, forming a perfect mat for the caved material. The débris penetrated to about 10 ft. below the water surface. Beneath the surface of the water the old timbers were sound, although considerably out of alignment. It was unnecessary to replace them, so it was easy to bail water and repair from here on.

About 40 ft. from the sump, the material which had escaped the self-constructed bulkhead was encountered and had to be shoveled out. The shaft was very wet after its several years of soaking, but, aside from being uncomfortably warm, the work during the last few shifts was not troublesome. The entire job was completed with only minor injuries to four or five employees, nearly all of which could have been avoided with proper care on the part of the men. In connecting the new with the first few sets of old timbers, the plumb lines showed a difference of ¼ in. at the ends and 1½ in. at the sides, which was somewhat remarkable considering the approximate starting point for the collar.

Not the least interesting feature in connection with his work was the cost. Though it is hardly to be claimed that the job would have been undertaken had the facts been known, the following figures are the best proof of the results obtained as compared with the cost of sinking a new shaft: Direct shaft costs, including foreman, timber, fuel, and necessary materials, $14,497.87; general overhead expense for seven and one-half months, $3,781.17; total cost, $18,279.04. Total shaft recovered, 810 ft.; direct cost per foot, $17.89; total cost per foot, $22.57.

The Golden Eagle shaft has one manway and one hoisting compartment, each 4 ft. 8 in. by 5 ft. 8 in. in the clear. The sets are 5 ft. 2 in. between centers and are fully lagged. It is believed that to have sunk a new shaft of the same dimensions and as well timbered, with the present prices for labor and supplies, would have cost well over $30 per foot.

Molybdenite Near Falcon Lake, Manitoba

The report of the Canadian Geological Survey for 1917 contains a paper by C. L. Bruce on the region near Falcon Lake, Manitoba, near the Ontario bondary, where occurrences of molybdenite have been found and claims have recently been staked. Falcon Lake drains into Shoal Lake, and thence flows south into the Lake of the Woods. During the summer Falcon Lake may be reached from Ingolf, on the Canadian Pacific Ry., by canoe through Long Pine and West Hawk Lakes, and also by way of the Falcon River from Shoal Lake. Through the winter months connection may be made with the railway by road.

The country shows the typical, broken, lake-dotted character of the pre-Cambrian period, and has somewhat greater relief than most areas having similar rocks. The oldest rocks consist of a volcanic complex of schists and ellipsoidal-weathering greenstones, involved in which are certain areas of sedimentary rocks, which have not yet been separately mapped. The volcanics, and probably the sediments as well, are intruded by a fresh, reddish to gray granite-gneiss, which forms the country rock to the northwest and southeast of the narrow belt of basic rocks between West Hawk Lake and Falcon Lake. West of Finnel Lake, which lies just north of Falcon Lake, there are many areas of ellipsoidal-weathering greenstone.

On the northwest side of the basic belt, near the Keewatin-Laurentian contact, a large number of pegmatite dikes of all sizes cut the older formation. Most of these are entirely within the schist and greenstone, but the largest one visible may be the pegmatitic edge of the main body of gneiss. The pegmatites occur in a belt lying parallel to the approximate line of contact between the two formations, and, though not continuous, form a zone about two miles long north of Falcon Lake. It is along this zone that claims have been staked for molybdenite. The pegmatites consist principally of a pink-weathering feldspar and quartz, some of the rocks being almost entirely feldspar, though others appear to grade into typical quartz veins. Muscovite is a common constituent of the pegmatites, and beryl is found, although rarely. Some molybdenite occurs in most of the pegmatite dikes, and one sample showed native bismuth associated with the molybdenite. The molybdenite is found with the following physical characters: (1) As a constituent of typical pegmatite dikes; (2) in equigranular granitic dikes, and (3) in quartz veins.

In the typical pegmatite dikes, the molybdenite occurs as crystals, varying from a fraction of an inch up to two inches in diameter. The size of the larger individuals seems to vary according to the distance of the dike from the parent granite mass, the larger crystals being found in the dikes close to the edge of the main granite area. In these dikes, however, the total amount of molybdenite present is not greater, and possibly is even less, than in those further from the intrusive. In the equigranular dikes the molybdenite crystals are much smaller, occurring in small hexagonal plates. In quartz veins molybdenite flakes are found in veinlets traversing the quartz. The molybdenite-bearing quartz veins are not large and contain too little of the mineral to make them workable, even if they were of sufficient size. The equigranular dikes carry more molybdenite than the other types, but all those seen were too small to be important.

In the pegmatites it is difficult to obtain an idea of the proportion of molybdenite. The crystals are scattered irregularly through the quartz and feldspar, so that a face showing no crystals may show several when a thin layer has been broken off. Ordinary sampling under such conditions is worse than useless. The only method of forming an accurate estimate of the content of a vein is to remove and mill a large quantity. Judging from dike material broken from the face of a small open cut, the molybdenite content is less than 0.25%. At this place the dike is from 2½ to 3 ft. wide and has been open cut for 20 ft. to a depth of 3 ft. The pegmatitic material breaks easily, and a small quantity of almost pure molybdenite could no doubt be produced by cobbing such material, but it is doubtful whether this could be done economically with a product of such low grade as this seems to be. However, the accessibility of the district, the large number of well-exposed dikes varying from 2 to 12 ft. in width, and the ease with which a considerable quantity of the material could be taken out, without expensive mining machinery, make it possible that this prospect might be commercially worked at this time.

The molybdenite content will probably continue constant, but the depths to which the dikes extend cannot be foretold. As they undoubtedly join the parent mass of granite below, the depth from the surface to which they reach depends upon the altitude of the granite, to be ascertained only by drilling or underground work.

Wolfram in Bohemia

Tungsten ores are now being mined successfully from old mines in Zinnwald, Bohemia, that had formerly been abandoned, according to a German periodical quoted in *Commerce Reports*. The production of wolfram ore in Austria prior to the war was negligible, but the old mines in the Zinnwald district alone have since 1914 yielded 93,000 metric tons of wolfram ore. Nearly all the ore is shipped across the border to Saxony to be smelted.

Standardization of Mining Methods II—Standard Machine-Drill Rounds*

By CHARLES A. MITKE†

The purpose of the article is not to deduce a new principle but to present an outline of a course of procedure followed by a mine organization in the development and adoption of a standard machine-drill round, which, with slight variation, would be suitable for all classes of ground. Results obtained from old types of drill rounds were considered, and, by careful experimentation, a design was evolved which accomplishes a maximum advance for the amount of drilling done and the explosive consumed.

THOUGH different operations connected with the driving of drifts and raises are important, in that they have a bearing on the cost, they are, nevertheless subordinate to the actual drilling. Success in drilling depends largely on the type of machine-drill round which is used, and involves a number of important questions, such as the "depth of round to be pulled" (advance), "placing of the cut," and "direction and number of holes necessary."

Too Little Consideration Given to Cost of Breaking Ground

The character of machine rounds is of the greatest importance as well as being a determining factor in the cost of breaking ground when drifting and raising, but it is, in a great measure, left to the individual judgment of the miner, who follows the old-time method employed in hand drilling and places his round according to the slips, fractures, or crevices which appear in the face of the rock. This he believes to be of the utmost importance, the only other worthy consideration being the number of holes to be drilled. If the ground does not break satisfactorily, more holes are considered necessary, and the prevailing idea, not only among the miners but among many shift bosses and foremen, is that the principal factor governing the breaking of ground is the number of holes drilled, without special regard to the direction in which they are driven, except that their position is determined by the faults and slips occurring in the face. In fact, it is a common practice, in cases where a drill round does not break, for the foremen and bosses to order the miner to "put in more holes," without making mention of the direction or depth they should be driven.

An estimate of the average advance per round in ordinary ground would be from 3½ to 4½ ft., with 5 ft. considered good work. At present, practically all rounds are drilled from 6 to 18 in. deeper than the actual advance made. Many miners drill 5 ft. per round, but the total footage made at the end of the month will average only 3 ft. per round. This is due almost entirely to the character of the round.

In rounds where the advance is far less than the ground drilled, the fault in nearly every case lies in the position of the cut holes, as the round will usually break no deeper than the depth of the cut holes, regardless of what depth the other holes are drilled. Consequently, on the position and depth of the cut holes depends the distance of advance of the round.

Earlier Types of Piston Drills Responsible for Lower Position of Cut Holes

The old type of piston drill, with which many miners gained their first experience in machine drilling, is responsible for the placing of the cut holes in the bottom of the drift, as it was necessary to point the holes downward, although this is a difficult position from which to break the ground when the round is blasted. Experience has proved to the miners that it is possible to break the ground with this type of round; therefore it is hard for them to believe that a round having the cut holes placed in some other position may give not only equally good results, but even better, and do more toward removing all the ground drilled than was possible with the old type of round. No round is advanced more than the depth of the holes drilled, but the purpose in working out a standard round is to determine upon the type which, under average conditions, will break all of the ground drilled, in both short and deep rounds. By accomplishing this, the average footage per man per shift would be considerably increased, and this would necessarily result in a decrease in cost.

Standard Round Customary in Tunnel Work

The realization of the advantage of evolving a standard round, though comparatively novel in mining, is not new in tunnel work, in the performance of which rounds are usually driven on contract, and it is to the interest of the contractor to develop a round that will remove the most ground with the least drilling and a minimum amount of powder. Remarkable results have been obtained in tunnel driving, as, for example, in the work at the Mount Royal tunnel, in which a record of 810 ft. per month was established; in operations by the Arizona Copper Co., showing 799 ft. per month, and by the Laramie-Poudre, 653 ft. per month; and at the present time a tunnel is being driven in the Southwest that averages 20 ft. per day, or 10 ft. per shift. Though the advance secured by the use of deep rounds in tunnel work cannot be attained in small mining drifts, nevertheless a type of round may be used which will show a material average increase in the footage over records made with the old type of rounds.

Development of the Standard Round

Some time ago, in an effort to secure a type of round which would break practically all of the ground drilled and which might be considered as a standard for average conditions, a number of experiments were made at the Copper Queen mine. These were carried on in all

*The second of a series of articles which began in the Nov. 9 issue.

†Mining engineer, Bisbee, Arizona.

kinds of ground and under varying conditions, so as to establish a basis for a round which could be adopted as standard.

One of the difficulties encountered in conducting these experiments was the opposition of the older men who had been mining from 15 to 25 years. "I have been mining for 20 years, and none of these young fellows 'round here can tell me how to put in a round"; "These blueprint rounds can only be drilled in the office on paper, but not in the mine underground," and similar expressions reflect the opposition that the proposition encountered. However, when it was properly explained to the men that the company would assume all responsibility in regard to breaking the ground, and that if the round failed there would be no discredit to the miner, they did their best with the particular round in question and afterward frequently presented other types of rounds with which they desired to experiment. Another obstacle which had to be overcome was the objection of the men to the use of one type of round in all classes of ground, regardless of fractures, water courses, faults and other irregularities encountered. In their opinion these variable conditions required special types of rounds, the position and number of holes varying according to the situation of the fractures and faults in the face, all of which should be taken into account.

Experimental Types Used in Development of Standard Round

Some of the experimental types of rounds which have been tried out should prove of interest. Fig. 1 represents the old type of 12-hole round, with the cut holes placed at the lower part of the drift face. The machine column and arm, upon which a No. 18 Leyner was mounted, is diagrammed at the right. The height of the arm above the bottom of the drift was 7½ ft. when the back hole was drilled. It was lowered 1 ft. for the three breast holes, then lowered to 6 ft. in height for the next six holes, and finally the machine was lowered as far as possible for the two lifters. This round was drilled in average ground. Fig. 1A is a side view of the same round, and shows where the holes bottomed when the round was drilled 6 ft. in depth. However, when the shots were fired, the actual advance at the drift was only 4 feet.

Another drift was begun in somewhat harder ground, and the round shown in Fig. 2 was tried out. The lay-out is almost identical with that shown in Fig. 1, although the miner who did the drilling claimed he was using an absolutely new design of round. The results obtained were similar to those secured in the round shown in Fig. 1.

Fig. 3 shows a round used in softer ground, and consequently a fewer number of holes were required. The round was drilled to a depth of 5 ft. The actual advance was only 4¼ feet.

A 13-hole round drilled in hard ground, with the depth to which each hole was drilled, is shown in Fig. 4. In blasting, a 50-lb. box of 40% gelatin was used, and 3½ ft. of ground was broken, leaving the face well squared up.

The nine-hole round shown in Fig. 5 was drilled in uniformly soft porphyry. In one drift 4.4 ft. of advance was made during each of 10 consecutive days, 5¼ ft. being the average depth of each round. Sixty sticks of 30% gelatin per round were used in this instance.

Fig. 6 shows the plan followed in a 13-hole round that was used in a number of drifts driven in good average ground, the arrows in the face showing where the holes bottomed. One drift showed an advance of 5½ ft. for 13 consecutive days. This type of round represented something new for the miners, and they first ridiculed it by calling it a "blueprint round." However, when the men discovered the footage which they could make by this arrangement of holes, they did not hesitate to use it in their work.

Fig. 7 shows a 14-hole round, which was used in hard ground. The rounds described in Figs. 2 and 4 were tried in this exceptional ground, but as a rule the advance was equivalent to half what it should have been for the ground drilled. In the round shown in Fig. 7 the advance was nearly always equal to the total ground drilled.

Fig. 8 shows a 13-hole round used in a number of drifts in average ground. In one drift 8-ft. steel was used, and the drift was advanced 7½ ft. for a period of 15 consecutive days. The cut holes usually met in the center. On one occasion after the holes were drilled the angles were measured and plotted, as shown in the drawing. When this round was fired it was advanced 7¾ feet.

Standard Machine-Drill Round for Drifts

Figs. 9 and 9A show the types of rounds which were finally adopted as standard, and both represent slight modifications of Fig. 8, with which the best results were obtained. The cut holes are situated in the center, and the burden is properly distributed on the different holes. The drift is arched so that it may be used for motor haulage, or, if it is to be timbered, three back holes are used. The numbers at the collars of the holes represent the order in which the shots are to be fired, and the two center holes, numbered "1," are drilled to meet and fired simultaneously. This round was drilled through ground which contained many slips, watercourses and fractures, and compared favorably with another drift in similar ground where the miner used a variable type of round to suit the constant changes in the ground. This latter round advanced only about two-thirds of the footage made by the standard round.

Fig. 9 is a 13-hole round for average ground, and Fig. 9A is a 16-hole round for hard ground, though in softer ground from 5 to 13 holes are frequently found to be sufficient. In these cases the center cut is put in and the same principle carried out as in the harder ground, but the number of holes around the sides and bottom of the drift is reduced.

Development of a Standard Round for Raises

The method of procedure followed in the development of a standard round for drifts was also adopted in working out a standard round for raises, and from the many designs presented and tried out those shown in Figs. 10 and 11 were selected as the most efficient. Fig. 10 is an example of the end cut in a 4 x 6-ft. raise and was a popular cut with the miners, although Figs. 11 and 11A represent the standard type of round adopted for raises. Fig 11 is used in a small raise 4 x 6 ft., whereas Fig. 11A is intended for a 4 x 8 ft. raise. In both cases the

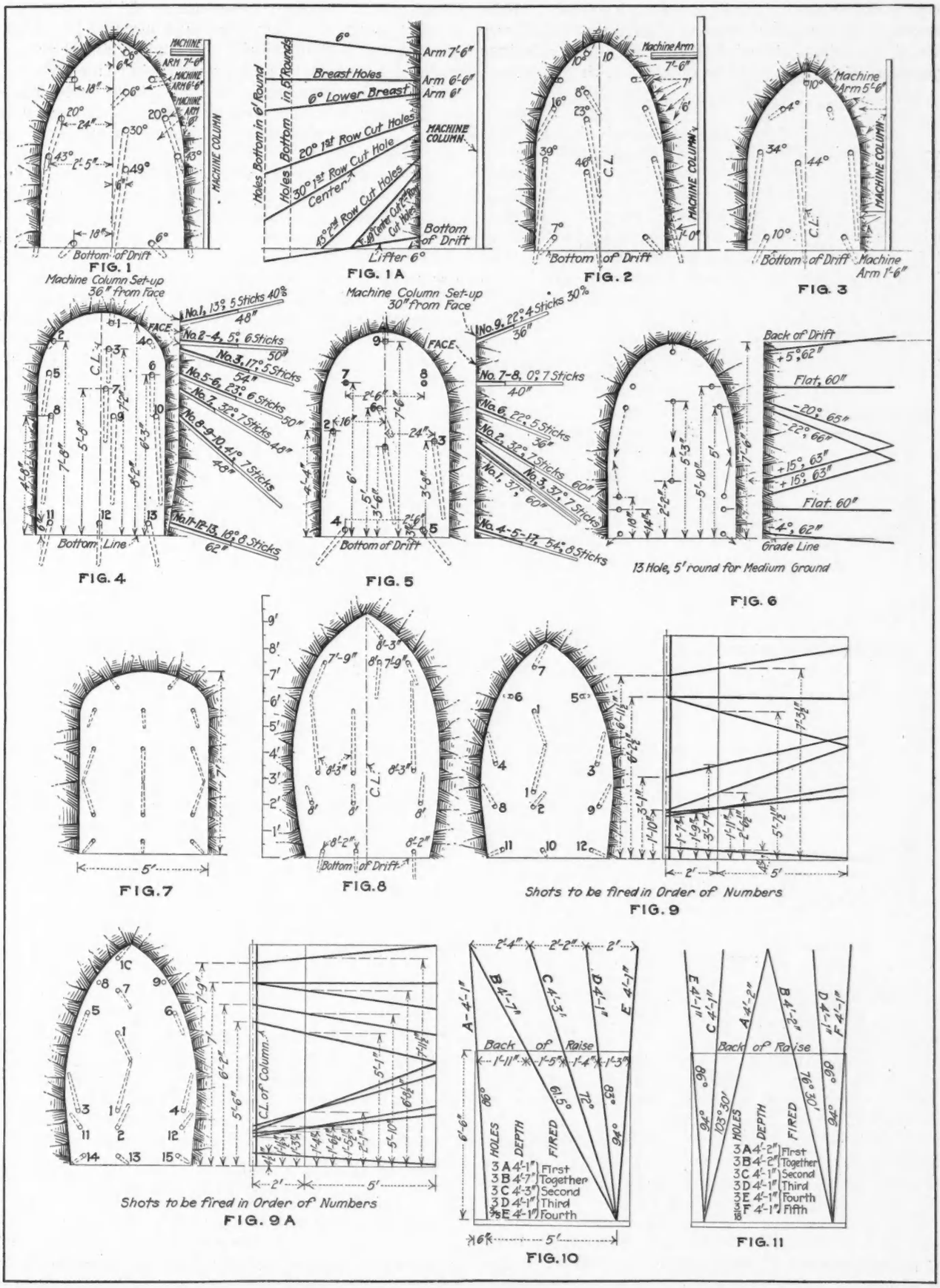

FIG. 1 Machine Column Set-up 36" from Face

FIG. 1A

FIG. 2

FIG. 3

FIG. 4

FIG. 5

FIG. 6

FIG. 7

FIG. 8

FIG. 9 Shots to be fired in Order of Numbers

FIG. 9A Shots to be fired in Order of Numbers

FIG. 10

FIG. 11

EXPERIMENTAL TYPES OF ROUNDS USED IN DRIFTS, AND STANDARD MACHINE-DRILL ROUNDS FOR DRIFTS AND RAISES

Fig. 9—Standard 13-hole round for drifts. Fig. 9A—Standard 16-hole round for drifts. Correction—In Fig. 5 the depths of holes No. 9, 7-8, 6, 4-5, should be 54 inches.

center cut is used. In the comparative tests between results of the methods shown in Figs. 10 and 11, it was found that Figs. 11 and 11A showed a better footage per man shift than could be obtained with Fig. 10.

Standard Round for Top-Slice Stopes

It is impracticable to devise a standard round that will be suitable for all methods of stoping. For example, in cut-and-fill one or two holes properly situated may break as much ore as a round of holes in a square-set stope. However, in horizontal top-slicing there is considerable uniformity in opening up lead sets, so in this special case the same principle which is practised in the standard round in drifts has been applied to this method of stoping, with satisfactory results, and is shown in Fig. 12.

When standard rounds were adopted, orders were given to the foremen to have blueprints made and posted in all the mine offices, so that the bosses might become familiar with them, and instructions were issued to use the standard rounds in all prospect and development work. Wooden models with wires showing the drill holes were then made and placed in the mine offices and later transferred to the miners' change room, so as to give the men an opportunity to familiarize themselves with the standard round. Drill instructors were appointed from among the miners who had made the best footage with the standard rounds, and they were sent to train all the machine men.

It is advisable that the drill instructor should be a man who has had experience in drilling different types of machine rounds in other camps for different classes of ground. Unless he has had a wide experience of this nature, the men whom he is supposed to instruct, and who have been in other camps themselves, are in a position to argue with him and tell him of the success of certain other rounds in these camps. If he is not in a position to prove to them that such a round is not efficient in the class of ground in which they are at present working, his efforts as an instructor will be unsuccessful. It is therefore necessary for him to have drilled other types of rounds besides the standard, so that he may be able to draw comparisons and prove its worth to the individual miners.

The instructor starts with one miner at a time, instructing him how to drill the new type of round, and stays with him until the miner becomes proficient and is convinced that he can secure further advance with the standard than he could with the other types. After one miner has mastered the standard, the instructor spends several days with another, and so on until all the machine men have become accustomed to the new methods.

In some cases the duty of instructing the men may be performed by a development boss, who acts both as instructor and supervisor of all development work. In others a machine foreman has been employed for this purpose, and his duties are similar to those of the drill instructors and development bosses. The question as to whether instructions should be given by a drill instructor, development boss or machine foreman should be decided according to conditions at the particular mine.

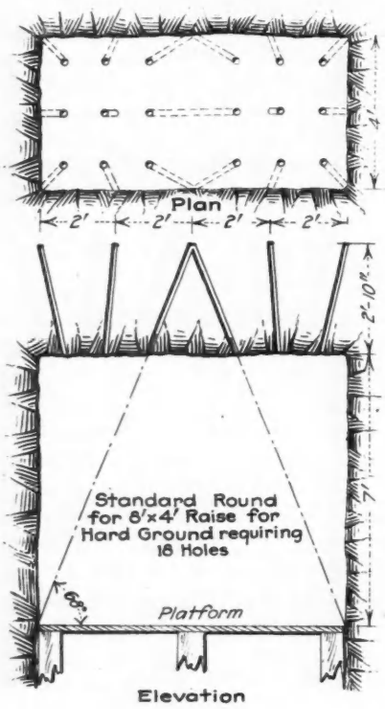

FIG. 11A

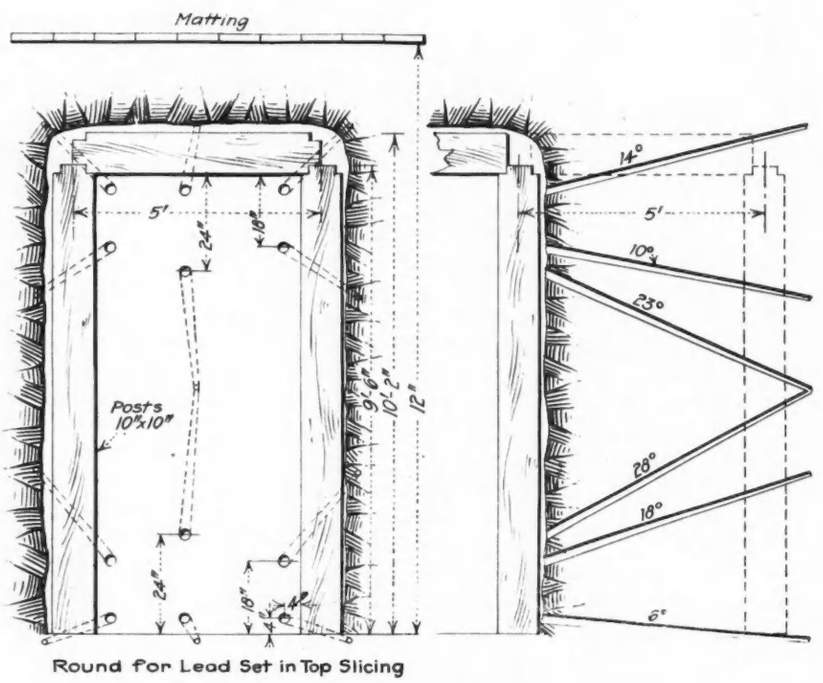

FIG. 12

STANDARD ROUNDS ADOPTED FOR USE IN RAISES AND TOP SLICING

Results Attending Adoption of Standard Round Have Justified Experimentation

Adoption of the standard round has led to a material increase in the footage per man shift. The amount of ground drilled is usually removed in the blast, as the holes bottom in a vertical plane which leaves a square face for the next set-up. Since the introduction of the standard round, the size and shape of drifts are more uniform, and the men are careful not to drill wild holes

and break a lot of unnecessary ground in the back or sides, as they formerly did.

It has been satisfactorily proved that a machine-drill round need not necessarily be drilled according to the slips and breaks in the ground, as the footage advanced by the standard round has far surpassed that obtained with a variable round put down according to the fractures and faults in the face.

In drifts where the bonus system has been instituted, the miners have repeatedly tried and failed to make the bonus when using the old type of round, and have found that it is possible to make the required footage only when the standard round is used.

Abnormal labor conditions and the loss to the mines of large numbers of trained miners who have joined the Army, have, during the last year, detracted from the results formerly obtained from the use of the standard type of round. However, when normal conditions are restored, results as good as if not better than those formerly achieved may be confidently expected.

The Pollution of Streams

BY CHESLA C. SHERLOCK*

An old rule of the common law, still in force, is to the effect that streams are common property, and that, whereas an owner of land alongside of which there is a stream may use the water for his own benefit as it passes his land, he must not pollute the water or render it unfit for subsequent use. This rule has resulted in a great deal of litigation, especially in instances in which mining companies have used the water in mining operations, afterward turning it back into its original channel.

It is permissible for a riparian owner, as defined in legal phraseology, to use all the water he desires, but he must not cut off the supply entirely or diminish it to an extent that makes it impossible for owners of other property to use it subsequently. It is permissible to take water freely from streams, which, however, must not be drained, or withheld from others who have equal rights in this connection. Inasmuch as it is often impossible for mining companies to use water without polluting it, or to avoid an actual loss before returning it to the natural stream, thus causing a considerable shrinkage in the normal supply, it can readily be seen that mine owners and operators are liable to be placed between the crossfire of two time-honored legal principles. The mine operator can use the stream, but he will be liable to the lower riparian owners, if they care to bring action for damages.

In a Washington case (Packwood *vs.* Mendota Co., *146 Pac. 163*), the court decided this specific point, holding that a mine operator who took water, for the purpose of washing his ore, which was then turned back into the stream and polluted it, is liable for damages to the lower riparian owners.

In a Pennsylvania case (Eckman *vs.* Lehigh & W. B. Co., *50 Penn. Sup. Ct. 427*), the court expressed the rule clearly, when it said: "The proprietor of a mining operation has no right to discharge culm and other refuse matter of the mine into a stream, or to leave it where it will be carried by ordinary floods onto the land of other persons. If he does so dispose of it, he renders himself liable for any damages resulting therefrom to such owner. Where the material is unlawfully put into the stream, the fact that an extraordinary flood was the contributing cause in carrying it onto the plaintiff's land does not relieve the wrongdoer from responsibility for his act."

In a Federal case (Arizona Copper Co. *vs.* Gillespie, *230 U. S. 46*), the Federal Supreme Court held that a statute declaring all streams to be public, and giving the right to use them for mining purposes, does not concede permission to send waste material or débris down the stream to the destruction or substantial injury of the riparian rights of subsequent users of water. The court further held that a person suffering such damage was entitled to injunctive relief from a continuance of the wrongful act, even though the injury might constitute a public wrong and be one for which a public prosecution might be maintained.

A West Virginia case (State *vs.* Southern Coal and Transportation Co., *71 W. Va. 470*), which involved a coal mine, illustrates a principle of law which is applicable to all mines and mining operations. The court held that, under a statute making it unlawful to throw into or allow to enter a stream any deleterious matter injurious to the propagation of fish, an operator of a coal mine has no right to cause such damage by polluting the stream with sulphurous or foul mine water. This verdict holds even though such water is a product of nature and the operator is under the legal duty to drain it from his mine, and though the stream in question is the natural receptacle of such drainage, and there is no reasonable or practicable way to eliminate the sulphur and other objectionable ingredients in such water before discharging it from the mine and letting it enter the stream.

A Kentucky case, however (*145 Ky. 137*), resulted in a decision that a riparian owner who changes the course of a stream and runs the water over his land, when he knows that it is contaminated with mineral matter, cannot hold the owner of a mine, who caused the contaminated material to enter the stream, in action for damages for the injury done to the land and to the vegetation thereon.

These cases illustrate clearly, I think, the duty and obligations of those responsible for mining or metallurgical operations which may lead to pollution or interference with streams, even when an express statutory license has been granted for their use. A mine operator may use a stream and the water therein, under his right as a riparian owner, irrespective of an express right of statute; but in either case, he must return the water, or a reasonable amount of it, to the stream, free from poisonous substances, uncontaminated and unpolluted. Not only that, but he must prevent poisonous mineral substances from entering the stream, even though they may do so by natural drainage, for he is still bound to consider the lower riparian owner, even if not using the water in the stream himself.

The right of an injured person to recover for damage caused seems to depend upon whether or not he knew and realized that the water was contaminated. If he knew this and took no action, he cannot recover in any subsequent claim.

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Coöperation in Mine Promotion and Management

By PAUL T. BRUHL*

A paper which emphasises the permanent value of honest coöperation between financial houses and their clients, between mining corporations and their staffs. Wealth from mining ventures is unfairly shared, according to the author, and greater facilities should be created to permit more complete participation in benefits on the part of the small stockholder.

THE example of the successful mining magnate in America has not conduced to the general prosperity of the mining world. His career may be dazzling, and may stimulate emulation; but there should be less concern for the ambitions of individuals and more for the general prosperity of the industry. The interests of the majority are not served when the prizes are immense and occasional.

Mining investment in the United States may be considered as a monopoly for a few and a snare for the vast majority of the investing public, and the point is often overlooked that, with the reputable mining company, all the cards should be on the table. There should be ample facilities for shareholders and intending shareholders to inform themselves of the progress and grade of ore in every drive and stope, day by day, week by week, and year by year. In England it is illegal to issue shares at a discount; consequently, long lists of mining stocks are at a premium. A page or even two pages of a daily newspaper are required to publish the transactions that occur during a session of the exchange. Numbers are interested, and critically so. A fierce light of public opinion beats down on the mining financier; and his career is short if he betrays his trust. In America, the mining news is relegated to an obscure corner of the daily paper, and little information is given to the public until after it has been utilized on the inside.

Mining Directors Have Moral Obligations

A Western Australian mine, with shares held mostly in London, was on the down grade. A director met one of the shareholders in the street and asked him if he still held his shares (he had acquired them at the instigation of that director; hence the responsibility). The shareholder inquired the reason for the question, and was informed that the property was turning out badly. Fortunately he had previously sold his shares at a big premium, but he was nevertheless interested, so he asked the director if he had sold *his* holding. What was the reply? "Certainly not. I am a director, and in honor bound to stand by the ship to the last. It is my duty to inform those who were influenced by me to invest; but I cannot take personal advantage of inside information coming to me in a fiduciary capacity." That director retained his entire holding until the mine was liquidated. He lost his money, but he made a name for honesty, and had no difficulty, subsequently, in finding investors for his properties.

Mining investors are always willing to take a chance. They are fully aware that such ventures have a gambling element, but they look for a square deal; and, even when they lose, they will follow the man who stood by them, and will take another chance with him. The lesson has not yet been learned in America that it is easier to market undercapitalized stock at a premium than overcapitalized stock at a discount.

Many of the leading British financial houses have won the confidence of the public by President Wilson's policy of laying the cards on the table—by open diplomacy. All the facts are available; the vendor's share is distinctly shown; the terms are clear on which the public is invited to subscribe. The promoters acquire a large profit, but there is no secrecy as to the amount, and the public can see for itself that the terms are equitable. It knows that, so far as human knowledge can go, facts are exactly as set forth, and realizes that the promoters are taking a proportionate risk. The endorsement of an undertaking by a reliable firm is sufficient to insure oversubscription immediately, and a substantial premium on the shares is almost a certainty.

Financial Houses Should Be Respected by Clients

Compare the methods of business that I have just described, with the peddling of dollar shares for a few cents, laboriously undertaken by the petty satellites of questionable promoters, who often, with good reason, conceal all the particulars that a European mining investor may learn through the daily press. There are hundreds of thousands of investors in many countries who look upon reliable financial houses as a chicken looks upon the mother hen. The old bird selects a warm place for herself, that is, at the same time, the best for the brood, which prospers simultaneously with the parent. No envy is occasioned by the accumulation of fortunes by the directing financiers, when these have been made by coöperative work and ability, instead of by fleecing the junior partners in the common enterprise.

American mining financiers seem to favor the policy of skinning the lamb from the beginning. Neither the property nor the investors are considered. It is a case of "after us the deluge"; and, as a result, there is a constant deluge. What is needed in America, with its enormous resources, is steady development and ever-increasing output—not a few great concerns of fabulous success, and a host of wrecked mines and disappointed shareholders. The aim should be the prosperity of the industry as a whole, not that of a few individuals who wander off with the proceeds to spend them in Paris and in other places, where the outlay does not benefit the country which is the source of the spenders' affluence. Necessarily, there must be a few who gain more than others, but their prosperity should arise from the fact of their having held the larger share—upon co-

*Metallurgical engineer, Berkeley, California.

öperation and mutual profit, not on the destruction of the smaller investors.

The plan of undercapitalizing some prosperous undertaking should be tried, affording the public an opportunity of participating in a shareholding that will inevitably net a large premium. The financial house that secures the reputation for such business will have no difficulty in attracting all the money it requires, and attracting it from the better and saner class of conservative investors. If the suggested tactics are pursued, it will have a far longer, happier, and, ultimately, a more prosperous existence.

The business of a mining finance house is to provide the means for thoroughly investigating properties and honestly calculating their possibilities. Having done this, let it conceal nothing with regard to the preliminary work and expense, and then invite the public to subscribe on a basis that indicates an obvious premium on the shares. The public, under such circumstances, will not grudge the relatively large proportion allotted to the promoters.

Coöperation Desirable in Mine Operation

A similar policy will succeed in the management of the individual undertaking. In many countries millmen and miners look upon their work as a profession. In this country there is a tendency to regard any man, irrespective of age or training, as good enough material. The result is that labor is frequently inefficient, migratory, and little interested in the company's welfare. Just as the financial house should make friends of its shareholders, and practically constitute them a permanent body of partners who can always be relied upon to reinvest the profits of one undertaking in another proposition under the same auspices, so the individual company should make friends with its staff, and enlist the interest of the men in the welfare of the mine. A contented workman swears by his mine, and is proud of it. The miner should be brought to interest himself in the output of a mine, in the same way that a fireman interests himself in the speed trial of his ship. An increase of a dollar a ton in recovery should be an occasion for rejoicing—it should give the workers the exhilarating feeling of having backed a winner.

The popular fallacy that the interests of employers and employees are antagonistic is in no industry more untrue than in mining. If the owners of a mine would see that the worker has reason to boast of his condition and prosperity, they would soon have occasion to boast of their own prosperity.

The shareholder comes into the financial undertaking when the greater risks have been overcome. The mine worker often receives his regular wage during periods when the output does not justify the operation of the mine at all. In both cases those who have borne the risk are entitled to a profit that is large in proportion to the general results. The shareholder receives an approximately even and regular dividend; the worker has an approximately even and regular wage. But when, in either case, luck accrues to the entire undertaking, all should benefit. The recognition that those who take the greater risk are entitled to a larger share should be reciprocated, when unexpected prosperity arrives, by considering the claims of those who have coöperated.

Compressed Air on the Rand

The Victoria Falls, on the Zambesi River, Rhodesia, Central South Africa, are situated at so great a distance from important enterprises that, to date, the vast power available has not been tapped in any way. Its ultimate utilization is, however, inevitable. The Victoria Falls Transvaal Power Co., Ltd., operates a steam-electric plant in the Transvaal. It is the largest undertaking of this kind in the British Empire, says the *Compressed Air Magazine*. Approximately 837,000,000 units (kilowatt hours), or 1,120,000,000 hp. hours, were sent out of the generating stations during the year 1917. This involved burning more than 1,000,000 tons of coal, a large proportion of which consists of "duff," and is a byproduct from the collieries. The year's operations involved the heating and evaporating into steam of about 6,500,000 tons of water, and this quantity was passed through the turbines and condensed in the surface condensers, which required the circulation of approximately 78,000,000,000 gal. of water. The total number of units sold for lighting, power, and tramways by the public utility companies and municipalities of greater London for the year 1916 was approximately 450,000,000 units, or about 40% less than the units sold by the Victoria Falls Transvaal Power Co., Ltd., to the mining industry on the Witwatersrand.

The compressed-air supply is much the largest in the world. During the year 1917 no less than 2,000,000 tons of air passed through the main pipe network from the two compressor stations to the mines for use in driving rock drills, and other purposes. At the time of maximum load each day, air is delivered at the rate of about nine tons per minute.

If

By Berton Braley
(With apologies to Kipling)

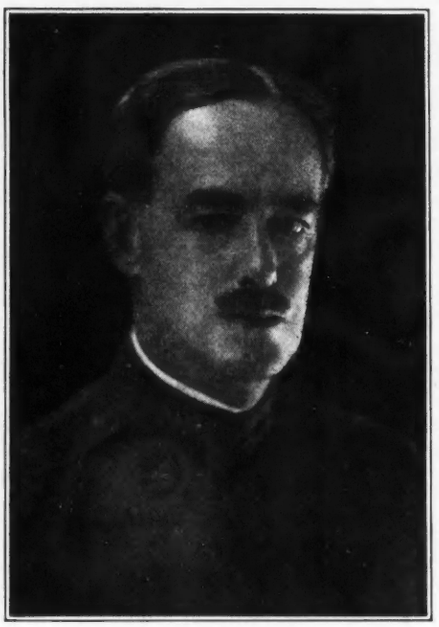
If you will bear your part without complaining
In all the toil and struggle of this war;
If you will give your all to help in gaining
The peace of justice that we battle for;
If you will save by thrift and self-denial
That our brave fighters may have what they need;
If you at home will stand up to the trial
As they who battle for true freedom's creed;

If you give your uttermost of labor,
Your finest effort, to your work each day,
Putting no extra burden on your neighbor,
Keeping yourself from slackness or delay;
If you will strain each fiber, nerve and sinew
In smelter, drift, refinery or shaft;
If you will give whatever strength is in you
In full devotion to your trade or craft;

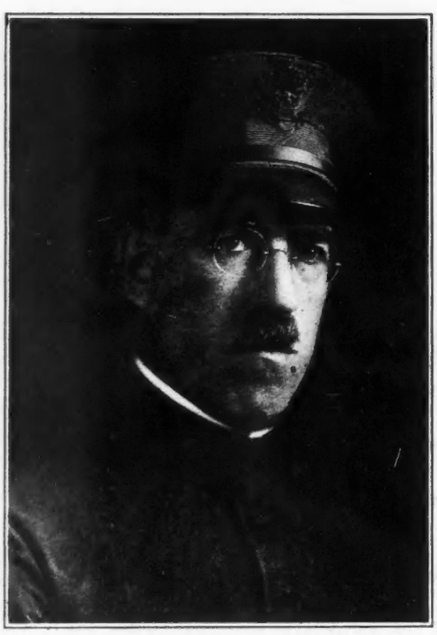
If you will look on loafing as a treason
To those who fight and to your nation's weal;
If you will strive with all your skill and reason
Until we crush the Prussian under heel;
If you will back, with money and endeavor,
The splendid boys who battle "over there,"
You will help to bring a peace that lasts forever
And you can know and say, "I did my share!"

Mining Men in the Service

MAJ. C. L. BERRIAN



MAJ. JOHN SEWARD



CAPT. HALLET R. ROBBINS

CAPT. E. O. DAUE

The Porphyry Coppers
II—Mining Methods*

By L. H. GOODWIN†

THE contention has often been advanced that many of the supposed advantages of steam-shovel over underground operations have been nullified by the extensive improvements in large-scale underground work; and the statement has been made that even the Utah Copper Co., if it had its mine to open again, would favor an underground mining system. It will be interesting, therefore, to review the results of the steam-shovel work at that mine, as published in its annual reports, and to compare the indicated cost of extracting its orebody by that method with deduced data as to the results that might have been obtained by underground methods. The Utah Copper Co.'s mine presents the best example for such a discussion, even if the fact that the other steam-shovel porphyries have not published sufficient data did not limit consideration of the problem to that property.

The final analysis of the advantage and utility of the respective methods must include a comparison of the entire cost of extracting the orebody by shovel operations with the corresponding cost if done by underground methods. It is manifestly impossible to reach entirely satisfactory and dependable conclusions when initial calculations must be based upon the incomplete data of a mine as yet in only the first stages of its life. When comparison is made, however, between a result obtained by the use of such incomplete data and that achieved by a method in which data from mines of different character had been used, there is slight difference.

Indicated Costs of Stripping

The indicated costs of mining the Utah Copper orebody by shovels is best considered under the two heads of stripping and mining, respectively. The report for the year 1917 states that, to the end of that year, 43,978,733 cu.yd. of capping had been removed by stripping operations. This figure does not check exactly with that obtained by adding the respective items covering this operation that are recorded in the annual reports for the several years from the time stripping was started, in 1906, to date. The discrepancy is probably due to some change in the basis of calculation; but this fact does not affect the accuracy of the total net cost of the operation, which appears to have been $16,251,252, or 36.97c. per cu.yd. In the 1914 report, the figure of 115 ft. is obtained by calculation from drill-hole records as the average depth of capping over the whole deposit, and this involves 185,533 cu.yd. of stripping per acre. Applying this figure to the total capping removed to the end of 1917, the amount is equivalent to completely stripping 237 acres. The ore reserves developed are reported to underlie 226 acres; and, as the equivalent of 237 acres has already been stripped, it appears that operations to date have stripped the orebody completely, and a small additional area (the estimate including vertical side slopes only).

The ratio of capping to ore, considering vertical boundaries, is given in the 1913 report as 1 to 4, as against a probable ratio of 1 to 3 when allowance is made for side slopes. To obtain an indicated cost of stripping the entire orebody, it becomes necessary to increase the amount already spent for stripping by 1⅓, or a total of $21,700,000. But it may be assumed that the ratio of 1 to 3 is not sufficiently conservative, and 1 to 2 may be considered a safer ratio of capping to ore. The indicated cost of stripping the entire orebody then becomes twice what it would be if vertical side slopes held, or $32,500,000.

Mining Costs Higher Than Stripping Costs

At the end of 1917 a developed ore tonnage of 371,752,000 was indicated as remaining under the area to be stripped, and 67,220,700 tons had already been mined from it, making a total of 438,972,700 tons to be considered. The actual operation of mining the ore is exactly the same as that of stripping the overburden, but the cost per unit cannot be assumed to be the same in the two operations. As a matter of fact, it appears that the cost of mining is usually higher than the cost of stripping. In the early stages of operation this will be true for the following and other reasons: Operations in ore are hampered by lack of space because of the limited areas of ore pits; the operations of the ore shovels are more intermittent than those of the waste shovels because the concentrating mill is not as flexible a unit in taking its supply as is the waste dump, and because more trouble is to be expected in supplying cars to the ore shovels; the waste need not be broken to as small sizes as the ore; and probably the capping is somewhat more easily broken than the underlying ore.

Thus, the cost of 36.97c. per cu.yd. indicated in the foregoing for stripping overburden corresponds to about 18.5c. per ton, as one cubic yard in place apparently represents approximately two tons of material. For purposes of comparison, the cost of ore mined by steam shovel during the year 1911 to 1916 inclusive has been computed, and the indicated average is 20.96c. per ton. During the year 1915 this cost was reduced to 16.61c. per ton, which is considerably lower than the indicated average cost of stripping, and in 1916 it was only 20.24c. It is likely that during the middle stages of a mine's existence its mining costs per ton might be as low as its stripping costs. In the latest stages, however, although the difficulties enumerated above will be largely eliminated, they will probably be offset by the increasing depth of operations below the surface, with possibly occasional slides of waste from the sides and similar operating difficulties.

Recognizing the impossibility of obtaining an accurate figure for the average cost of mining the whole orebody, it will perhaps be well to assume that the average cost of shovel mining to the end of 1915, including the low cost obtained during that year, will be as representative as any that could be used. The figures available are for the years 1911 to 1915 inclusive, and

*Part I of this series appeared in the Nov. 2 issue.

†Mining engineer with Rogers, Mayer & Ball, 42 Broadway, New York.

indicate that over 29,000,000 tons had been mined, at an average cost of 21.25c. per ton, which is the actual mining cost alone and includes no charges for diamond-drill development and no proportion of prepaid stripping expense, but does include the proper proportion of general and administrative charges. On this basis the indicated cost of mining the whole orebody becomes 438,972,700 × $0.2125 = $93,281,699, and when to this is added the previously obtained indicated cost of stripping it, the total cost of extracting the orebody becomes nearly $126,000,000. To compare with this assumed cost, then, an underground method, in order to compete successfully with the shovel method, must show a total cost, including underground development, of not more than $126,000,000 divided by 438,972,700 tons, or 28.7c. per ton.

The mine now under consideration used an underground method for a time, and cost figures for most of the work are available. To what extent they are representative of a system that might have been employed to mine the whole orebody, is, of course, unknown, as various external factors may have exerted an influence. That this work was to be but an incident in the mining of the whole deposit was known from the first, and therefore it received comparatively little attention, which tended, of course, toward high costs. A factor which probably worked in the opposite direction was that no attention had to be paid to future operations and that cheap ore could be obtained by sacrificing the usefulness of underground openings. Most of the underground production was secured during the years 1910 to 1913, inclusive, and cost figures were published for the three later years of operation. A résumé shows that more than 3,000,000 tons was mined, at a cost of 52.14c. for direct mining and 16.09c. for development, or a total of 68.23c per ton, which includes the proper proportion of general expense.

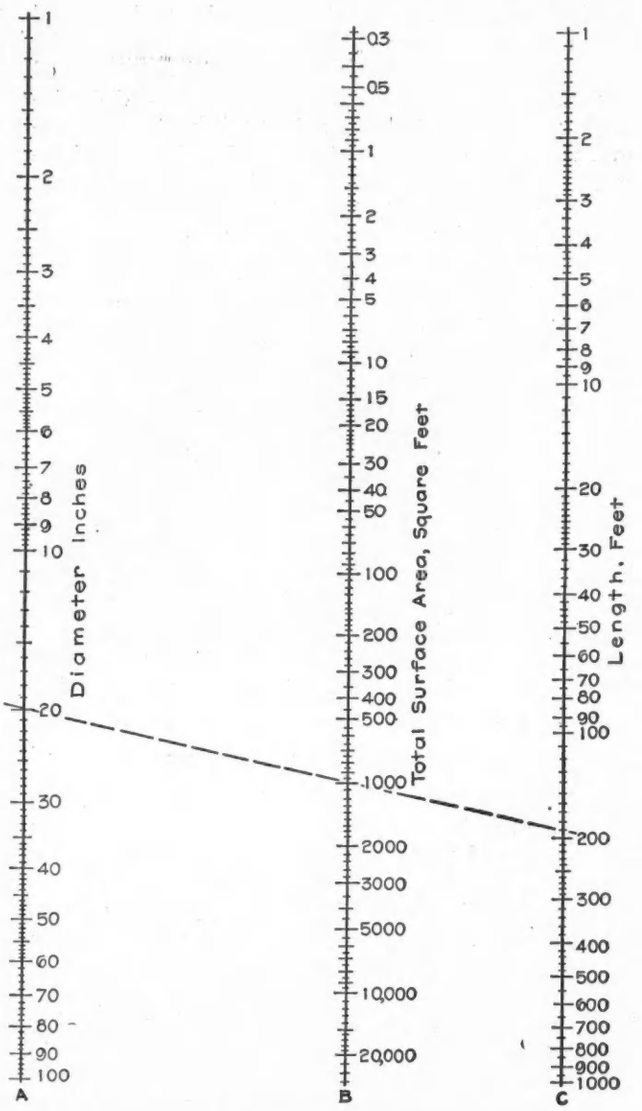
The performance of other mines in underground work conforms, in general, to this result. The new mining plant of the Inspiration is widely regarded as a good example of underground efficiency, and its total unit mining cost, as published for the year 1915, is almost exactly the same as that indicated above for Utah in three previous years, or 68.11c. per ton. This includes a prorated charge of 20.00c. for development expense. In 1916, Inspiration's cost was 60.6c. per ton, including the same prorated development charge. At the Ray Consolidated property the average cost of mining, including a charge for development for 9,889,359 tons milled during the five years ending with 1915, was 80.84c. per ton.

A comparison of the most favorable results secured by underground operation with the deduced figure for shovel operation shows a large saving by the latter method. Though many of the figures presented may perhaps be regarded as not applicable to the Utah orebody, the indicated saving is thought to be large enough to cover all possible contingencies. The consideration of contingencies may be grouped under three heads, namely, the possibility of higher costs by steam-shovel operations than are indicated, that of lower costs by underground operations, and the comparative merits of the two systems as regards efficiency in extracting the ore, with reference, particularly, to admixture of waste with ore.

Chart for Determining Pipe Areas

BY W. F. SCHAPHORST*

The accompanying chart will be found convenient for determining the radiating surface of all kinds and sizes of pipe; the heating surface of boiler tubes, superheater flues, condenser tubes; the square feet of surface of refrigerating coils; the square feet of metal needed for circular ventilating and heating ducts; and for like



A CONVENIENT CHART FOR DETERMINING PIPE AREAS

purposes; in fact, wherever it is desired to find the area of a cylinder.

As will be noticed, the chart's range is wide—from 1 to 100 in diametral measurement and from 1 to 1000 ft. lineal measurement. The dotted line drawn across the chart, for example, shows that where the diameter is 20 in. and the length 191 ft., the total area is 1000 sq.ft. The chart may also be used "backward" to advantage. For example, if any figure in column *C* is known, and the total radiating area in column *B* is known, a straight line through the two points will give the current diameter in column *A*.

*Mechanical engineer, Woolworth Bldg., New York.

Effective Tube-Mill Liners

By A. W. ALLEN

WHEN inadequately protected, the head castings of tube mills are likely to wear and fracture, causing serious accidents and delays. The fundamental requirement for effective protection of a nonrenewable surface is that the liner should be in direct contact with the material to be shielded. The danger of scouring is always increased when a space intervenes between the two; and the life of the liner is, moreover, lessened. Stamp-mill operators maintain that, after a mortar-box liner has worn through so that the casting behind it is badly cupped, the life of any new liner which is placed over the worn part will be comparatively short. This may be due to the fact that absolute rigidity cannot be maintained, as is the case when the liner is bolted to an even, unworn surface.

Makers of crushing and grinding machines often ship a tube mill which has dished end-castings. Liners accompanying it are sometimes well designed for the purpose, sometimes totally inadequate. Fig. 1 shows an example of the latter type. Mills of this class were

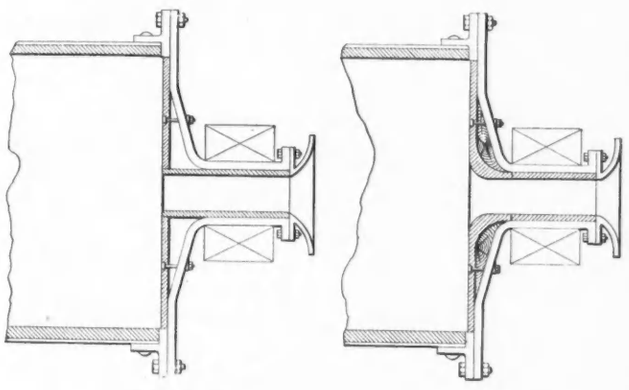


Fig. 1 Fig. 2

TUBE-MILL HEAD LINERS

installed in one instance within my recollection, and it was apparently taken for granted that the liners were suitable. After a few months of operation the sharp edges of the end- and trunnion-liner plates wore away, thus permitting access to the space between liner and shell. Gravel, sand, and, later, pebbles found their way there, and rapidly scoured the surface. This evidently passed unheeded for several months; or, if noticed, the amount of damage done was not realized. In due course the metal was worn to such an extent that the shell fractured at its weakest spot—the junction between trunnion and head—and the mill collapsed, resulting in expense and interruption of operations.

Attention was then directed to the design of the liners originally purchased with the mill, and a radical alteration was contemplated, Fig. 2 showing the style adopted. The liners were cast locally from scrap metal in convenient sections, were held in position by means of bolts in the usual way, and supported, as were their inefficient predecessors, by radial ribs which formed a part of the original head casting. The space between liner and shell was taken up with carefully fitted wooden blocks, which doubtless swelled when the mill was in operation with wet pulp, and this helped to insure an absolute rigidity of the various component parts of the end of the mill. As indicated in the cut, the liners were designed so that there was ample metal where abrasion was greatest. The result was entirely satisfactory, and no further trouble was experienced in this connection.

Wear on the cylindrical portions of the tube-mill shell seldom occurs, because the majority of liners in use are bolted directly to the surface, and can be made of simple design, to conform exactly to the contour of the interior. When such liners are nearing the end of their life, they become so thin that fracture invariably develops, usually in the neighborhood of a bolt hole, and the escaping pulp acts as a danger signal and a warning that the shell is exposed. This is the great advantage which results from the use of liners bolted to the shell, and it usually outweighs the benefits claimed for other types, some of which can loosen from the shell and so permit damage.

A point to be taken into consideration when a certain type of liner is to be adopted is whether it will form an absolute safeguard against shell wear, or only so if certain contingencies do not arise. Some classes of tube-mill liners may break, wear through in parts, or collapse, and so expose the shell to abrasion of pebbles and ore. This may be noticed in time and promptly repaired; it may pass unheeded; or the accident may be realized and a chance taken that material damage will not result before it may be practicable to shut down.

Mill superintendents are usually anxious to maintain their output, and are often impressed with the necessity for keeping up the tonnage to the maximum; and an accident to mill liners toward the end of the month may lead to a delay in repairing. A proportion of the responsibility, where material damage results, should be borne by those who advocated the particular liner in the first instance.

Silex or similar stone lining, which is held in place by magnesite or cement mortar, often proves a menace, because imperfectly finished blocks are difficult to install satisfactorily. Short pieces of drill steel are sometimes driven between the blocks before the cement is set, to assist in maintaining rigidity of the whole lining, but a piece of stone occasionally falls out, and the accident may pass undetected unless the millman's hearing is exceptionally acute. Damage to the shell invariably results.

In cases where liners cannot be made to conform to the contour of the surface to be protected, or where, in such a contingency, an unnecessary waste of metal would be involved, the advantages assumed to result from the adoption of that particular construction should be questioned. Tube mills with ends cast at right angles to the axis of rotation furnish flat interior surfaces on which simple and effective head liners can be bolted. Additional stability, when necessary, can be insured by external strengthening ribs. Damage to unrenewable parts is then unlikely to happen without obvious neglect.

Capacity of Belt Magnetic Separators

By GEO. J. YOUNG

THE capacity of a commercial separator of the Wetherill type is expressed in pounds of feed per hour. The main factors controlling capacity are the width and speed of the feed belt, the thickness of the feed material on the belt, the specific gravity of the feed material, and the proportion of magnetic material. The width of the feed belt is fixed according to the design of the machine. Commercial sizes of the Wetherill are 6 and 18 in. The speed of the feed belt also varies with different classes of apparatus; usually several speeds are available. The minimum speed is 30 ft. per min., and there is no advantage in adopting a lower rate. The maximum speed of the Wetherill is 110 ft. per min., but this is too high for material finer than 30 or 40 mesh, as dusting results at this speed. For material of this size, 60 to 80 ft. per min. is the highest speed advisable. Within these limits the capacity of the separator will be determined by the thickness of the feed

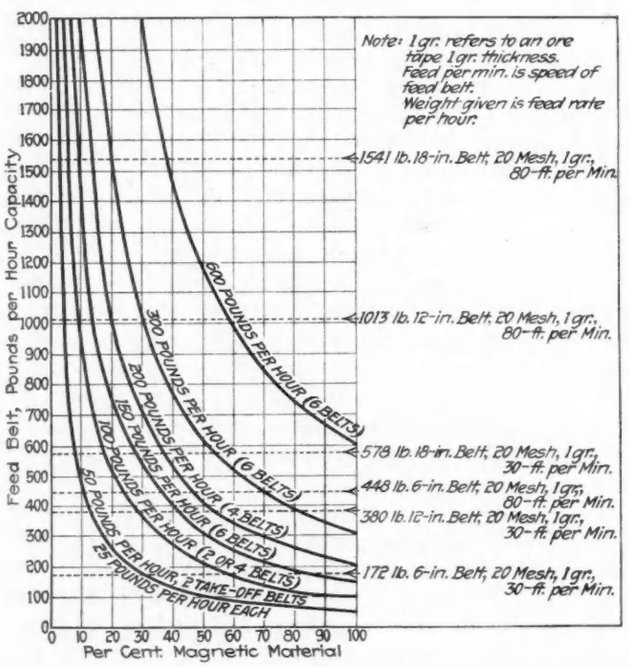


CHART SHOWING CAPACITY OF MAGNETIC SEPARATORS

bed. The ideal condition would be a thickness of a single mineral grain of maximum size, but this would greatly limit capacity. Conversely a bed three or four grains thick would be likely to give a contaminated product. Selection must be made between the extremes, and the thickness determined according to the nature of the product desired. With minerals requiring maximum field intensity, a thin bed on the feed belt is only permissible, though minerals of high magnetic permeability can be separated from a thicker bed.

Two or more take-off belts (depending upon the number of magnets) are used on the Wetherill separator. Take-off belts are limited in their discharge capacity, and, under normal conditions, are operated at a maximum speed of 300 ft. per min. The highest take-off rate that I measured was 200 lb. per hour for one belt. I am of the opinion that 50 to 100 lb. per hour is the upper limit of the take-off rate for clean separation, although I have had no opportunity of using a machine larger than the 6-in. Wetherill. If a maximum rate is decided, then the total for a given machine will be the product of the number of belts and this rate. Under proper working conditions the burden of magnetic material should be evenly distributed among the

VOLUME IN CUBIC FEET PER HOUR DISCHARGED BY FEEDER

		Feed Belt Speed					
		30 Feet Per Minute		60 Feet Per Minute		80 Feet Per Minute	
		Volume Per Hour in Cubic Feet					
Mesh	Grains Thick	6-In. Belt	18-In. Belt	6-In. Belt	18-In. Belt	6-In. Belt	18-In. Belt
6	1	8.52	28.50	17.04	57.00	22.10	75.92
	2	17.03	56.90	34.06	113.80	44.20	151.84
	3	25.40	75.40	50.80	150.80	66.30	227.76
10	1	4.30	14.20	8.60	28.40	11.03	37.96
	2	8.60	28.40	17.20	56.80	22.06	75.92
	3	12.90	42.60	25.80	85.20	33.09	113.88
20	1	2.16	7.22	4.32	14.44	5.60	19.27
	2	4.32	14.44	8.64	28.88	11.20	38.54
	3	6.48	21.66	12.96	43.32	16.80	57.81
48	1	0.76	2.46	1.52	4.92	1.97	6.77
	2	1.52	4.92	3.04	9.84	3.94	13.54
	3	2.28	7.38	4.56	14.76	5.91	20.31

(1) Feed-belt speed.

take-off belts. This is not always feasible, because, in some cases, the greater part may be of pronounced magnetic permeability, and will naturally be caught and discharged by the first pair of take-off belts. Thus the capacity of a two- or three-magnet machine is no greater, under such circumstances, than that of one with a single pair of magnets. In a number of experiments with pyritic material that had been given a magnetizing roast, I found that, by careful adjustment of pole distances and amperages, I could secure a moderately good division among the take-off belts. The second magnet removed a magnetized product of lower permeability than the first; and in the case of each take-off belt, the second belt of each magnet did likewise.

It is evident that, under certain conditions, the feed rate will be limited by the take-off capacity of the separator; and if it is assumed that this is, in turn, limited by the number of belts (a reasonable assumption), then the smaller separator, the 6-in. size, has a relatively greater take-off capacity than the larger, 18-in. feed belt.

The density factor can be readily determined by filling a 1000 c.c. dry graduate with the proposed feed, and weighing the content. Multiplying the weight by 28.45 will give the weight in pounds per cubic foot. This factor will be found useful in reducing volume measurment to weight.

The proportion of magnetic material is an important factor. A feed containing 80%, as compared with one containing 10%, would bring eight times the amount of magnetic material to the take-off belts in the same time. For a product containing a large proportion of magnetic material, the capacity of the separator is determined by the take-off capacity; and for material containing a small proportion, by the feed belt. The interrelation between feed-belt and take-off capacity is shown in the chart. The table gives the theoretical volume

of feed per hour at different speeds and for different grain sizes.

The method of using the chart is best illustrated by an example. Assume that it is desired to treat 1000 lb. per hour of product containing 60% of removable magnetic material. This would require a machine with a take-off capacity of 600 lb. per hour, and a three-magnet separator would be required. For handling a product containing only 10% of removable magnetic material, a take-off capacity of 100 lb. per hour would be required, and this would be furnished by one magnet. A feed rate of 1000 lb. per hour would equal 12 cu.ft. per hour. Referring to the table, for a 20-mesh feed one grain high, a 6-in. separator would have a feed-belt capacity of 5.6 cu.ft. per hour; a tape two grains high would constitute a feed rate of 11.2 cu.ft. per hour at a feed-belt speed of 80 ft. per min. Thus a 6-in. two-magnet machine would answer for 1000 lb. of product containing a high proportion of magnetic material; and a single-magnet separator for the product containing a low proportion of magnetic material.

In selecting a separator, the proportion of removable magnetic material is a factor in determining the width of feed belt. It is evident that an 18-in. feed belt would bring an oversupply of product to the take-off belts in the case of a feed containing a large proportion of removable magnetic material, as shown in the chart. An 18-in. feed belt would bring 1541 lb. per hour of 20-mesh material, one grain high, (80-ft. per min. feed-belt speed). Only a product containing 39% of magnetic material could be handled. Thus the 18-in. belt would be unsuitable for anything containing more than 39%, because the feed stream would have to be greatly diminished below the receiving capacity of the belt. On the other hand, a product containing a low percentage of removable magnetic material, 5 to 15%, could be advantageously handled on the 18-in. belt machine.

Where capacity is of secondary importance, the 6-in. feed belt, with magnet-field strengths suitable for the separations desired, will answer all practical requirements. In designing a large separatory plant, experiments for capacity determinations should be made on separators not smaller than the 6-in. size.

Diamond Drilling in Cornwall

In Cornwall the use of the diamond drill in coal-boring operations has long been an established institution, but until recently its value as a prospecting tool in the metalliferous mines had not been proved, says the *Iron and Coal Trades Review*. Some years ago attempts were made to use the diamond drill in the Cornish mines, with unsatisfactory results. Trials were made with two machines, one of pseudo German-English manufacture and the second of Swedish origin. The first, working for a short time, ran up a bill of £1000 for 100 ft. drilled, and the second was even a more dismal failure, as three weeks' work in granite showed an advance of only three feet. It is, therefore, not surprising to find the Cornish miners prejudiced in the matter of diamond drilling, and if it were not for the enterprise of Bewick, Moreing & Co., of London, a well-known firm of mining engineers, it is doubtful if the diamond drill would ever have had a second trial as a prospecting apparatus. When the firm named took over the general management of the East Pool and Agar Mines it was decided to adopt the diamond drill, and the results have more than justified the company's enterprising action in this direction while establishing the successful use of the drill in lode prospecting in this locality.

Oliver Wethered, of the Geevor Tin Mines, Ltd., and Dolcoath mine, made an agreement with the Sullivan Machinery Co., of London, for drilling at an agreed price per foot, and under this and other contracts nearly 5000 ft. of diamond drilling has been done to date in Cornwall, besides the 1500 ft. by East Pool. All this drilling is underground, the holes being put in horizontally, and the deepest one has penetrated to a total depth of 971 ft. in the Dolcoath mine. This was begun on April 4 and completed on June 22 of this year, and shows a progress of over 100 ft. per week. During this time, double shifts were worked five days a week and one shift was worked on Saturday, and the total cost for carbons amounted to approximately 3.5s. per ft., a moderate figure.

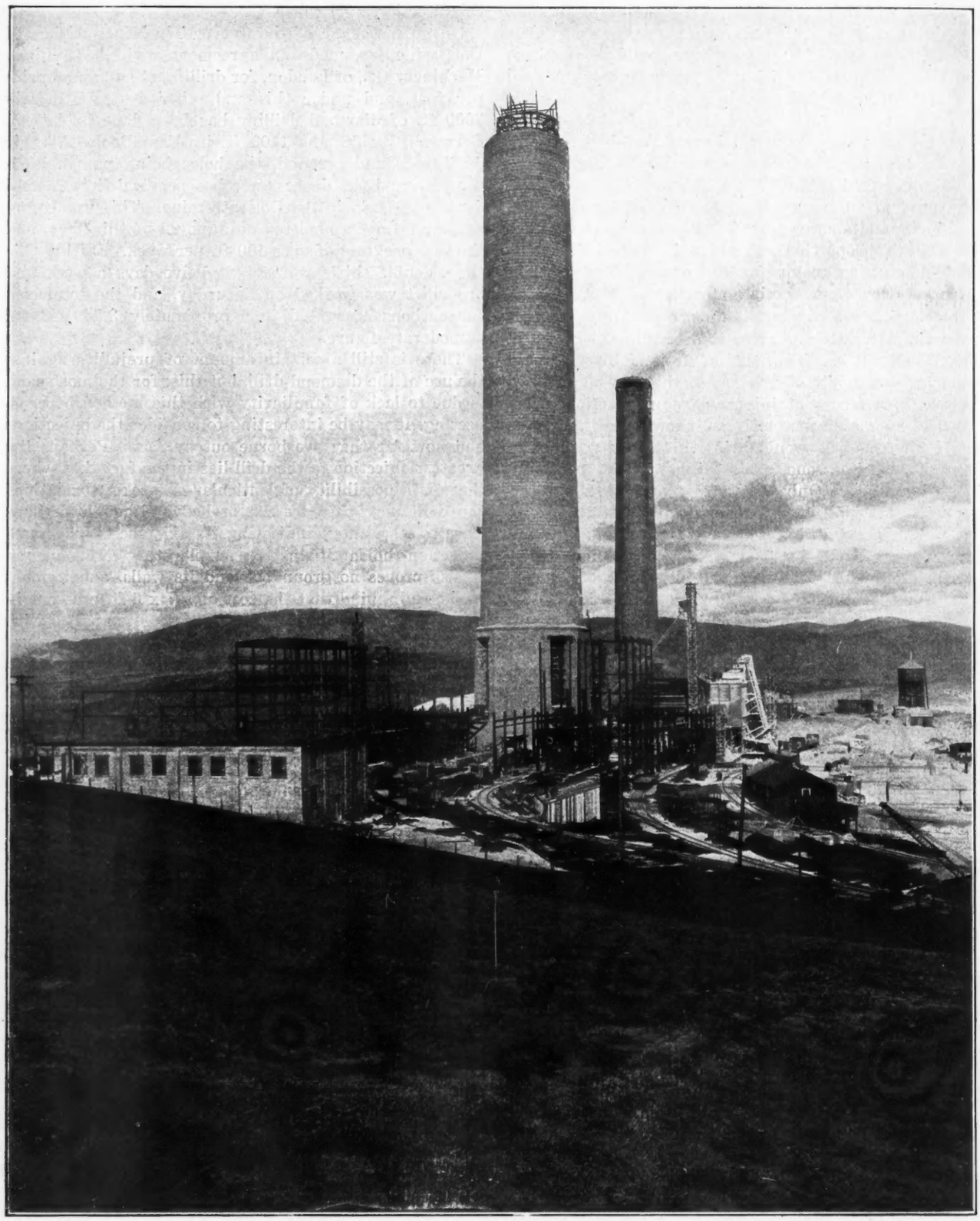
There is still a certain amount of prejudice against the use of the diamond drill, but this, for the most part, is due to lack of familiarity with this method of prospecting. It may be interesting to consider the objections and how far they are borne out by facts. Perhaps the greatest objection to the drill lies in the fact that where there is a possibility of lenticular or pocket formations the drill may pass by the orebody, although perhaps close to it, without indicating its existence. The same objection holds against an exploratory crosscut, as it also proves no ground beyond its walls, and it must be borne in mind that the cost of a 7 x 6-ft. crosscut in Cornwall—approximately 50s. per ft.—compares with the drill hole at 18s. per ft., and the rate of advance in crosscutting through the granites is not more than 2 ft. in 24 hours, as compared with 20 ft. progress with the diamond drill.

Another objection is the small size of the core extracted by the diamond drill, which it is claimed is unsuited to accurate sampling of the body passed through. If there is anything in this argument it is offset by the low comparative cost of drilling compared with crosscutting, although it is not easy to see how anything can be fairer or more accurate than the drill core. A further objection is the tendency of the drill hole to deflect from the line of projected bore. In some cases such deflection certainly does take place, but, except in deep holes, it is at best a negligible quantity, and when drilling in granites may be said to be non-existent.

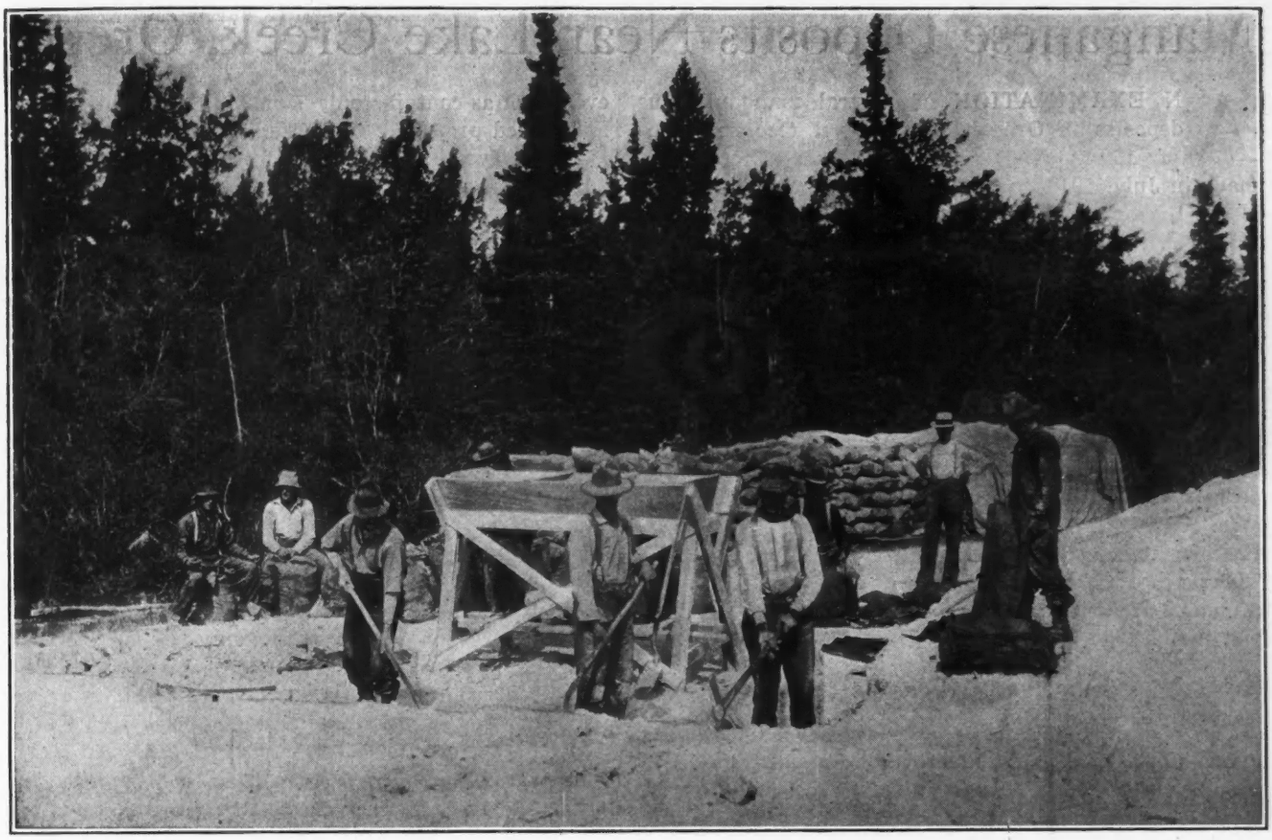
From the results already obtained from diamond drilling in Cornwall, it is clear that this form of prospecting is a valuable addition to the development methods already practiced in that field. It has been shown that ten times the rate of progress can be secured at one-third of the cost, and that the management is afforded an accurate knowledge of the formation penetrated, thus being able to determine rapidly which areas are profitable, as against those not worth further development.

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

Photographs From the Field



NEW STACK AT THE WASHOE REDUCTION WORKS, ANACONDA, MONT., SHOWN 440 FT. ABOVE THE FOUNDATION. WHEN COMPLETED THE TOTAL HEIGHT OF THE BRICKWORK ABOVE THE FOUNDATION WILL BE 550 FEET



SACKING MAGNESITE FOR SHIPMENT AT ATLIN, BRITISH COLUMBIA

GENERAL VIEW OF HYDRO-MAGNESITE DEPOSIT AT ATLIN, BRITISH COLUMBIA

The deposit covers about 80 acres, and the amount of material which is available in the bed is estimated at half a million tons. Up to the present, little development has been done, chiefly because of the distance from commercial centres, as Atlin is one of the most northerly points of British Columbia, and operations make it necessary to ship by water from Atlin to the White Pass & Yukon Ry. Co. terminal on Atlin Lake, thence to the North Pacific Coast, and from there south by steamer to Victoria, Vancouver, or Seattle. A few tons have been taken out for experimental purposes recently, and the results are said to have been satisfactory. Chemical analysis shows from 96 to 99% magnesium oxide after calcination. It is thought likely, because of the evident high grade of the material, the fact that it is in a finely divided condition and lies on the surface of the ground, and because the demand is growing in Canada, Western America, Australasia, and Japan, that some effort will be made which will result in the mining of the deposit.

Manganese Deposits Near Lake Creek, Oregon

AN EXAMINATION of several manganiferous deposits in Oregon, including a reconnaissance of 150 square miles near Lake Creek, was made in July, 1918, by J. T. Pardee, a geologist of the U. S. Geological Survey, in company with Henry M. Parks, Director of the Oregon Bureau of Mines and Geology. Messrs. Parks and Pardee are jointly responsible for the estimates and conclusions here given.

So far as known, the manganiferous deposits of the Lake Creek district are confined within an area of about 150 square miles in the central part of Jackson County, Ore. The area is rather sparsely settled, and farming is the principal industry. The nearest large town is Medford, which is 15 miles directly southwest of the deposits but nearly twice that distance by the available roads. Eagle Point, a town on the Pacific & Eastern Ry., is the most convenient shipping point. The surface of the region is hilly and in places mountainous, but moderately rugged. Streams are numerous, and the climate is mild.

Volcanic Rocks Underlie District

The area is underlain by igneous rocks that appear to be chiefly basaltic and andesitic flows and tuffs. The sequence of the rocks in part in the Lake Creek district comprises, beginning with the lowest flow, a platy basalt, 500 ft. or more thick; a red basalt tuff, commonly manganiferous, 100 to 300 ft. or more thick; a platy basalt, a few feet to 100 feet thick or more; dark gray to buff, locally manganiferous, andesitic tuffs and breccias, a few feet to 500 ft. thick; vesicular to compact massive dark gray and purplish gray andesitic flows and tuffs, about 500 ft. thick; and dense black basalt that weathers light gray on the surface, a few feet to more than 100 ft. thick.

Only insignificant amounts of manganese were observed in rocks other than the tuffs. All the layers dip 8° to 10° ENE, and apparently have been broken by faults with downthrow prevailingly on the west. At the Tywell mine the red tuff is cut by an andesite dike that appears to lead to an overlying andesitic flow. The rocks of the district resemble those of part of the middle or later Tertiary volcanic series of central Oregon, and may be of the same age or series.

Manganese oxides are locally plentiful in the gray tuff on the Gus Nichols and Vestal claims, but are confined chiefly to the upper part of the red tuff. Most of the outcrops of this rock show considerably more manganese than the other rocks. Pits or other workings show that at the depth of a few feet the rather soft oxides seen at the surface generally give place to hard, compact material containing abundant manganite. In several places bodies of hard oxides have filled cracks and vesicles and have replaced some of the rock. The exposed parts of these bodies appear to be free from foreign matter and sharply distinct from the barren parts of the tuff. The results obtained at a small plant operated by the Manganese Metals Co. appear to show that material rich enough to be called ore should contain not less than 10% Mn, but most of the manganiferous material seems to be so easily workable that even such as contains only 7 or 8% Mn might be mined and milled profitably if worked on a larger scale.

At the Tywell mine, a face of ore estimated to average 20% Mn is exposed for a length of 150 ft. and a height of 10 ft. It extends further horizontally in two directions for unknown distances—possibly for 1000 ft. —and at some places it may be considerably thicker than it is at the exposure. The information afforded by drill holes and open cuts, and the inferences drawn from the distribution of float, indicate that this body probably extends through four acres or more and contains about 10% Mn. Though practically no ore has been prospected or mined elsewhere in the district, the red tuff in several places at the surface shows a mineralization comparable with that at the Tywell mine, and the areas of tuff that bear manganese stains include several hundred acres.

In the most promising areas the tuff is either uncovered or lies beneath only a few feet of overburden. At the Tywell mine part of the tuff area is overlain by lava that ranges in thickness from a few inches to 100 ft. or more. In the principal working, a large open cut, the ore has been followed back into the hill to a point where the overlying lava is 15 ft. thick. It appears reasonable to assume that the ore extends at least a few feet further under the lava, but practically no evidence of its extent could be obtained. As most of the deposits of manganese oxide in the Northwest are superficial, the Lake Creek deposits probably do not extend far beneath the lava, and the lava-covered areas have therefore been left out in making the estimates of known and probable ore reserves here presented.

The manganese oxides were clearly formed later than the tuff, and in at least one or two places they were evidently deposited by descending solutions. No minerals which suggest that the ore is of deep-seated origin were found, and it is doubtless residual. The oxides have apparently been partly leached out of the weathered tuff. At the Tywell mine, 5 to 10 ft. from the surface, there are many cavities that appear to have been filled with manganese oxides but that are now nearly empty, and most of the oxides remaining in other places are soft. Apparently the manganite in the unweathered parts of the deposit was changed by weathering to pyrolusite, part of the manganese being dissolved and carried away.

In addition to the manganese oxides and silicate minerals, the crude ore contains some hematite and limonite and a little gypsum and zeolite. The concentrate is reported to contain a little barite. Data given by the Manganese Metals Co. show that the ore so far mined has averaged about 20% Mn. Car samples of two shipments of concentrate ran 47.5 and 48.5% Mn, and assays of other samples of concentrates are reported as follows:

ANALYSES OF CONCENTRATES OF LAKE CREEK MANGANESE ORE

	Gold Oz. Per Ton	Silver Oz. Per Ton	Iron %	Manganese %	Phosphorus %
Sample 1	0.08	11.1	1.2	52.5	0.09
Sample 2	0.08	14.5	1.4	46.5	0.207
Sample 3	0.16	11.15	0.9	52.8	0.174

About 1500 tons of ore, containing at least 15% Mn, is in sight. In addition, incomplete prospecting by

drilling and open cutting indicates that at least four acres are probably underlain by 10 ft. of ore (about 120,000 tons) containing probably 10% Mn. The surface indications in other parts of the district warrant an estimate that they may yield 130,000 tons more of material carrying at least 10% Mn, so that the probable reserves of ore of this grade total at least 250,000 tons.

Development of District Begun Last Year

Manganese mining is a new industry in the Lake Creek district, actual development work having been begun late in 1917. Since October of that year the Manganese Metals Co. has explored, by open cuts and drill holes, three or four acres on the Tywell ranch, about five miles southwest of Lake Creek postoffice, and has erected a mill capable of treating 20 tons of crude ore in 24 hours. This mill has been in operation intermittently since Mar. 15, 1918, and has produced concentrates that contained an average of about 45% Mn, four tons of crude ore yielding one ton of concentrates. Since this company began work, the known limits of the manganiferous area have been considerably extended by prospectors, and many claims have been located.

The cost of hauling concentrates by teams from the Manganese Metals Co.'s mill to the railroad at Eagle Point is now $4 a ton. At a moderate expense the roads could be made usable for heavy trucks throughout the dry season, from April to November. Water for working many of the deposits can be obtained almost throughout the year without great expense, and timber for mine and mill construction is within easy reach of most of the mines. Wages are $5 or more a day, and mining supplies are about as expensive as they are elsewhere in the Northwest. Electric power is available from a transmission line passing through Eagle Point.

Options Taken by Victor Rakowsky

Options on several claims, including the larger part of the holdings of the Manganese Metals Co., have recently been obtained by Victor Rakowsky, of Joplin, Mo. Mr. Rakowsky has arranged to begin developing the deposit on the Tywell ranch by churn drilling, and has taken steps to obtain water and machinery sufficient to extract, on a large scale, such orebodies as he may find. He will probably have demonstrated the value of his property and of his other options within a few months, and his plans include the erection of at least one mill, having a daily capacity of 500 tons of crude ore, which is to be in operation before the end of 1918. Unless some unforeseen contingencies arise, the mill of the Manganese Metals Co. will no doubt continue production at its present capacity.

The results so far obtained by Mr. Rakowsky on a test shipment and by the Manganese Metals Co. show that high-grade manganese concentrates can be made profitably from the ore at the Tywell mine and presumably from that at the other Lake Creek deposits. In fact, the richness or purity of the manganese oxides in this region, and the sharp line of demarcation from the waste, make these deposits workable, and distinguish them from others of low grade, such as those which are associated with quartz lodes. Though the extent of the workable bodies has not yet been demonstrated, there is evidently sufficient ore in this district to warrant extensive operations.

Frozen Organic Klondike Deposits

In a paper recently read before the Royal Society of Canada, J. B. Tyrrell describes the deposits of frozen material which overlie the gravel in the bottom of the valleys in the Klondike, and which, it is assumed, occur only in Arctic or sub-Arctic regions. The material is locally known as "muck," and the deposits, which are of vegetable character, may have a thickness of 10, 20, 30, or even as much as 100 ft. The plane of separation between the gravel and the vegetable matter is usually sharp and well defined, though occasionally little layers of the latter may be found included in the upper beds of the gravel.

The deposit is composed in part of mosses, such as *sphagnum* and *hypnum*, and also of sticks and limbs of trees, leaves, and of all similar kinds of débris. It also contains a large quantity of water in the form of ice. Here and there are layers of clear ice which have been formed by spring water rising from beneath, and freezing before it reached the surface. In one instance which was examined the water derived from this ice was found to be quite hard from the presence of salts of lime. Some gritty material may also be present in the deposit, and occasionally, toward the bottom, there may be a few thin layers of sand.

In color, the frozen vegetable matter is usually dark bluish gray or brown, much like the bottom turf in the Irish bogs, though it becomes lighter with the presence of sand. On the undrained parts of alluvial flats it is now generally covered with mossy swamp, and near the channels of streams it supports a lusty growth of white spruce forest.

The "muck" deposit and the gravel and rock which are found underlying it are permanently frozen to depths of about 200 ft. below the surface. In mining operations, shafts can readily be sunk through it with pick and shovel, for an experienced man can pick it off in layers without difficulty. The deposit was formed while the rocks and soil of the country were permanently frozen, and while the supply of ordinary alluvial material was cut off. The process of its formation started in a period of great cold in early glacial times, and has gone on continuously and uninterruptedly down to the present.

If the cold period when the beds began to be formed was at the beginning of the first glacial period, then the gravels of the alluvial bottom lands, which underlie the "muck," would be pre-glacial in age. From this it would be necessary to conclude that the valleys holding these gravels were excavated before the glacial or Pleistocene epoch, and that these valleys are therefore of Pliocene age. When the cold period began, the country appears to have been fairly thickly populated with mammoth, mastodon, bison, elk, moose, horses, bears, and other animals of that era, for bones are found in large numbers in the underlying gravels and in the bottom of the deposit, but there is reason to believe that the climate soon become too severe for them, and their remains are scarce in the higher portions of the deposit, and finally disappear from it altogether.

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

Development of the Ferromanganese Industry*

By Theodore Swann.

Prior to 1914, the United States produced less than one-half of its ferromanganese requirements, and in 1914 only 54% out of a total 183,728 tons, produced and imported. In 1917 this amount was increased to 331,381 tons, of which 286,000 tons, or 86%, was produced in the United States. In 1918 home production will be not less than 90%. Under pre-war conditions the world's supply of manganese ore came mainly from Brazil, India, and Russia. The shortage of shipping brought about by the war, made it imperative that the United States should develop its own resources.

Domestic Production of Manganese.

The domestic production of manganese ore in 1914 was 2635 tons—insufficient to make one-half of 1% of the ferromanganese required. In 1915 this was increased to 9709 tons, or enough to meet about 2% of requirements. During 1916 the domestic production more than trebled that of the previous year, and amounted to 26,997 tons, or enough to make less than 3% of America's increased ferromanganese requirements. In 1917 the production of high-grade domestic ore quadrupled that of the previous year, and 113,734 tons was produced—enough to make more than 10% of the ferromanganese required.

The domestic ore production of 1917 only supplemented the foreign supply, the shipment of which was rapidly becoming difficult. In the first six months of 1918 the high-grade domestic manganese ore production was greater than that of the entire year of 1917, with prospects for a decided increase in the second half over that of the first half.

During July, 1918, a total of 30,370 tons of ferromanganese was produced, containing 20,226 tons of metallic manganese, and 23,021 tons of spiegeleisen, containing 4698 tons, making a total of 24,924 tons of metallic manganese in the total ferromanganese and spiegeleisen produced. The percentage of metallic manganese derived from domestic ores in the tonnage reported for July, 1918, was 47.9.

Manganese Requirements.

It has been estimated, from the consumption to date this year, that the iron and steel industry will require, during the remainder of this year and the first half of next year, 31,000 tons per month of metallic manganese in the form of ferromanganese; and, assuming that the average grade will be 65%, the monthly requirements of ferromanganese will be 32,300 tons. In addition, 3000 tons per month of metallic manganese, in the form of spiegeleisen, will be needed. Assuming the average grade to be 18%, the monthly requirements will be 16,500 tons.

The total metallic manganese requirements for the year ending June, 1919, for both ferromanganese and spiegeleisen, are therefore assumed to be 288,000 tons. From the best information available, the United States will produce ores that will contain at least 50% of the manganese content required to make this tonnage of ferromanganese and spiegeleisen.

Conservation of Manganese

At the May meeting of the American Iron and Steel Institute, C. R. Ellicott presented a complete and instructive paper, entitled, "The Conservation of Manganese." In addition to acknowledging the facts so ably presented therein, one may well pay tribute to the many producers of domestic manganese ore who are rapidly making the United States less dependent upon other countries. It is the patriotic duty of both the producers and users to encourage the production of domestic ores, and to break away from the prejudice against the use of low-grade alloys.

It has been suggested that the steel industry could further aid in the conservation of shipping by using, when possible (in many instances to their direct advantage), silicomanganese, which could be made from high-silica domestic ores. Prominent American metallurgists consider the advantages of silicon alloyed with manganese to be:

1. The silicon reduces the carbon content, giving the desired low-carbon alloy for the steel addition.
2. The combined selective action of silicon and manganese will be more active than either element alone.
3. The resultant combined oxides, forming manganese silicate, will, owing to greater fluidity, be eliminated from the metal more readily than the oxides of either alone.

Deposits of Silicomanganese Ore

There are numerous deposits of manganese ore too high in silica to be used in making ferromanganese. These however, are available for making silicomanganese. It is possible to make silicomanganese from high slags carrying from 10% and up of manganese, and also from manganese ores carrying as low as 18% manganese and as high as 40% silica. This source of supply has been proved to be available by one electric-furnace operator, who made, from slags running 10 to 17% manganese, several carloads analyzing about 64% manganese, 12% iron, 23% silicon, and 0.60% carbon. The average slags produced with the above metal contain under 4% manganese.

The manufacture of ferromanganese in the electric furnace is one of the important developments in connection with the utilization of domestic manganese ores, especially when the plants are near the mines. Perhaps the greatest value today of the electric furnace, in connection with the production of ferromanganese, is the conservation of coke. In July, 1918, over 7½% of the entire production was made in electric furnaces. It is estimated that by the end of this year such appliances will be making about 15% of the total ferromanganese produced in the United States.

The slag and volatilization losses in the smelting of ferromanganese constitute problems for the metallurgists of the country. It is believed possible to increase the recovery by 10%. If such increase could be made, a saving of about 30,000 tons of metallic manganese would be effected, thus releasing more than 75,000 tons of shipping.

*Abstract of paper presented at the Fourth National Exposition of Chemical Industries, New York, Sept., 1918.

The Russian Industrial Nightmare

HUGO KLEIN, a steel metallurgist who is a member of the German Military Commission now at Kieff, in the Ukraine, has written an article, appearing in *Stahl und Eisen,* dealing with the troubles of the South Russian industry since the outbreak of the revolution, which we reproduce from the *Ironmonger.* He recalls that in April, 1917, the preliminary government of Prince Lvoff, which preceded that of Kerensky and the destructive anarchism of the Bolshevists, issued an order for the formation of workmen's committees in all industrial undertakings, whether owned by the government or by private proprietors. This order was, no doubt, due to the pressure of the Petrograd workmen's council, and was probably agreed to by Prince Lvoff and his Moderates, because they thought that, by setting up such committees, they would at least reduce the number of mass meetings of workmen, which in Russia invariably degenerate into political wrangles. The committees were in practice to frame their own rules and themselves define the nature of their activities, rights, and duties. The participation of the directors of the works was limited to the provision that the draft rules were to be discussed at a joint meeting of the committee and of the directors, and settled by mutual agreement. In most plants, however, these joint meetings were never held, but the decisions of the workmen's meetings were set up as law, and the directors had to content themselves with silent opposition.

Mass Meetings Frequent

If the Ministry thought that by this order the workmen's agitation would be diverted into less violent channels, they soon discovered their mistake. Several meetings were held weekly, either in the yards or within the factories, and while they were in progress, generally from one to one and a half hours, all the plant, even furnaces, remained unattended. The managers were not notified of the meetings, nor was their permission asked. "The Present Political Situation" was a favorite theme of discussion, and the "expert advisers," which under the order might be added to the workmen's committees from outside the factory employees, usually turned out to be itinerant professional orators, students, lawyers, or others. They "instructed" the illiterate workmen in the aims and objects of the Petrograd workmen's and soldiers' councils, and a net of orders emanating from these councils was drawn over the whole country. The same system of deliberate disorganization by which the army was wrecked was applied to the factories.

Minimum Wages Fixed for Metal Workers

In May, 1917, at the invitation of the president of the iron distributing office, which had been created by the government during the war, joint meetings of the manufacturers' and workmen's delegates were held, at which for the first time minimum wages applicable to all classes of workers in metals were to be fixed. The workmen's delegates rejected the increases offered by the manufacturers, and left the meetings, but gradually the new scale was agreed to by the workmen and put into force. In the course of the summer the workmen seized sole control of the various funds for the purchase of food and other necessities for the workers and of the welfare institutions which had been organized in many factories, and large sums of money were stolen or squandered.

Managers, engineers and other members of the staff were gradually deprived of all authority and influence. Any one of these who had made himself disliked was forced out of his position, and managers were constantly dismissed by their workmen for "anti-revolutionary sympathies." Their successors had to be approved by the workmen's committee before they took up their appointment. The most trivial incidents in the day's work were discussed at interminable length, and judgment was pronounced upon them at the workmen's councils. With the installation of the Bolshevist government in November, 1917, the democratization of works proceeded apace. Lenine ordered the formation of supervising committees consisting only of workmen, who examined all the works' reports, controlled all purchases and sales and demanded the right of countersigning every letter that left the works. But the most embittered fights were for the control of the cash-box.

"Hand Over," the Revolutionists' Watchword

The progress of the Russian revolution showed no trace of the inspiration of any elevated thought, of any respect for human rights. Its sole watchword was "Hand over!" Hand over the land to the peasant; hand over the factory to the laborer. No thought was given to the new duties which must accompany the new-claimed rights. The land was left unplowed; the factories stood idle. Piece-work was abolished, and there were no bounds to the waste of time. While the creation of wealth grew less and less, new paper money was printed in ever-growing masses, and as no one produced anything useful, the purchasing power of money sank and famine prices ensued.

The monthly output of coal in the Donetz district, which averaged 2,000,000 tons in peace time, and was still 1,358,000 tons in September, 1917, sank to 491,000 tons in January, 1918, and has since ranged from 325,000 to 500,000 tons. The monthly output of pig iron in South Russia, which amounted on an average to 260,000 tons before the war and in 1916 was still 237,000 tons, fell in November, 1917, to 106,000 tons, in December to 93,000 tons, and in January, 1918, to 82,000 tons. Since that time no returns have been published. In April and May of the present year, all the blast furnaces were idle with the exception of two near the coal mines, but their output was very small.

Factories Close But Wages Continue

At the end of 1917, the production in the mines had decreased to such an extent that the factories were obliged to suspend work, but by order of the Workmen's Committee the men continued to draw their full wages, and if there was not enough money in hand of the works' funds, the wages were paid out of government money.

Then came the last chapter: the nationalization of the works. The Bolshevist government called upon the workmen themselves to assume the management of the

factories. In most of the factories, however, no men could be found who were able to carry out this request. In some plants the supervising committee exercised its powers side by side with the directors who really did the work proper, and in others workmen were elected to the board, but failed to exercise any real influence. The only factories in which the order of nationalization was actually carried out were those to which the Petrograd government had sent special delegates. The parting present of the Bolshevist government was the "Mutual Contract," which was signed on Mar. 16, 1918, after long negotiations between the All-Russian Trade Union of Metalworkers and the Manufacturers' Syndicate, under pressure of the Bolshevist government.

Unions Only Could Hire and Discharge

Under this contract all workmen could be engaged or dismissed only by their respective trade unions. The workmen were divided into groups, and the wages were fixed on the same basis, although not at the same figure all round, so that there was little difference between the pay of the skilled worker or the man in a responsible position and that of the unskilled laborer. Previously, a leading roller and a skilled machinist had been paid four or five times as much as an ordinary day laborer, but the underlying idea of the Bolshevists was to make wages as nearly equal as possible. So the laborer's wages were put at one rouble per hour, whereas the highest wage of a skilled worker was fixed at 1.90 roubles. A large number of the men were dissatisfied with this arrangement, and also with the equal treatment of work in different groups.

When work was temporarily suspended, the men were to be paid two-thirds of their wages for the first 12 days and one-half for the remaining period of idleness. If during this time the workman demanded to be paid off, he was to be paid 12 days beyond the day of his leaving. If the works were permanently closed, the directors had to pay the dismissed workmen 24 days' wages, and as the rule entitling the men to 12 days' wages on dismissal was not repealed, when many of the works closed down the men demanded payment for 36 working days. The manufacturers had signed the "Mutual Contract" under duress, and on the understanding that the work performed should reach a good average standard and that the government would fix higher selling prices for the finished products, and when neither of these conditions was fulfilled, they declined to recognize it any longer.

Conditions Worse When Teutons Arrive

When the German and Austrian troops marched into South Russia the difficulties of the industry became worse still. The available rolling stock had diminished with the retreat of the Bolshevists, the army authorities seized what was left, and the coal supplies were barely sufficient for the railways. Nothing could be spared for the iron works, and those which had still managed to keep going were now obliged to close down. After the resumption of railway traffic, the partial removal of the considerable stocks of half-finished and finished manufactures that had accumulated at the works, and the reopening of the banks, many of the factory owners put an end to their undertaking to pay wages during the suspension of work, by dismissing all the men. Even Lenine recognized in time that it was a mistake to abolish all piece-work and that the management of industrial undertakings can be carried out only by men whose training fits them for their positions. Hence he afterward issued another decree, in which piece-work was reëstablished and orders were given for the reinstatement of the technical and commercial managers "in order that further millions may not be lost by the nation"—a decree which is typical of the disorder into which the Bolshevists have thrown the world of labor. The latest device is to vest the management of every factory in a committee of eight, consisting of representatives of the government, the manufacturers, and the workmen.

Work Resumed in Some Places

Three of the "mixed" iron works in the Ukraine, the Société Dniéprovièn ne, Kramatorskaya, and Donetz-Yurievka, have lately resumed manufacturing on a small scale. Others, including the South Russian Tube Works, the Briansk and Taganrog Iron Works, and the iron works in the coal district (Hughesovska, Makeievka, and the Russo-Belge Co.), are preparing to restart at the end of August. At first only some of the openhearth furnaces and bar-iron and roofing-sheet mills will be set going, in order to work up the existing stocks of steel ingots, pig iron, and scrap, and to get as large a quantity of finished products as possible ready for the market with a minimum consumption of coal. The works in the coal district have enough materials at hand to be independent of supplies by rail for some months, but of the factories outside the district, only those which are assured of a coal supply, or which produce special products, such as black and galvanized roofing sheets, tubes, and tires, which are urgently required, will be able to do anything until after the harvest, when labor will return to the coal mines. With a resumption of the coal output, and in view of the accumulation of stocks of blast-furnace coke, it should be possible to blow in a number of blast furnaces in October.

Risk Not Assumed by Miner

By A. L. H. Street*

Upholding judgment in favor of the operator of a drilling machine in a mine, who was injured by a fall of loose rock, and who asserted negligence of his employer in assuring him that the stope at the particular place where the accident occurred was in safe condition, it was recently decided by the Utah Supreme Court, in the case of Urich *vs.* Utah Apex Mining Co., 169 *Pacific Reporter*, 263, that though plaintiff was required to inspect his place of work, he did not, on the theory that he was bound to make the place of work safe, assume the risk of injury from rock falling from the roof of the mine in a place other than his immediate place of work. It appeared that the accident did not occur where plaintiff had been engaged in operating a drill, but at a place he was passing in obedience to an order of the shift boss, who temporarily assigned him to other work.

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Mineral Industry in Burma*

Grains of gold are washed down by many streams in Burma, and the panning of gold dust from sand forms a precarious means of livelihood. The upper reaches of the Irrawaddy and the Sittang appear to be the most prolific. In the Irrawaddy above Myitkyina the Burma Gold Dredging Co. has carried on operations for some years, but has met with many difficulties. The largest yield in a year has been 8000 oz. of gold.

An attempt was made to extract gold from quartz at Kyaukpazat, in Katha District, and quarrying and crushing were started in 1895. The yield of gold was about 1200 oz. The gold-bearing quartz proved to be only small in amount and was soon exhausted. The washings in streams show that many parts of the province are rich in gold, but it has nowhere as yet been found near the surface in remunerative quantities. It may some day be mined profitably from lodes, but capital has not so far been applied to such a venture.

The Chinese at one time had silver workings at Bawdwin, in the Northern Shan States, now the scene of the industries of the Burma Corporation. That these workings must have been extensive is shown by the amount of slag that has been left on the surface and by the bareness of the adjacent hills from which firewood was cut. The mine is now worked chiefly for lead, and will be referred to later. The only other silver mine in Burma worked in recent years is at Bawzaing, in the Southern Shan States, where the chief of the state, assisted by a Chinese lessee, extracts silver in small quantities from argentiferous galena by primitive methods.

Tinstone has long been worked in Tavoy and Mergui districts. It is found in granite and also in alluvial deposits. The mine workers are mostly Chinese. The physical difficulties of the country, the high rate of wages and the absence of communications have impeded commercial undertakings, and the industry is carried on on a small scale. Tin undoubtedly exists in large quantities in these districts, and its working may become a commercial success when better means of communication and transport have been established.

The export figures for tin ore and tin, in tons, are: 1911-12, 279; 1912-13, 429; 1913-14, 395; 1914-15, 290; 1915-16, 330.

Broad tracts of ferruginous laterite are found in many parts of Burma. Some of these have been worked for iron, and the abandoned workings can still be seen.

The Burma Corporation's mine at Bawdwin, in the Northern Shan States, is the only important source of lead and silver in Burma. In 1915, 42,000 tons of ore and slag was smelted. The total production of hard lead was 13,522 tons, of which 6947 tons was refined and sold in Eastern markets, and 6575 tons, containing 248,875 oz. of silver, was shipped to England to be refined. The mine is connected by the company's light railway with the Mandalay-Lashio Ry. The roasting plant, which consists of three roasters in operation and two under construction, will, when completed, have a daily capacity of 150 to 200 tons of ore. In June, 1916, the daily production was at the rate of over 50 tons of lead, containing from 3000 to 4000 oz. of silver. Fine silver is not yet produced on the spot. No zinc concentrates were exported during the year. The Geological Department of the government of India considers that the question of the ultimate treatment of the Bawdwin concentrates is an important one for India, because if it were found possible to erect zinc smelteries in Burma, the resultant production of large quantities of cheap sulphuric acid should have a far-reaching effect on industrial development.

The figures for export of lead, in tons, are: 1911-12, 10,131; 1912-13, 7489; 1913-14, 3422; 1914-15, 6499; 1915-16, 10,846.

Of recent years a great demand arose for wolfram in the manufacture of high-speed steels, and attention was directed to the source of supply in Tavoy and Mergui districts. The whole of the supply went to Germany, from which country all tungsten used in England was obtained. Since the war began a greatly increased amount of tungsten steel has been required for the manufacture of munitions. Methods of working, which before the war amounted to little more than surface extraction, have been improved. The output, which was 2326 tons in 1914 and 2645 in 1915, rose to 3034 tons in 1916, and 4000 tons in 1917, and is rapidly increasing. The Tavoy field produces one-third of the world's output. All wolfram produced is earmarked for dispatch to the British government.

*Excerpt from an article by Sir Harvey Adamson, in the bulletin of the Imperial Institute.

Mineral Exports From Bolivia in 1917

Minerals maintained a leading position in Bolivian exports in 1917, 86% of the shipments last year being credited to the mining industry, according to *Commerce Reports*. Tin held its place of honor, its shipments in 1917 amounting to 46,430 tons, against 35,000 tons in the preceding year. Though the increase in quantity was 10,000 tons, or 31%, the increase in price was 100%, the 1917 value amounting to $33,250,800, whereas in 1916 it was $16,634,280. Copper exports grew from 29,000 tons in 1916 to 37,000 tons in 1917. The mineral deposits are found in four central departments, Potosi leading and Oruro following, with La Paz third and Cochabamba fourth.

Carrying Katanga Copper

The *Ironmonger* in a recent issue describes the present situation of the Benguela Ry., which will run from Lobito Bay, in the Portuguese colony of Angola, on the west coast of Africa, to Benguela, on the east coast. So far, 325 miles have been opened, and earthworks have been completed for another 75 miles, but it has been necessary to suspend construction because of the impossibility of getting railway material at present. The gage of the line is 3 ft. 6 in. It will run along the watershed dividing the tributaries of the Congo River from those of the Zambesi, and will join the Capetown-Bukama line about 90 miles north of Elizabethville, in the Belgian Congo. When it is completed it will give an Atlantic outlet to the copper of the Katanga mines, which has now to be transported to Beira, on the east coast, for shipment to Europe. Thus not only will the overland route be shortened, but the ocean voyage will be reduced by 3000 miles.

Correspondence and Discussion

Safety Measures and Hoisting Efficiency

I quite agree with the spirit of an editorial which appeared in the *Journal* of June 15, entitled "Safety Measures of the Right Sort," and concur with the conclusion that safety regulations should be made effective by imposing prison sentence as well as monetary fine upon the person responsible for an avoidable accident.

Although I have never worked in Sudbury, I doubt that the guilty person was sent to jail. The hoisting practice of the district must be somewhat out of date if chairs are still used in the shafts, for these are relics of the days when hoisting engines' brakes were unreliable. The use of chairs has survived in some districts, but that does not make the practice proper and safe, and there are several reasons why they should not be used in a shaft. In the first place, they are likely to cause accidents similar to the one recorded at the Mond No. 1 mine, which was, fortunately, unattended with serious result.

Chairs are generally equipped with a pin to hold them out of the shaft, but usually the management demands such fast handling of the cars that dependence is placed entirely on the overbalancing of the lever arm to hold them in this position. Occasionally, because of accretions of one kind or another, they become balanced; and the jar from a passing cage, if the guides are at all rough, may throw the chairs back into the shaft. The cage, when it is lowered, then seats itself at the station, the cable coils up in the shaft (a considerable length of rope may be unwound before the hoisting engineer notices the lack of weight) and the up cage is pulled into the tangle, thus damaging the timbering, cutting up the cable, and, possibly, seriously injuring some one. It is probable that the cager at the Mond mine did throw the chairs out, and that they were jarred back into position again in the shaft. If he did so, the accident was not his fault, but the fault of the management; for it may be entirely attributed to questionable hoisting practice.

The liability of accident as a result of chairs being left in place or dropping into the shaft is not the only reason why they have been discarded in many mines. It is poor practice to use them, both because their adoption slows down the rate of hoisting, and because, by taking the weight off the cable and putting it on the chairs, a greater strain is thrown upon the hoisting rope in starting the loads. The life of the cable, which is an expensive article at the present time, is proportionately shortened. The engineer, when chairs are used, must "feel" for them every time he lowers a cage to the shaft level from which he is hoisting; and if he lowers on them too hard he will break something, and tie up the shaft. When chairs are not used, the engineer "drops" the cage to within an inch or two of its proper position, usually on an exact level with the floor.

The skill with which a good hoisting engineer will "spot" his cage without chairs, at a level 1200 to 2000 ft. below surface after "dropping" the cage at a high speed, is surprising. I have seen hoisting engineers at the Mountain Consolidated shaft, at Butte, "spot" a cage at a lower level 20 times in succession, in the ordinary course of hoisting, without once missing the station floor by as much as an inch. While the cage is dancing with the stretch of the rope, and before it has come to a real stop, the cagers, if they understand their work, will have the empty car off and the loaded one on, and will have rung for the engineer to "spot" the next deck, level with the station. If the deck should be stopped two inches high or three or four inches low, the cagers will handle the cars almost as quickly as if the deck had been "spotted" level with the station.

Salt Lake City, Oct. 1, 1918. C. T. R.

Uncertainties of Geological Evidence

The Plutonic school of geologists, who make up in enthusiasm what they lack in numbers, have assiduously hunted over the southeast, or disseminated-lead belt, of Missouri for conclusive evidence as to the deep-seated origin of the huge bodies of low-grade lead ore. Though trifling amounts of lead and zinc occur in the limestones of all ages in Missouri, from the coal measures down to the basal Archean granites, no important quantities of either metal, beyond the small, erratic production of "gopher" miners, have been produced except in the famous Joplin region in the southwestern corner of the state, which covers several counties, and the disseminated belt in southeastern Missouri. The latter district has been the premier lead producer of the United States for several years, and more than 90% of the output is obtained in one county (St. Francois). The explanation of this intense localization of the lead in southeastern Missouri has always been a difficult nut to crack, especially as the deposits are so large and persistent, with extensive though practically barren areas intervening between the different orebodies. Some of these exceed a mile in length, range from 10 to 100 ft. in thickness by 50 to 500 ft. in width, and generally follow two well-defined courses. Though there is no sharp boundary delimiting the sides of the orebodies, their great size, fairly uniform low-grade character, and their occurrence at the base of the lowest limestone found in Missouri, that sometimes rests on the granite, is in marked contrast to all the other Ozark lead and zinc deposits. The Joplin deposits occur in the sub-Carboniferous.

Geologists who have a bias toward the deep-seated origin of mineral deposits promptly grasped these salient differences from the other numerous Missouri lead deposits as indicating ascension from great depths, especially as they occur at or close to the Archean granites and porphyries of the Ozark uplift, whereas the latter are deeply buried throughout the other mineral

districts of Missouri. Although the practical absence of silver in the disseminated lead (about an ounce per ton of lead) seems to preclude a fissure-vein type of origin of the lead, true quartz veins in the Missouri granite and porphyries sometimes carry galena that is rich in silver, though in other veins the silver is practically absent, amounting to only ½ to 2 oz. per ton. Hence the silver evidence is neutral, although some enthusiastic dissensionists have insisted that this one feature precludes acceptation of the theory of the deep-seated origin of the lead.

The invariable occurrence of the sulphides of nickel, cobalt, and copper in the disseminated ores, which increase in quantity the nearer the lead deposits occur in relation to the granite, as at Fredericktown and Mine LaMotte, further points to a deep-seated origin, especially as nickel and cobalt do not occur anywhere else in Missouri except at St. Louis. But in some of the close-grained, compact lithographic limestone beds in the St. Louis quarries (sub-Carboniferous), geodes are found that are lined with beautiful dolomite and calcite crystals on which rest tufts of millerite, or nickel sulphide, as delicate yellow hairs. Solid blocks, free from cracks or seams, on being broken, are found to contain the millerite bearing geodes, hence it is evident that in this instance the nickel was derived by lateral secretion and is in no way connected with a deep-seated origin.

The fact that the thin layers of shale that occur at the base of the disseminated lead bearing limestone (Bonne Terre) are more or less converted into chlorite, whereas the shale in upper horizons is unaltered, has also been construed as pointing to deep-seated thermal waters, but this metamorphism is of a local chemical nature and does not extend for more than 50 to 100 ft. above the base of the Bonne Terre limestone. Also, the fact that the freshly mined, bright, disseminated galena soon "sunburns," or tarnishes, on exposure, whereas elsewhere in Missouri the galena remains bright, is due to its containing a little iron, probably as carbonate. The enclosing limestone rapidly "sunburns" on exposure, changing from gray to brown, owing to associated iron carbonate—in fact it contains sufficient of that substance to be attracted by a powerful magnet.

The presence of much faulting in the disseminated belt has a neutral bearing, as most of the orebodies occur at a considerable distance from the important faults.

Two occurrences recently came to my notice that would have greatly encouraged the Plutonic geologists in their search for convincing evidence to confirm their views had the specimens to be described been forwarded to them with the mere statement as to where they were found. A sample of felsite—a genuine igneous rock—was found "outcropping" close to one of the largest mines in the Flat River district, and at Bonne Terre, near the St. Joe mine, a weather-beaten piece of fluorspar, containing lead, was found "outcropping" in a field. It was difficult to resist the temptation to send the specimens to a certain distinguished geologist of the Plutonic school, with the above meager information, as it might have started "another meeting on the Stanislaus," in which he would have had at least two powerful "weepons of offense." But some things are not what they seem, and investigation disclosed that the felsite was a solitary specimen that was found on the roadside, where it had been either hurled at a dog, or fell out of the rig of a fisherman who had returned from Iron Mountain Lake—in the midst of felsite and a favorite resort for the Lead Belt fisherman.

I identified the fluorspar as of true deep-seated origin, as it came from the fissure veins of Hardin County, in southern Illinois. The latter place formerly furnished flux for the Flintshire furnaces that the old Desloge Lead Co. operated at Bonne Terre about forty years ago. What small boy stole it from the fluorspar bin, and whether he used it to throw at rabbits or groundhogs, deponent sayeth not. H. A. WHEELER.

St. Louis, Mo., Oct. 22, 1918.

Co-operation Among Small Mines

Referring to the article by Geo. J. Young in your issue of Nov. 9, I am acquainted with the Rex Mill mentioned and with the Gold Circle district in which it stands, and Mr. Young is quite right when he suggests that coöperation might have resulted in more rapid and better development of the district as a whole, and would undoubtedly have been to the material advantage of several prospectors in the vicinity. Until human nature changes or until men learn that team work is as profitable for a few individuals as for larger organizations, the fact will remain that many cases of individual effort will fail where coöperation might have succeeded.

The Rex Mill was built for one property and was subsequently used as a custom mill, but in no sense as a coöperative proposition. Satisfactory recoveries were made, but the miners felt that it was being run for the benefit of its operators and not to their advantage, so that little use was made of it.

Later the Elko Prince Mining Co., operating under the management of the Dorr Co., built a substantial mill designed to take care of any custom ores that might be offered. The operators of this mill were a guarantee that customers would receive fair treatment, but only a limited tonnage was offered. The feeling still prevailed that the prospectors were to get the worst of it, or perhaps it was that they still hoped to make mines of their own that would equal or surpass the Prince.

Failing to get custom ores, the Elko Prince formed a leasing company with the object of developing the best claims in the vicinity. This has not yet been and probably will not be a success, as the most desirable ground is held at such terms as to render development impossible.

With all the elements present for successful coöperation, money for development and a mill for treatment, property owners do not see their way clear to fall in line. In a few years the Elko Prince will be worked out, its mill dismantled, and the prosperous little camp will become a dead mining town with possibilities still sleeping that might have kept it alive for years had owners only held that spirit of coöperation for which Mr. Young pleads. MINING ENGINEER.

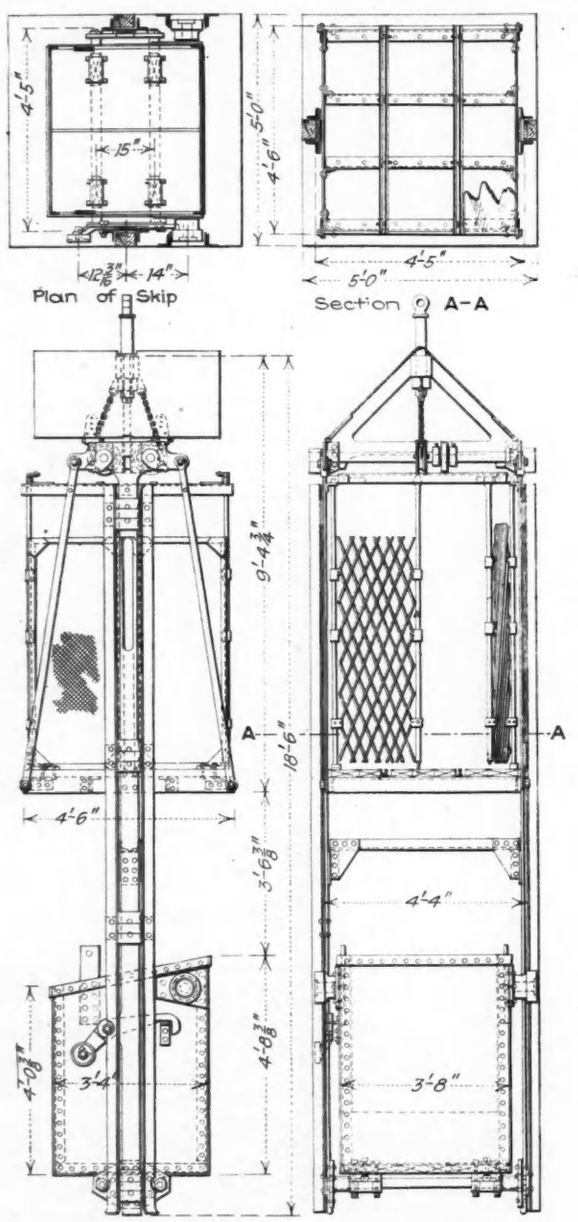
New York, Nov. 12, 1918.

Details of Practical Mining

United Eastern Mine Cage and Skip

BY B. C. STAIGER*

The design of a combination cage and two-ton skip, which has been in operation at the United Eastern mine for two years and continues to give excellent service, is illustrated herewith. The plans were designed by the firm of Otto Wartenweiler & Co. of Los Angeles, from preliminary sketches furnished by the local mine office.



COMBINED TWO-TON SKIP AND CAGE

The shaft has two 5 x 5-ft. hoist compartments, so that the hoisting equipment is operated in balance. The total weight of the combination cage and skip is approximately 4500 lb. Each cage accommodates 12 men. Drills and steel are handled in the skip, and timber that cannot be placed on the cage is swung by chain and clevis beneath the skip. The design allows less headroom than if the skip were placed above the cage, and for this reason Wellman-Seaver-Morgan hoisting-rope releases have been placed in the headframe as protection against overwinding.

SIZES AND MATERIALS OF MAIN MEMBERS OF COMBINATION CAGE AND SKIP USED AT UNITED EASTERN MINE

Member	Size, in inches	Material
Main bail	3/4 x 5	Mild steel
Cage yoke	1 1/2 x 4	Norway iron
Deck supports	1/2 x 2	Norway iron
Deck straps—cage	1/4 x 6	Mild steel
End straps—cage deck	1 x 4	Mild steel
Deck angles	3 x 4 x 3/8 L's	.....
Cage gate guides	2 1/2 x 2 1/2 x 1/4 L's	.....
Cage gate guide supports	3 x 3 x 3/8 L's	.....
Dog shafts	2 7/16	Cold rolled steel
Main guides	3 x 3 x 3/8 L's	.....
Bonnet	1/4 in. plate	.....
Draw bolt	2 in. square	Norway iron
Gate bars	3/4 x 1 1/8	Mild steel
Gate hinge posts	1	Standard pipe
Gate posts	1	Extra heavy pipe
Gate catch rod	3/4	Cold rolled steel
Side screen	1/4	Double crimped wire, 1 in. mesh
Side screen frames	1 1/2 x 1/2 x 1/4	Channels
Skip	1	Mild steel
Skip shafts	2 1/2	Cold rolled steel
Bail brace	2 1/2 x 2 1/2 x 1/4 L's	.....
Wearing plates—side and bottom	1/16	.....
Main bottom and side plates	1/4	.....
Tumbler horn	1/4 x 5	.....

The sloping top on the skip was an error in the design, but this has been corrected by building the back and sides up to a horizontal line, and this incidentally increased the capacity of the skip by 250 lb. The change was made necessary by the fact that the underground pockets have been placed on the same side of the shaft as the surface bins.

Each underground pocket is supplied with a two-ton measuring pocket for each hoisting compartment. Although this installation is entirely "home made," the success of its operation may be judged by the fact that the cage-tender sends up a skipload of ore every 63 seconds from a depth of 600 ft. though the hoist has a maximum rope speed of only 800 ft. per minute.

*Engineer, United Eastern Mining Co., Oatman, Arizona.

Simple Block Signal for Adits

Haulage along mine adits can easily be rendered safe for use by different trains from several branch drifts by simply running alongside the lighting wires an extra lighting circuit on which red lamps are placed at intervals of 200 ft. or so along the drift, depending on conditions. This auxiliary circuit is arranged in a series of blocks, according to circumstances. At each end of a block a simple lever switch is placed. Whenever a train enters the block, the driver or trainman throws the switch, thus lighting the red lamps along the block to tell others that it is occupied. When the train goes out of the block the switch at the other end is thrown, cutting out the red lights.

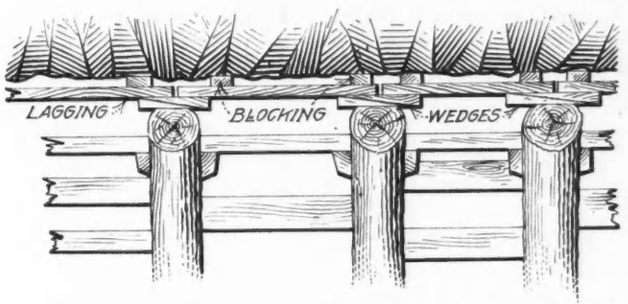
Such a bloek system is inexpensive and saves much

time. Ordinary electric lamps dipped into red staining solution are effective. There is no chance of accident through lamps burning out or breaks in the circuit, for unless the red lamp at the switchboard lights when the switch is thrown, the train is not allowed to enter the block. The red lights along the drift also serve as a warning to any one in it that a train is coming.

Effective Method of Securing Lagging

A two-wedge method of securing lagging that can be used to excellent advantage in most cases along drifts or stopes, although some difficulty might be experienced in placing the wedges in the breast set, owing to the small amount of room usually allowed between the set and the breast, is shown in the illustration. General practice is to place the lagging directly on top of the cap. Above that the blocking is put in and so wedged as to come in contact with and help support the back.

The scheme of using two wedges not only insures a closer contact of the blocking with the back but offers a flat horizontal bearing surface to the weight, whereas, if only one wedge is used, a slanting bearing surface will be exposed, and any movement of the stope or drift



TWO-WEDGE METHOD OF SECURING LAGGING

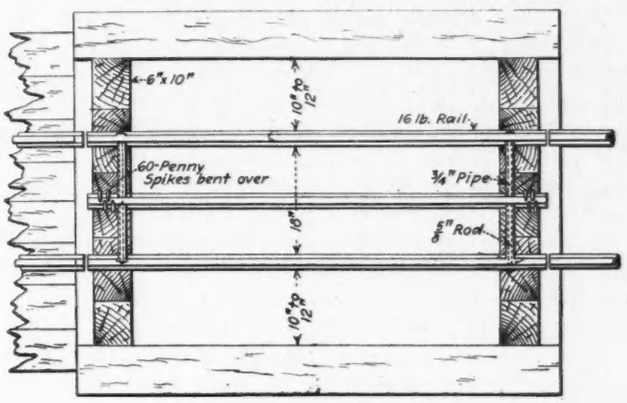
might produce a slip or slide of the lagging and blocking. A wedge sharpened at one end and having the two bearing surfaces parallel would secure the same effect as the result obtained by using the two wedges, although the former could not be expected to give the same amount of pressure upward as is secured by the use of two wedges.

Convenient Mine Grizzly

Best safety practices today demand that all chutes in stopes and along levels should be covered by grizzlies. A grizzly that is light, made to a standard size and type, and that permits cars and timber trucks to pass over it, is used at the Hecla mine, Burke, Idaho, and is shown in the accompanying drawing.

This grizzly is of simple construction, consisting merely of three pieces of rail cut long enough to bridge across the top of a chute and bolted together with pieces of pipe between the rails as distance pieces. These pieces of pipe are long enough so that the two outer rails are held to the gage of the track. The grizzly is nailed into position, flush with the rails of the track on either side of the chute, by driving 60-penny spikes on each side of the middle rail next the cross-bars and then clamping them down over the top of the rail. Thus the outside rails are kept free for the passage of cars, and yet the grizzly is secured in place in such a manner as to be easily taken up.

Usually the chute is wide enough so that a space 10 in. or a foot wide is left on each side of the outer rail, but when the chute is a little wider, the floor planks can be laid so as to narrow down the openings on the outside of the grizzly, and if the chute is much wider



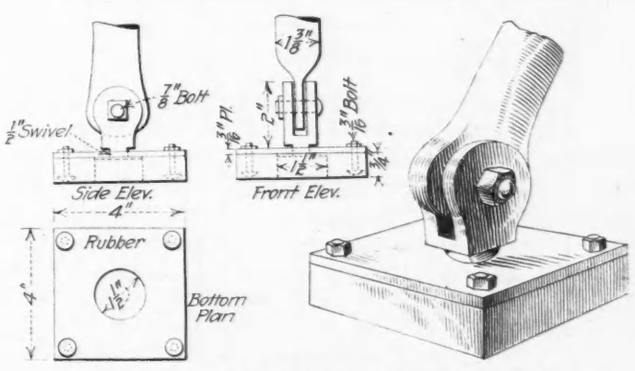
PORTABLE GRIZZLY

than the grizzly, two grizzlies can be put in side by side. Sixteen-pound rails have proved to be sufficiently strong for such grizzlies, as they need be only 5 ft. long, which is the distance of the stull-caps, center to center, along the vein.

Safety Base for Ladders

BY W. H. MACMAHON*

A satisfactory safety base for a ladder that is to be used on cement or iron floors may be constructed from old and soft rubber pump valves or disks. These rubber disks are 5 in. in diameter and ¾ in. thick, with a ¾-in. circular hole in the center. In making the base, the hole is enlarged to 1½ in. and the disk fastened to a piece of iron plate by means of four small bolts whose heads are countersunk in the rubber. The plate, with its rubber face, is fastened to the ladder by means of a



DETAIL OF SAFETY BASE FOR LADDERS

swivel joint. The accompanying sketch shows the details of construction. The rubber disk has been trimmed to 4 in. square to make a neater looking job, although the base works just as well when the full-sized disk is used. The swivel joint is made as tight as possible, so that the cavity in the rubber will act as a vacuum cup and will hold securely on wet floors.

*Safety inspector, Republic Iron and Steel Co., Gilbert, Minn.

Events and Economics of the War

With an armistice signed by the German envoys at midnight on Nov. 10, the Kaiser fled to Holland, and Berlin and other cities in the hands of revolutionists, the end of the war was practically attained, though formalities remain to be concluded. Toward the last, the German retreat from France had become a flight, with the Allies in swift pursuit; Sedan was taken by the Americans and Mezières by the French.

In Austria, the occupation by Italian troops of territory to be held as guarantees was begun. Czech and Jugoslav republics are said to have been set up, the former at Prague and the latter at Agram.

In this country, the United War Work Campaign was opened on Nov. 11 to continue for seven days. Twenty-two alien concerns were listed on Nov. 9 for sale by the Alien Property Custodian.

A slackening of the restrictions on less essential industries was announced.

Reconstruction Bill Pending

In connection with the possibility of a reconstruction agency being established, opinion in Washington indicates that the members of the War Industries Board will probably be appointed to this work, if the Overman bill, providing for a commission of five to be named by the President, is passed by the present Congress. There is every expectation that the bill will go through. A similar measure has been proposed by Senator Weeks, which would have the commission made up of members of Congress.

Many in Washington believe that the War Industries Board is the only agency equipped with machinery and supplied with the information necessary to give suitable guidance to business for after-the-war work.

Tin Importers Protest

A protest was made to the War Industries Board on Nov. 6 by the newly organized Tin Importers' Association, over the ruling that the United States Steel Products Co. should have sole direction over the import of the metal into this country. The association informed George Armsby, chairman of the subcommittee on tin of the War Industries Board, that this would create a monopoly of the tin trade in the country for the benefit of the company named, which is a subsidiary of the U. S. Steel Corporation.

The Tin Importers' Association was formed soon after the War Industries Board announced its ruling. Among the members are: W. R. Grace & Co., Mitsui & Co., Nathan Trotter & Co., Lewis Lazarus & Co., Mitsubishi, Goshi Haisha, James W. Phyfe & Co., Frame, Leycraft & Co., and the Wah Chang Trading Co. Arthur E. Winter, of Winter, Son & Co., is president; I. J. Louis, of the Vernon Metal and Produce Co., is vice president, and E. W. Starke, of Caswell & Starke, is secretary and treasurer.

Anthracite Prices Raised

New prices for anthracite, revised to meet increased labor costs due to the higher wage scale just granted to anthracite workers, were announced on Nov. 7 by the U. S. Fuel Administrator. They are effective on coal mined on or after Nov. 1. At that time, approximately 60% of the estimated season's supply had been mined, and all of this will be sold at the old prices. The full power of penalty under the Lever law, Dr. Garfield said, will be exercised to prevent the adding of any allowance to coal shipped on or after Nov. 1 on which the increased wages were not paid.

Power Plants Save Fuel

Through the coöperation of industrial power plants, which have put into force the standard recommendations of the U. S. Fuel Administration for promoting efficiency in the use of fuel, a saving of three and a half million tons has been effected in the first six months following the announcement of the national program. At the same time, maximum production has been maintained in the factories. Some plants which have kept systematic records report a fuel saving as high as 25%, and the average is estimated between 10 and 15%. This large economy has been effected at practically no expense to the plant owner.

Steel Problems After the War

Among the peace problems with which the steel manufacturers of the country will have to cope, not least important are the probability of shrinkage in inventories and the necessity of reduction in wages. On this subject the executive head of one of the biggest independent steel companies is quoted by the *Boston News Bureau* as saying:

"One thing is probable, and that is the danger that many buyers of steel now having contracts with manufacturers at war prices, having bought heavily to over-anticipate requirements, will do everything in their power to abrogate such contracts. The manufacturer must, therefore, be the loser, as his inventory of raw materials, bought at war prices, was necessarily made to take care of these obligations, and cancellation of orders for the finished product must consequently entail a large inventory loss to the manufacturers through value shrinkages.

"The second result of an early cessation of war must be a readjustment of wages, as with declining orders and future close competition, manufacturers, to keep plants employed, will be compelled to produce their goods at lower costs. A protective tariff is the only means by which they can be protected.

"Following the cessation of war, therefore, there will certainly follow a lowering of costs of raw materials and a reduction in wages to meet these future conditions."

Nickel Matte From Australasia

As an exception to List of Restricted Imports No. 1, it was ruled by the War Trade Board on Nov. 1 that licenses may now be issued, when the application therefor is otherwise in order, for the importation of nickel matte from Australasia, provided that shipment be made as ballast in sailing vessels carrying wool; also provided that the maximum quantity of nickel matte to be loaded in any one ship be 15% of the deadweight capacity of such ship.

Potash From Blast-Furnace Dust

In June, 1917, according to a recent consular report, the British Ministry of Munitions opened a potash production branch to work out the results of valuable experiments made by Kenneth M. Chance, one of the directors of the British Cyanides Co., Ltd., and Lennox Leigh, of the North Lincolnshire Iron Co., in producing potash as a byproduct of the blast furnace, through the addition of salt to the charge.

In order to deal with the blast-furnace dust as a raw material for potash production, the British Potash Co. was formed. One-half of the shares in this company are held by the government and the other half by the British Cyanides Co., Ltd., the North Lincolnshire Iron Co., Ltd., and Messrs. John Lysaght, Ltd. Three directors represent the private interests and three the government interests. A factory erected at Oldbury, near Birmingham, equipped with a most modern plant and designed to turn out from 400 to 500 tons of potassium chloride per week, is in operation, and the period of scarcity has passed. It is part of the plan to erect a conversion factory, where the chloride not needed for agricultural purposes may be converted into other refined potash salts. Other factories in the neighborhood of blast-furnaces are contemplated, and there are hopes of obtaining especially large quantities of potash from the Cleveland iron district.

As blast-furnace dust has become such an important raw material, it was found that government control in handling it would be advisable. Therefore, in August, 1917, the blast-furnace dust-control order was published, followed in February, 1918, by the potassium-compounds control order. Thus orders control all dealings in potash salts, namely, chloride, carbonate, sulphate, and hydroxide. Transactions in blast-furnace dust are carried out under license from the potash-production branch of the Ministry of Munitions, through agents specially appointed by the food production department.

Further Tin Regulations Issued

WASHINGTON CORRESPONDENCE

Regulations under which imports of tin will be distributed among private consumers, jobbers, and dealers, holding purchasing licenses issued by the War Industries Board, are as follows:

1. The revocation of outstanding licenses for the importation of pig tin, tin ore and concentrates, or any chemical extracted therefrom, as to ocean shipment after Oct. 20, 1918, shall remain in effect.

2. The Bureau of Imports is authorized hereafter to issue licenses for the importation of pig tin, where the applications therefor are otherwise in order, to cover shipments purchased prior to Oct. 1, 1918. For this purpose the date of purchase is to be determined by the American Iron and Steel Institute. Licenses so issued are to provide for the indorsement of the bill of lading to the American Iron and Steel Institute.

3. The Bureau of Imports is authorized to issue licenses for the importation of pig tin, where the applications therefor are otherwise in order, to the United States Steel Products Co., regardless of the date of purchase of said pig tin. Licenses so issued are to provide for the indorsement of the bill of lading to the American Iron and Steel Institute.

4. The Bureau of Imports is instructed to issue no licenses for the importation of pig tin except those described in paragraphs 2 and 3 above.

5. The Bureau of Imports is authorized to issue licenses for the importation of tin ore, tin concentrates, and chemicals extracted from tin ore, in accordance with its rules and regulations covering the licensing of the importation of these commodities in force on Oct. 4, 1918.

George Armsby, chief of the tin section of the War Industries Board, comments on the regulations thus:

On Aug. 28, 1918, the U. S. Government entered into an agreement with the governments of Great Britain, France, and Italy covering the purchase and distribution of their requirements of pig tin. Under the agreement an Inter-Allied Tin Executive was set up in London to control and direct all purchases of pig tin for the participating countries. The Inter-Allied Tin Executive has appointed its buying agents in the several principal producing countries, and this purchasing machinery has been in operation for some weeks. None of the countries participating in this international agreement will purchase tin except through the Inter-Allied Tin Executive, and will grant import license only for tin purchased by the Inter-Allied Tin Executive.

The War Industries Board requested the American Iron and Steel Institute to assume charge of the importation, financing, and distribution of the imports of pig tin under its supervision, and the United States Steel Products Co. will be the medium through which the American Iron and Steel Institute will operate in the carrying out of this work and will receive and pay for, at the source, the tin allocated to the United States under the international agreement above referred to, and will distribute this tin at cost to the consumers, jobbers, and dealers in the United States who hold purchasing licenses issued by the War Industries Board. Arrangements are now being made for the issuance of these licenses, and announcement will be made as soon as the licensing system is ready to be put into active operation.

No selling price has been announced on the tin that has been purchased by the Inter-Allied Tin Executive, and allocated to the United States, but this price will probably be announced between now and Dec. 31, 1918.

Consumers, jobbers, or dealers requiring spot tin can be assisted in locating available stocks by communicating with the subcommittee on pig tin of the American Iron and Steel Institute, Room 1811, 71 Broadway, New York City, as the American Iron and Steel Institute is well posted as to all surplus stocks of spot tin.

A report made to the War Industries Board, as of Oct. 1, indicates that there was a maximum stock of spot tin on hand in the United States at that date. Purchases of tin by the executive for shipment to the United States are progressing satisfactorily.

Import licenses will be granted covering contracts entered into prior to Oct. 1, 1918, where satisfactory evidence can be shown that the tin was actually purchased prior to that date.

Producers of quicksilver will meet with representatives of the War Industries Board on Nov. 20 to consider prices and other matters pertaining to their industry.

Mixed carloads of sulphuric, nitric, and muriatic acids are subject to the same rules and regulations, as regards the prices fixed by the Government, as though the carload were made of only one kind of acid.

Under a new agreement between the War Trade Board and the Swedish government, the Swedish Metal Import Association will handle such shipments as may be made from this country of mica, graphite and metals not worked, metal manufactures, lead, tin, tin plate and terne plates, graphite crucibles, aluminum, nickel, and similar commodities.

Twenty-seventh Still Needs Smokes

"Cease firing" it may be, but "cease smoking"—never. The comforts of life will be wanted by the men of the 27th Engineers, no matter what happens abroad. It can safely be said that months will elapse before the mining regiment returns after the "mopping up" is finished on the other side. So there will still be work for the Comfort Fund to do in brightening things up for the men.

The money that has been contributed to the Fund since it was established about a year ago has accomplished much good, and those from whom it came may be glad that they responded to the appeal. Everything that anyone has done in helping the cause along will be a source of satisfaction to him when the men actually start to return. It is then that the consciences of slackers will prick the hardest, and those who might have helped but did not will feel keen regret. For comparisons will be possible and it will be too late to alter the record.

There is still opportunity, however, for the mining man to put a little joy into life for those in the 27th Engineers. These are days of grace that should be utilized to the full in squaring oneself with his conscience.

HOW THE COMFORT FUND STANDS

Previously acknowledged	$18,492.77
C. M. Eye	10.00
C. A. Burdick	5.00
Mining and Metals Section, National Safety Council	125.00
John Herman	10.00
Lane Pearl	5.00
W. L. Gibson	5.00
C. M. Fenton	10.00
Charles Le Vasseur, monthly	5.00
B. N. Jackson	10.00
H. A. Johann	10.00
Mrs. A. B. Emery, Messina, Transvaal	10.50
A. C. Stoddard	5.00
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Lawrence Addicks	20.00
R. R. Boyd	25.00
E. R. Varela	5.00
W. J. Walcott	25.00
Total	$18,823.27

Make your checks payable to W. R. Ingalls, treasurer of the Association of the 27th Engineers. Acknowledgment is made only in the *Journal*.

Protection for Potash Companies

WASHINGTON CORRESPONDENCE

To meet a general desire that the potash industry be not allowed to retrograde to its pre-war status, the Government is being urged to take every step possible to protect the capital investment of those who have undertaken, or may undertake, the recovery of this mineral within the borders of the United States. Owing to the peculiar occurrence of potash, doubt is expressed as to whether adequate provision is made in the War Revenue Bill to exclude potash operations from heavy taxes before the investment is amortized. The following specific provision has therefore been suggested to the Senate Committee on Finance:

In the case of buildings, machinery, equipment, or other facilities for the treatment of potash-bearing brines or other natural potash deposits, or for the recovery of potash from other sources, or as a byproduct in other operations, there may be allowed a reasonable deduction for the amortization of such part of the cost of such facilities as has been borne by the taxpayer; such reasonable allowances in all cases to be made according to the peculiar conditions in each case and under rules and regulations to be prescribed by the commissioner with the approval of the secretary.

World's Production of Aluminum*

The annual production of aluminum before the war was about 68,000 tons, which was distributed as follows: United States, 33%; Canada, 8½; Switzerland, Germany, Austria-Hungary, 17½; France, 26½; England, 11; Norway, 2¼; Italy, 1¼ per cent.

The important factories in the United States are the two at Niagara Falls, with a capacity of 50,000 hp., and one at Massena, of 100,000 hp. capacity. In Canada there is a factory at Shawinigan Falls, of 60,000 hp. capacity. These four factories all belong to the Aluminum Company of America.

In France there are factories with an aggregate capacity of about 100,000 hp., viz., Société Electrometallurgique Français, with factories at La Praz and at Gardannes; and Compagnie des Produits Chemiques d'Alais, with factories at Calypso, at Felex, and at St. Jean de Maurienne. The Swiss aluminum industry controls factories with an aggregate capacity of 100,000 hp., viz., one at Neuhausen, Switzerland, one at Rheinfelden, Germany, and one at Lend-Gastein, Austria, also Grippis Borgne. They are all owned by the Swiss Aluminum Industrie Aktiengesellschaft. In the United Kingdom, there are two works belonging to the British Aluminium Company and one owned by the Aluminium Corporation.

France and Switzerland have exported most aluminum. Prior to the war each exported 7000 tons to 8000 tons per annum. Germany has been the largest importer of aluminum, 16,000 tons in 1912 and 12,500 tons in 1913. It is difficult to obtain reliable information about the production of aluminum during the war. Prices have risen abnormally, and new factories have been started which have secured contracts extending over several years after the conclusion of peace. Their continued operation will be determined by post-war conditions.

If projected factories are built and come into operation, the production of aluminum after the war is likely to be about doubled. If the aluminum factories can double their output, an annual production of about 150,000 tons of aluminum may then be reckoned upon. Of this aggregate 50% is likely to be produced in the United States and Canada, and 13% in Switzerland, Germany, and Austria-Hungary. The production in Germany, Austria, and Hungary has of late been pushed ahead with much energy, on account of the war requirements, and several factories are planned and probably in course of construction in Bavaria (in which the Allegemeine Elektricitat Gesellschaft is interested), in Austria, and in Hungary. There will probably be a further production of 13% in France (26½% before the war), 8% in England (11% before the war), 11% in Norway (2¼% before the war), and 4½% in Italy (1¼% before the war).

Recent events have started the disintegration of the special war agencies of the Government. This is particularly noticeable in the U. S. Fuel Administration and in the War Industries Board. Men of experience and ability, who have been willing to work as volunteers or at a nominal salary during the emergency, now are anxious to resume their former activities.

*Abstracted from the *Chemical Trade Journal* and from *Engineering*.

Draft Calls and Inductions Suspended

The Secretary of War has made the following announcement:

"I have suspended further calls under the draft and inductions, and there will be, for the present, no additional men brought in. As far as practicable we will turn back those who have been entrained and have not yet reached training camps."

What Is an Engineer?

The following definition has been promulgated by A. H. Krom, director of engineering, United States Employment Service, Chicago:

"An engineer is one who economically directs manpower. and, by scientific design, utilizes the forces and materials of nature for the benefit of mankind."

In view of the importance of the engineer in the present war. it is highly desirable that his status be properly defined.

October Pig-Iron Production

Pig-iron production during October was expected to show a new record, but the inroads of the influenza epidemic upon working forces brought the total below that of September, according to *Iron Age*. Production was 3,486,941 tons, and the daily average was 112,482 tons for 31 days.

Twelve furnaces were blown in and 12 blown out during the month, leaving the total unchanged at 365. Capacity active on Nov. 1 was 113,500 tons, against 114,570 tons on Oct. 1.

Reserves of War Minerals Justified

The War-Minerals Act will probably be administered almost entirely by the U. S. Bureau of Mines. The President has authorized the use of $100,000 to begin work under the new law. Legal opinion holds with practical unanimity that chrome, pyrites, manganese, and any other war mineral of which there may be temporary overproduction come under the act. Conditions are considered to warrant reserves of these minerals. Much importance is attached to this interpretation, as it will enable the Government to assist producers of chrome and other minerals who are now facing a difficult situation.

A rough survey of the situation, however, leads officials to believe that the amount which would be endangered by the immediate ending of the war does not exceed $10,000,000. This is divided as follows: Potash, $5,000,000; manganese, $3,000,000; pyrites, $1,000,000, and chrome, $1,000,000. Some think that the chrome situation is not as serious as represented, and that the interests of domestic producers will be protected if imports are restricted for another year.

Mahlon M. Garland, of Pennsylvania, has been suggested as chairman of the Committee on Mines and Mining in the next House. He has been a member of Congress since Dec. 6, 1915. Mr. Garland was long president of the Amalgamated Association of Iron, Steel and Tin Workers, and at one time was vice president of the American Federation of Labor.

Broken Hill Proprietary Co., Ltd.

The semi-annual report of the Broken Hill Proprietary Co., Ltd., which owns famous zinc-lead-silver mines in New South Wales, Australia, and iron mines at Iron Knob, South Australia, indicates a considerable expansion in output. The results of the operations of the ore-dressing mills and concentrating plants for the period under review—the six months ended May 31, 1918—indicate improved metallurgical extractions at lower working costs. The Broken Hill mills handled 70,843 tons of sulphide ore, and produced 11,958 tons of lead concentrate, assaying 60.55% lead, 29.14 oz. silver per ton, and 13,608 tons of slime. Tailings reground amounted to 117,133 tons, producing 2723 tons of concentrate, assaying 57.66% lead, 29.04 oz. silver per ton, and 14,714 tons of slime.

The zinc flotation plant dealt with 144,944 tons of tailings, as compared with 92,907 for the previous semester, and the production of zinc concentrate amounted to 36,630 tons. The current output of slime, with 43,674 tons from the dumps—a total of 73,991 tons, as compared with 50,248 tons during the previous half year—was treated in the Bradford-process flotation plant, which produced 8161 tons of lead concentrate, assaying 60.4% lead and 83.44 oz. silver per ton, and 19,203 tons of zinc concentrate, assaying 50% zinc.

The output from the company's iron mine in South Australia, at Iron Knob, was 164,780 tons. Of this, 135,847 tons was sent to the company's steel works at Newcastle, New South Wales. The rapid expansion of Australia's youngest industry, as reflected by these operations, is shown as follows:

OUTPUT FROM NEWCASTLE STEEL WORKS FOR YEAR ENDED MAY 31, 1918

	Half Year, Nov., 1917	Half Year, May, 1918
	Tons	Tons
Pig iron	41,351	67,803
Steel ingots	52,878	89,011
Coke	35,044	74,025
Sulphate of ammonia	598	1,120
Tar (gallons)	345,911	777,324

The net profits for the half year amounted to £359,706 4s. 8d., as compared with £290,881 3s. 2d. for the previous six months.

Broken Hill South Silver Mining Co.

The report for the half year ended June 30, 1918, of the Broken Hill South Silver Mining Co., of Broken Hill, N. S. W., Australia, shows that the amount of sulphide ore mined and raised during this period was 127,745 tons, as compared with 69,758 tons during the previous semester. The total tonnage treated in the mill was 128,400, as compared with 69,390 for the previous period, with an average content of 15% lead, 7.9 oz. silver per ton, and 14.6% zinc. The selective-flotation slime plant handled 19,136 tons of current slime and produced 2773 tons of concentrate, assaying 61% lead, 51.3 oz. silver per ton, and 7.7% zinc. Accumulated slimes to the extent of 15,916 tons were also treated in this plant, from which the yield was 2294 tons of concentrate, assaying 53.9% lead, 46.0 oz. silver per ton, and 13.7% zinc. The total yield of concentrates from all sources was 26,490 tons, as compared with 12,970 during the previous period, and the assay content 65.3% lead, 29.4 oz. silver per ton, and 8%

zinc. Owing to the war and the fact that timber from America is now unobtainable, local woods are being used for mine-support work.

Working costs, including development and concentrating expenses, amounted to 29s. 11.7d. per ton, as compared with 31s. 5.4d. during the previous six months. The company still has on hand 794,789 tons of old mill tailing, and 442,932 tons of slime. The former contains 5.5% lead, 3.4 oz. silver per ton, and 16.0% zinc, and the latter carries 10.8% lead, 6.1 oz. silver per ton, and 14.2% zinc.

Kerr Lake Mines, Ltd.

The report of the Kerr Lake Mines, Ltd., for the year ended Aug. 31, 1918, shows that the gross production from all ores amounted to 2,582,992.82 oz. silver, 199,331.28 lb. cobalt, and 545.5 lb. mercury. These figures include 54,523 oz. silver on hand Aug. 31, 1918. Of the total, 2,004,737.91 oz. of silver, 199,331.28 lb. cobalt, and 525.5 lb. mercury was contained in ore shipped. The remainder was recovered from silver ores milled by the Dominion Reduction Co., at Cobalt.

Ore hoisted during the year amounted to 43,129 tons, of which 1017 tons was sacked for shipment. A bumping table eliminated 14,277 tons of waste from the remainder, leaving 27,835 tons of milling ore. Ore reserves, as at Sept. 1, 1918, were estimated at 34,730 tons, containing 1,637,300 oz. of silver.

New Westinghouse Research Building

High-grade experimental work cannot be carried on in the midst of the noise and confusion of production—quiet is the first essential for achievement in research where uninterrupted concentration is required. Delicate instruments and the costly mechanism of an experimental laboratory must be protected from the dust and vibration of the shops. The manufacture of electrical machinery and apparatus is one of the most intricate and complicated in industry, showing constant improvement and progress. The various departments in large works are frequently confronted with new problems that require special research work.

The Westinghouse Electric and Manufacturing Co.'s new research building at East Pittsburgh, Penn., erected to provide for the growing demand for advanced research, is situated about a mile from the works. Architecturally, the building is plain but substantial, of reinforced concrete and brick, trimmed with white terra cotta. The plumbing and wire services are arranged in such a way as to enable additions to be made in any particular laboratory when needed without disturbing any other part of the building. Provision is made in the new building to carry out a variety of experiments in many lines of work, including magnetic insulation, metallographic metallurgy, chemistry—both organic and inorganic—furnace combustion, wood-working, illumination, glass blowing, and other phases of industry.

The power house contains motor-generator sets for supplying single-phase, two-phase, and three-phase current at 220 volts, and direct current at 250 volts (three-wire circuit). A motor-driven air compressor supplies compressed air at 125 lb. pressure (8.75 kg. per sq.cm.), and a large motor-driven vacuum pump supplies the necessary house vacuum. A liquid-air machine, capable of supplying 1½ to 2 liters of liquid air per hour, is also installed in the main power house. The storage battery is in a separate room in the basement of the power house and consists of a total of 218 cells, so divided that various groupings and combinations may be obtained.

In one end of the basement is the furnace room, with a battery of electric furnaces of various types, together with the necessary control for melting, annealing and other metallurgical processes. Stacks are provided at each end of the building, with openings in the basement, for experimental furnaces using fuel, usually natural gas. The woodworking and metal-working shop and storeroom are also in the basement.

On the first and main floor are the main and private offices, the library, and the conference room. The remainder of this floor is assigned to physical, electrical, and magnetic research. The second floor will be given over to the same general class of work as the first floor. The third floor is devoted to chemical and electrochemical research, illuminating laboratories, and a glass-blowing room.

Though this new laboratory has been occupied for only a comparatively short time, the work already accomplished gives much promise for the future. It is, of course, intended that the fundamental and advance work shall be carried on by this section of the engineering department. Applications of new processes and products thus developed, however, are to be carried out by sections in more intimate contact with the production departments. As this special research section and all the others are under one management, men can readily be transferred from the more commercial sections to the laboratory, or vice versa, as the exigencies of the case demand. Thus a man working on some metallurgical problem can follow it up to the point of commercialization in the factory itself.

The history of the Westinghouse research organization is noteworthy. This division was founded in 1906 as one of the several divisions of the engineering department. It is now divided into seven laboratories. The extent of work covered by the whole division is broader than is ordinarily included in research work. For example, it has charge of the preparation of all specifications for the purchase of materials used by the company, together with the experimental and development work leading up to these specifications. It includes a process section, which has electrical control of all the various processes used by the company in the manufacture of its products. It has charge of the routine chemical and physical testing for all departments, including the inspection department. It has technical control of the various metallurgical processes, such as those involved in the brass foundry, copper mill, scrap recovery plant, and similar departments. Through the activity of its members on various standards and other committee work, it comes into contact with numerous organizations not strictly of research nature, both within and without the organization.

The seven laboratories are known as the chemical, physical testing, process, electrical, molded materials, ceramic, and research. The research laboratory, in the new building, is divided into sections, each with a section head reporting directly to the division engineer.

Editorials

End of the War

THE Great War came to an abrupt end on Nov. 11. The ending was sudden owing to the complete collapse of Germany, which was forced to sign an armistice of terms so harsh that it is deprived of any power to resume hostilities. Everybody also knows in a general way what the terms of peace will be. Thus there will be no prolonged negotiations and uncertainties. The victorious associated powers will meet to arrange the details. Then Germany will accept them, there being nothing else for her to do. There will be an adjustment of the evils that Germany has been propagating during two centuries. Subjugated peoples will be freed. Partitioned nations will be reconstituted. Even in Germany itself will the people now be at liberty to determine the kind of government that they want to have. These will be the major results of the Great War.

But not less than these is the solidarity that the struggle has created among free and enlightened nations. Forever will French, Belgians, British, Italians, Serbians, and Americans be friends. We bow especially to the French, who bore the brunt of the battle and under whose leadership victory was won. Not less do we admire the British, who, with the Australians, Canadians, and Indians, exhibited unparalleled sincerity, steadfastness, and sturdiness. The chivalry of the Italians and the gallantry of the Serbians likewise move our hearts. Nor do we forget the Russians, who sacrificed themselves, and in so doing gave the Allies of the West a chance to prepare, and thus ward off German victory during the first two years. As for ourselves, we may feel an everlasting pride that we joined those noble Allies and strengthened them just when help was most needed.

Reconstruction

THE great problem with which we are now to be confronted is reconstruction. For four years the civilized world has been engaged largely in making munitions and engines of war. Machine shops have been changed from the manufacture of articles for peaceful purposes to the production of shrapnel and shells. The automobile manufacturers who were making pleasure cars have been diverted to the making of lorries and tanks. The day has come when such things will no longer be needed, and the great problem is now to get the factories and their work people back to former lines.

The producers of the metals and other commodities will be affected just as much as the manufacturers who use them. We know how painful was the transition from a peaceful basis to a war basis. There is no reason to expect that the reversion will be less troublesome. On the contrary, it is more likely to be harder than easier. Scarcely any thought has yet been given to the great problems of this kind that confront us. In this we are greatly behind Great Britain and France, which long ago organized their reconstruction commissions.

We shall have considerable time in which to prepare for the demobilization of the army of two million men that is now in Europe, for they will undoubtedly have to remain there for some time, and their retransportation will necessarily be slow. Even the demobilization of the troops in cantonments in this country may be delayed for some months. But what will not be delayed is the cessation of making explosives, rifles, cannon, shells, tanks, aëroplanes, and other purely military munitions. Many hundreds of thousands of men and women who have been engaged in such production will be thrown out of employment, and in many cases will find themselves in mushroom munitions districts, wherein further employment is not to be expected and whence they will be obliged to migrate to the older industrial districts. This dislocation will inevitably create disquieting disturbances.

What is to be done to meet the situation? Manifestly there is need for intelligent thought and action by governmental commissions. Yet we think that private concerns must themselves do most of the thinking and acting. The manufacturer of automobiles, for example, who has been diverted from the building of pleasure cars to the construction of motor trucks, ought to be making preparations to get back to his normal business with the least possible delay. His plans ought to have been all ready, so that he would know just what moves to make upon termination of the war. Perhaps this is so.

There is, anyhow, going to be a radical readjustment, which will try the patience and test the resourcefulness of everybody. The difficulties will be minimized, however, if everybody approaches the new problems with a spirit of coöperation and if the right kind of thinking be done in advance.

Mexico After the War

NOW that the Great War is ended, and the achievement of making the larger part of the world a decent place in which to live has been consummated, there still remains what will doubtless appear as a trifling problem to solve. The great nations of the world, representing justice and the strength to enforce it, will be free, after having disposed of the more virulent pest, to attend to the elimination of minor irritants. Conditions in Mexico will demand attention; they must be improved from within or from without.

After having invited foreign capital to develop her resources, Mexico must see that the country is made safe for lawful enterprise. Neither the United States, Great Britain, nor France has any intention of writing off its investment there because of recent lawlessness. Nations have obligations toward their citizens just as the heads of enterprises are responsible to stockholders.

There is little justification for any further delay in the granting of the protection to life and property that civilized nations accord to those whose money, energy, and initiative they have welcomed.

The right to carry out industrial enterprise in Mexico is the unquestionable prerogative of those who have loyally obeyed the laws, respected the national institutions, and aided in the country's development. At the conclusion of the Great War an adjustment of the Mexican question will be demanded by those who have the right to do so. Our southern neighbor has everything to lose and nothing to gain by an adherence to the policy that has done such damage to her national credit and has halted all real progress in Mexico for years.

Getting Together

IT IS A PLEASURE to record that fewer strikes are now to be noted in mining districts. Strikes still occur, but they are not in mining. What does this lull mean? Is it patriotism on the part of labor or of the managements; or both? Or is it just simply getting together? We hope that it is due more or less to all three causes.

Under the strenuous calls for production that the country has had to meet it is a pleasant duty to set down the fact that many a laborer is getting to his work ahead of the clock and not quitting with his hammer in the air; that he is taking a bottle of coffee for lunch instead of going around the corner to get some beer to wash down his sandwiches; and it is just as pleasant to note that some of our gold-mine managements are straining every nerve to keep the plant in operation, for the benefit of their regular employees and their families, in spite of the ore being taken out at small profit or at no profit at all. Both are showing a desire to get together. Perhaps it is for patriotic reasons, perhaps it is just because it is right to do so; but, whatever the cause, the result is of deep significance, and its effect will remain with us. And there will probably come a day, if it is not with us already, when patience and toleration from both sides will be required as they have not been required before—when it will be harder and yet more necessary to get together than it is today. The man who has been getting $5 per day will not relish a cut to $4, or it may be to $2.50, no matter how the price of commodities falls. Nor will the man who has been paying the $5, robbing his mine and making no profit while taking out much-needed metal for the Government, relish a continuation of that procedure when peace has been declared.

There will be much reason, then, for each to consider the other's point of view, and not allow the selfish instinct to get too much the upper hand. It is time right now to begin thinking of what each of us can do, what each of us should do, in order that we may get together then as well as now.

It is pretty well agreed among economists that present high prices are due to a scarcity of sufficient labor to perform all the work that is required of it, and the bidding of employers, at a continuously increasing figure, for the labor needed in their plants, each hoping to outbid his neighbors.

In a country as free as the United States, this bidding for labor will continue as long as the excessive demands last, and for that length of time high wages will be with us. They may even keep on growing higher, with advantage to no one, employer or employee. A pair of shoes are worth about one day's work, and that is about what the worker will pay for them, whether conditions enable him to get $7.50 per day at his trade, or only $2.50.

We are almost upon the day when the world will be trying to catch up with those things that have been left undone—the time when we will be busy replacing what has been destroyed. The United States will have much of this to do, and there will be work for every man and woman who wants it. Before that period is upon us, there is danger of another one, when the employer must of necessity lower the cost of his production or quit altogether, and the employee must lower his demands or quit also. There will be hot-heads on both sides, and there will be some trouble, but we look forward with confidence to the attitude that will be taken by those who are working with their hands for a living and to those who are paying the wages. We feel confident that, having done it once, they will continue to get together.

This brings another thought. We are all human beings, whether we employ or are employed. When we are working for a corporation we sometimes visualize that corporation as an octopus, some great soulless monster, reaching out its tentacles to draw in our vitality to itself without a thought that we are men. But stop and think a moment. That corporation may be a single being as human as ourselves, or it perhaps is made up of a great many humans with the same desires, hopes, and ambitions as our own. Indeed, if we have been so fortunate as to accumulate $100 we are liable to be a part of that octopus ourselves.

It is not an easy matter to speak to a corporation and be on familiar terms with it; one has the feeling that it is not tangible, that he can get no nearer to it than the manager or superintendent, or it may be the shift boss, and that anything which he gets from the corporation is just so much pure gain. With this idea revolving in the back of his head, he feels much more like fighting for what he can get than going 50—50 with his employer. If we stop to think, however, that one of those bloated bondholders of which the corporation is made up, is old widow Jenkins with whom we board, it does seem to be a little more human. When Captain Tom was suffocated in trying to pull some boys out of the shaft fire, his widow received $1000 insurance, and she put it into the mine where he had always worked. But she is only one of a hundred who have done the same thing with their little pile, trusting that the boys would play fair when making their living by the use of that money. It is much easier to go 50—50 when you look at it from this point of view, and easier to get together with the management.

And you, Mr. Manager, you must remember that, though it is up to you to keep the wheels running, you are using humans to work for other humans; that they are not simply stulls to be thrown aside if they don't exactly fit the stope and have to be blocked at both ends. Whether they speak your language or some other, whether they see as you do or not, they are still human, and it is your function to work the two ends and the middle, and get them together, whether or no.

In our issue of Sept. 21, we reproduced several photographs of plants in South America under the caption of "Cottrell Precipitation in South America." In this designation we were partly in error, inasmuch as there is no Cottrell installation at either the Compañia Minera de Oruro or at the Borax Consolidated, Ltd. The work to which they pertain was of an experimental nature only, and the photographs were taken by one of the engineers of the Western Precipitation Co., and sent to the *Journal* as being of interest to its readers.

BY THE WAY

"Wot's thee want naow , Dicky, m'son?" "W'y, damme, Cap'n, I's got to 'ave 'nother wrench." "Gos along do; wot's tha matter with'n? 'Ere only foor days ago I did'st give thee one. Wot 'ast thee done with'n?" "Well, Cap'n, I tell 'e. I take'n down in tha bloody stope, an' firs' bloody thing I naws, w'en I gaws to look for 'e, w'y, damme, un was'nt theer; so some bloody beggar mus' 'a stollen she." "W'y, thee bloody gert fool, Dicky; w'y did'st thee not put a mark on she?" "So did I, Cap'n; so did I. An' dost naw, that all in spite of un, they stol' wrench. mark an' all?"

Several years ago, two "Cousin Jack" miners were spending a few days in the city before returning to work. Having spent the greater part of their lives in mining camps, the entire scene was new to them. While strolling along and taking in everything, they happened across the well-known Italian organ grinder, with his overdressed monkey, gallantly arrayed in a red flannel suit, resplendent in brass buttons and busily engaged in collecting pennies from the passers-by. After a few moments, the Italian swung the organ on his back and yanked at the chain; whereupon Jocko sprang on his master's shoulder. The Cornishmen, neither of whom had seen anything like this before, followed at a short distance. This seemed to interest Jocko greatly, and he amused himself by making grimaces at the pair. It was finally more than the "Cousin Jacks" could stand. "'Arry," says Dicky, "seems to me that there bloody beggar is makin' fun o' we." Harry was silent for a few minutes, and then, with an air of recollection said, "Damme, I naws thee. Thee's Jimmy Kevern's son from Redruth. Too bloody small to join tha h'army over in ole country; 'ad to come over 'ere to do h'it."

We read and study of why the little particles of metal should float and do float, writes Tom L. Gibson, of Grant, Colo., but nothing is said of why they don't float when they should float. Or why the same ore with the same gangue, with the same amount of oil and acid, floats and froths today, and tomorrow it does not. The office engineer will say that this is impossible—and as a field engineer I almost agree with him. However, I have ocular demonstrations every day of this condition. In smelting, the impossible happens once in a while, but in this float game it is a daily occurrence. With physical and chemical conditions the same, any one of a half-dozen things might occur. A heavy froth or no froth at all, a dirty froth or a clean one, a brittle froth or a tough one. The only person who can explain the reason is the man who has been in the mill only a couple of days. Then in a six-cell machine with the same connections, baffles all alike, impellors with same speed, why should the water level in the V boxes be so widely varied?—Why should the barite stick in the second V box at all times and never in the rest of the V boxes, when all are alike?—Why, when I put my oil in the ball mill and the pulp comes out a seething mass of black lead-laden froth, should it come out in my V boxes with a measly, dirty camouflage of a froth?—Why is it that the first two V boxes and the last two will have an excellent froth and the two center ones giving forth only a vacant stare?—Why is it that a man knows more about a float machine after he has been on it 24 hours than after he has been on it a month?—Why is it that No. 40 oil sometimes looks almost like turpentine and the next barrel has the viscosity and color of a heavy gravity pitch? Truly, "where the wind listeth" has nothing on the float machine.

The Cornish Miner

By D. E. CHARLTON

Oh, oo's that chap in diggin' clothes,
Oo 'andles all tha h'ore;
An' oo's tha chap oo naws 'is groun',
An' naws it all tha moor,
Tha longer that 'e works un?
M'son, jus' listen 'ere,
E's no bloody h'engineer,
But, tell e wot, e's on tha spot,
An' wot 'e naws, 'e naws e's got,
An', dam-me, well e's learned un.

Oh, oo's tha chap that naws tha drill,
O' any kin' or makin',
An' gawin' h'up or gawin' down,
Can work 'er w'en she's shakin',
Jus' turn tha valve an' 'old un
In shaf' or on tha sub,
Makes no dif'rence wot's tha rub?
'E naws tha feel of any steel,
I'll tell e wot 'e naws a deal
That mus' be nawn in drillin'.

Oh, oo's tha chap that spits tha fuse,
Oo naws wot shots e'll need,
An' places them to break jus' right?
To tampin' 'e gives 'eed,
So not a bit is wasted.
Now, dam-me, there's no doubt,
For I'm tellin' three straight h'out.
'E naws jus' 'ow to raise a row,
An' jus' wot time 'e mus' allow
Before tha beggar's pasted.

Oh, oo's tha chap o' girth an' brawn,
Oo naws tha set that's needed—
Oo naws jus' 'ow a stull is put,
An' wot groun' should be 'eeded
When caves do start a-workin'?
M'son, jus' 'ark to me,
Min' I'm tellin' this to thee.
Thee'd ought to see tha strength o' 'e,
Why, dam-me, makes no work o' she,
W'en all tha res' are shirkin'.

'Is name is Tom, 'is name is Dick,
Per'aps it may be 'Arry.
Thee'll fin' in this 'ere minin' work,
That none o' they will tarry.
They're boun' to push tha job through.
Thee asks, 'Oo is this 'ere?
For to thee it mus' h'appear,
'E's a liner. An' none finer,
Dam-me, 'e's a Cornish miner,
Min' you, 'e's some beauty, too.

NEW PUBLICATIONS

My Reminiscencer. By Raphael Pumpelly. In two volumes. New York, 1918. Henry Holt & Co. Price, $7.50.

Raphael Pumpelly, distinguished geologist, who is now in his 32nd year, is so old a man, whose professional career dates so far back, that few of the present generation know of his early thrilling experiences in mining, thinking of him rather as a geologist and explorer. His long and useful career was full of exciting experiences and valuable achievements. It is well, therefore, that he has published his memoirs, which are lively and entertaining. They are written with such an ease of style and an exhibition of humor that they are quite unlike any dry records of the experiences of a distinguished man, but rather are the narration of a story-teller.

Pumpelly, who was born in 1837, entered Yale, but soon afterward was sent to Europe to acquire his education, however on no definite plan. While still a youth he set out upon his first adventure—a tour through the mountains of Corsica—during which his interest in nature, especially geology, was excited. Following this, pure chance led him to Freiberg, where he entered upon the study of geology, mining, and metallurgy. At Freiberg he met James D. Hague and Charles and Louis Janin, but Americans were not plentiful at Freiberg at that time (1856). Previous to that year the registry showed the names of only 12.

Pumpelly's account of his life and experiences at Freiberg, and of a summer vacation spent in a second tour of Corsica, is one of the most interesting parts of his memoirs. The "Moufflon Story" that he tells about himself surpasses in humor and style the stories of similar nature that we are wont to read as inventions in the magazines. We experienced a keen appreciation of the "Moufflon Story."

Returning to the United States, Pumpelly obtained his first professional engagement, which was to test a gold mine in Virginia, which he promptly found to be too poor, but while there he tried the chlorination process then invented by Plattner, and this was, not unlikely, the first application of gold chlorination in the United States. In 1860 he went out to the Santa Rita mines, south of Tucson, in Arizona. This was the heroic age in Arizona, when a few bold adventurers were trying to exploit mines in the region then just acquired by the Gadsden Purchase, always in imminent danger of Apache raids. Pumpelly's superior was killed in one of these, and he himself narrowly escaped with his life, but he remained stoutly at his post in order to smelt enough ore to obtain silver wherewith to pay off the Mexican miners of the company. A reading of these experiences is commended to young graduates of the present time.

Accomplishing his purpose, Pumpelly abandoned the mines and escaped over the desert to California, during which he had more thrilling experiences. Arrived at San Francisco he found that he, together with W. P. Blake, had been engaged as geologists by the Japanese government, and he proceeded to Japan. While there he had interesting experiences, but practically did not accomplish much, the Japanese really not yet being ready for foreign assistance. However, he created a native staff, whom he taught, and he showed native miners, for the first time, how to break rock by blasting.

From Japan Pumpelly went to China, where he studied economic conditions, geology, coal resources, etc., and fulfilled some official commissions. In 1865 he started home, traveling overland from Peking through Mongolia and Siberia, and arriving in New York in 1866.

In the United States he soon became engaged in active professional work, especially in the exploration of the iron ranges of the Lake Superior region, in the development of which he played an important part during many years. In the early '80s he organized and conducted the northern transcontinental geological survey for the Northern Pacific Ry. Following that his life was spent largely in travel and miscellaneous professional and scientific work, which culminated in explorations in Turkestan in 1903 and 1904.

As a publication of reminiscences, Pumpelly's is extraordinarily interesting, not only for what he has to tell but also for how he tells it. Especially is this so with what relates to the earlier part of his life. Everybody who is interested in mining in southern Arizona, in explorations in the California desert, and mining on the Gogebic range will find much entertainment in this account of early times by a pioneer who played his part in things.

The Diesel Engine, Its Fuels and Its Uses. By Herbert Haas. Pp. 133, illus. Bull. 156, U. S. Bureau of Mines, Washington, D. C.

The pamphlet was issued for the primary purpose of disseminating information with regard to the characteristic features of oil engines in general and the Diesel engine in particular. The result desired is the greater utilization of heavy fuels, and the economizing of oils which are needed for other purposes. In the matter of the conservation of light oils, the Diesel engine is destined to play an important part, because of its ability to utilize crude oils which are unsuitable for all other types of engines.

The mechanical and structural features of the engine are considered with commendable detail, and descriptions are given of the different types manufactured in the United States. The advantages of the Diesel engine are summarized under the heads of (1) cheapness of fuel required, (2) the fact that the plant is self-contained, (3) the small space required for fuel storage, (4) the speed with which full power can be attained after starting up, (5) the general reliability, and (6) high efficiency.

The Diesel type of engine has been, and is being, widely adopted by our South American neighbors, particularly in connection with mining and nitrate enterprises. It is also being used extensively in other industrial work, there being a large number of Diesel engines in operation in the city of Buenos Aires. The pamphlet under review will serve a useful purpose if it draws more attention to the fact that the Diesel engine is, under a wide variety of conditions, an efficient and economical power producer.

Annual Chemical Directory of the United States, Second Edition, 1918. Consulting Editor, B. D. Lovelace; Managing Editor, Charles C. Thomas. 6 x 9, pp. 534; $5. Williams & Wilkins Co., Baltimore, Md.

A well-arranged compilation of chemical products used for scientific, technical, and industrial purposes; names of manufacturers and dealers; lists of apparatus and equipment; directories of chemists, engineers, laboratories, and technical societies; and publications on the respective subjects during the year.

The work involved in the classification of the numerous products is obvious, and we appreciate the editor's comment that an extraordinary confusion exists at the present time with regard to chemical nomenclature. Manufacturers are urged not to add to the existing confusion by giving new names to products already in common use.

We have only one minor complaint to make in the arrangement of the book, and would suggest that, in future editions, a brief statement of the matter dealt with in each particular chapter is given as a page heading, and the continuous repetition of the title of the book at the head of each page be avoided. This change would considerably enhance the value of the directory as a ready reference.

The Geology of the Tuapeka District, Central Otago Division. By P. Marshall. Pp. 79, illus. Bull. 19, New Zealand Geological Survey Branch, Wellington, New Zealand.

Annual Report of the Comptroller of the Currency to the Second Session of the Sixty-Fifth Congress of the United States, Dec. 3, 1917, Vols. I and II. 5½ x 9, pp. 1142. Treasury Department, Washington, D. C.

The Journal of the Iron and Steel Institute. Edited by George C. Lloyd. Pp. 590; illus.; Vol. XCVII. Iron and Steel Institute, London, England.

Personals

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

W. Spencer Hutchinson, mining engineer of Boston, is now in New York.

Courtenay De Kalb, of San Francisco, is in Washington, representing the California chrome producers.

E. William Kohl, Jr., superintendent of the Nicoya Mining Co., San Jose, Costa Rica, is now in New York.

E. T. Corkill, formerly safety engineer for the Sudbury mines, Ontario, is now general mine superintendent.

H. Vincent Wallace, consulting mining engineer, has opened an office at 329 Central Bldg., Los Angeles, California.

Gordon Wilson is leaving Arizona to become mill and cyanide superintendent of the Fresnillo company, at Fresnillo, Zac., Mexico.

H. Douglas Allen has been appointed general manager of the Jantar Nigeria Co., Ltd., and the Kuru Syndicate, Ltd., in Nigeria.

D. Harrington, mining engineer, formerly at the Montana School of Mines, is now with the U. S. Bureau of Mines, Golden, Colorado.

J. B. Tyrrell, mining engineer of Toronto, has returned from a visit to the new gold prospects in the Matachewan district, northern Ontario.

I. Edmund Waechter has accepted a position on the chemical staff of the Carnegie Steel Co., Youngstown district, as chemist and metallurgist.

F. G. Stevens, of Toronto, has gone to British Columbia to investigate a property which the Mining Corporation of Canada has under option.

W. H. Landers, who was recently promoted in France from captain to major, has been ordered to report to the Chief of Engineers in Washington.

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

Chester Purington sailed recently for Russia with a crew of technical men, to resume the operation of properties in which he was formerly interested.

A. L. Sweetser, formerly New York representative of the Huff Electrostatic Separator Co., has joined the staff of the "Engineering and Mining Journal."

Dr. H. S. Washington, of the Geophysical Laboratory, has been appointed chemical associate to the scientific attachés at the American embassies in Paris and Rome.

C. L. Dake, professor of geology at the Missouri School of Mines, has returned after spending a year on consulting work for Valerius, McNutt & Hughes, of Tulsa, Oklahoma.

Capt. Maurice Cockerell has succeeded Sir Lionel Phillips as director of the department for the development of mineral resources in the Ministry of Munitions, Great Britain.

Richard G. Place has resigned as chief chemist of the Vermont Copper Co., South Stafford, Vt., to accept a position with the Golden Age Mining and Reduction Co., at Boulder, Colorado.

A. E. Collins, for the last five years government mining inspector in northern Ontario, has resigned to become safety engineer with the International Nickel Co., at Copper Cliff, Ontario.

Rush T. Sill, of Sill & Sill, consulting mining and metallurgical engineers of Los Angeles, has been commissioned a captain of engineers and has reported to Fort Douglas, Utah, for training.

Armin A. Schlesinger, president of the Northwestern Iron Co., Newport Chemical Co. and other Schlesinger corporations, has accepted a commission as captain in the Chemical Warfare Service.

W. P. Mullane has been appointed general superintendent of the Sligo Iron and Steel Co.'s plant at Connellsville, Penn., which is now owned by the Commercial Iron and Steel Corporation, of New York.

Martin Schwerin has returned to New York from Quebec, where he has installed a mining plant for the Dominion Mines and Quarries, Ltd., at Black Lake. He will reopen his office in New York.

R. F. Randolph has resigned as general superintendent of the Dominion Iron and Steel Co., Sydney, N. S., and will return to the United States. **H. E. Rice,** formerly assistant general superintendent, is his successor.

Carlos W. Van Law, one of the vice-presidents of the United States Smelting, Refining and Mining Co., and general manager of operations in Mexico and Colorado, has resigned. He will engage in general consulting practice.

Claude Ferguson has resigned as superintendent of the Copper Queen Gold Mining Co., Stoddard, Ariz., and has accepted a similar position at the Consolidated Arizona Smelting Co.'s De Soto and Swastika mines. His address is Ocotillo, Arizona.

Henry H. Armstead, president of Armstead Mines, Inc., operating at Talache, Idaho, has been promoted to be major in the Quartermaster Corps. He has been stationed at Chicago, where he has assisted in organizing stevedore and labor units for overseas duty.

A. N. Diehl, assistant to the vice president of the Carnegie Steel Co., Pittsburgh, Penn., has been appointed general superintendent of the Duquesne works, succeeding the late Edward J. Hamilton. Mr. Diehl was superintendent of blast furnaces at the same works for 15 years.

Clement F. Poppleton, for the last two years with Perin & Marshall, New York, will take charge of building and operating a tin plate plant for the Broken Hill Proprietary Co., Australia. He will design the plant himself and the machinery will be built in Australia under his direction.

E. M. Norris, foreman at the Tramway mine of the Anaconda Copper Mining Co., has been appointed to assist the superintendent of the company, with jurisdiction over the group of properties known as the Boston & Montana, which position was formerly held by **C. L. Berrien,** who is now serving in France.

Andrew M. Fairlie, consulting chemical engineer, has opened an office for general consulting practice at Room 1204, Third National Bank Bldg., Atlanta, Ga. Mr. Fairlie, who has been chemical engineer for the Tennessee Copper Co. for several years, is still retained by that company in a consulting capacity.

Frank D. Carney, chief metallurgist of the Bethlehem Steel Co., Bethlehem, Penn., and **Lewis B. Lindemuth,** superintendent of the crucible and electric furnace departments of the same company, have resigned and will form the partnership of Carney & Lindemuth, consulting engineers in iron and steel metallurgy and practical steel works operation, with offices at 40 Wall St., New York.

Obituary

Howard W. Du Bois died Sunday morning, Nov. 10. A more extended notice will be published later.

Raymond B. Earle, professor of geology at Hunter College, New York City, died of pneumonia on Nov. 10.

J. F. Ripley, president of Ripley Manufacturing and Machinery Co., Joplin, Mo., died in Joplin on Oct. 28.

Ralph T. Godbe, assistant superintendent of the Chief Consolidated Mining Co., Eureka, Utah, died Oct. 29 of pneumonia. He was 30 years old.

Edward J. Hamilton, general superintendent of the Duquesne works of the Carnegie Steel Co., died Oct. 23 at his home in Duquesne, Penn., of pneumonia following an attack of influenza. He was 51 years old.

Frank Stephens, chief electrician of the United Verde Copper Co., died of influenza recently at Jerome, Ariz. He contracted the disease while wiring an emergency hospital, which work he had refused to allow his men to do.

Harold Thompson, mining engineer, died recently of pneumonia after a short illness. He was formerly a resident of Kingston, Ont., and was with the Hollinger Consolidated Gold Mines, Ltd., of Timmins, Ont., at the time of his death.

Winthrop R. Cady, sales manager of the Colorado Iron Works Co., died in Salt Lake City on Oct. 25, of pneumonia following influenza, aged 31 years. Mr. Cady had a record of 17 years' continuous service with the company, and had a wide acquaintance among metallurgists and mining men of the West.

Frederick F. Fredlund, manager of the mechanical department of E. J. Longyear Co., of Hibbing, Minn., died at his home in Minneapolis, on Nov. 1, of pneumonia, following an attack of influenza. He was born in Ishpeming, Mich., and studied mechanical engineering at the University of Michigan.

Societies

Mining and Metallurgical Society of America, New York section, held a meeting on Nov. 13, at the Columbia University Club, 4 West 43d St. The program consisted of presentations of the ideas of various members as to sundry reconstruction problems that may be discussed to advantage at subsequent meetings. The opening address was given by J. R. Finlay.

Spokane Engineering and Technical Association was recently organized in Spokane, Wash., under the joint auspices of the local sections of the American Institute of Mining Engineers, the American Institute of Electrical Engineers and the American Society of Civil Engineers. The first meeting was held on Sept. 20, at which a program for the following year was adopted. The second meeting took place Oct. 18, at which the Columbia section of the American Institute of Mining Engineers was in charge.

Industrial News

Western Electric Co., Inc., announces the election of Charles G. Du Bois as vice president.

Traylor Engineering and Manufacturing Co. announces the death on Oct. 26 of its secretary, Francis R. Crispen.

O. H. Sellars, district representative of the Ingersoll Rand Co., at Miami, Ariz., is convalescing at Lordsburg, N. M., after an attack of influenza.

Walter A. Zelnicker Supply Co., St. Louis, Mo., announces the appointment of R. H. Wilson as assistant to the president, with office in St. Louis.

Ricketts & Co., Inc., assayers, formerly of 80 Maiden Lane, New York, have moved to 280 Madison Ave. Charles E. Wagstaffe Bateson, Dr. M. L., Hamlin, and T. A. Shegog, formerly assistant professor of chemistry and metallurgy at the Royal College of Science, Dublin, are associated with them.

Electric Furnace Construction Co., Philadelphia, has made the following appointments: F. W. Brooke, vice-president; G. H. Twose, secretary and treasurer; G. W. Ketter, chief installation superintendent; Neil Neville, assistant to the president in selling and business organization, and G. L. Ashmore, electrical engineer.

United Filters Corporation is moving its Eastern works and testing laboratory into its own thoroughly equipped factory building at 355 Cortland St., Belleville, N. J.; telephone Belleville 5875. About Nov. 15 it will also move the sales office to 65 Broadway, New York; telephone Rector 7598. It requests that hereafter all samples of material for laboratory tests and all filter parts forwarded for repairs or renewals be shipped to the Belleville address, as given. All correspondence with customers will be handled through the New York office.

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.

Drill Core, Discharge Apparatus for. Robert E. Carmichael, Damon, Tex., assignor of one-half to George Hamman, Houston, Tex. (U. S. No. 1,280,159; Oct. 1, 1918.)

Excavating Machine. George W. King, Charles B. King, Benjamin Jacoby and Herbert E. Roush, Marion, Ohio, and Grant Holmes, Danville, Ill., assignors to the Marion Steam Shovel Co., Marion, Ohio. (U. S. No. 1,280,238; Oct. 1, 1918.)

Explosive. Adolphe Segay, Ware, England. (U. S. No. 1,280,563; Oct. 1, 1918.)

Flume Construction and Car Therefor. Vincent K. Woods, Marble Creek, Idaho. (U. S. No. 1,280,352; Oct. 1, 1918.)

Jigs, Chats Separator for. Arpad S. Malocsay Miami, Okla. (U. S. No. 1,280,263; Oct. 1, 1918.)

Mine Ventilation. Martin J. Lide, Birmingham, Ala. (U. S. No. 1,280,254; Oct. 1, 1918.)

Smelting—Process of Roasting Ores. Albert B. Newman, Langeloth, Penn., assignor to Metallurgical Co. of America, New York. (U. S. No. 1,280,283; Oct. 1, 1918.)

Editorial Correspondence

WASHINGTON, D. C.—Nov. 11

Importation of Low-Phosphorus Iron Ore up to 70,000 tons prior to July 1 from Spain, Sweden, Norway, and North Africa has been allowed by the War Trade Board in a ruling dated Nov. 11. Heretofore importations have been limited to such quantities as could be brought as ballast. All the low-phosphorus ore brought in will be allocated by the War Trade Board.

With the Exception of Shipments from Cuba, Canada and Brazil, no licenses are being issued for the importation of chrome ore. All outstanding licenses were revoked as of Nov. 11. This action was requested many weeks ago, when it became apparent that all the chromite needed could be produced domestically.

NEW YORK—Nov. 12

Interest in the Russian Mining Situation is keen. One expedition sailed for Russia last week, and there is a possibility of three other parties leaving soon.

Activity in Mexican Mining and Smelting is noted in the rebuilding of structures destroyed during the last eight years and the placing of properties in condition for continuous operation.

Manufacture of Aluminum Nitride on a laboratory scale has yielded such results as to warrant the construction of high-temperature electric furnaces at Massena, N. Y., by the Aluminum Co. of America. Further experiments in four-ton lots are now being carried out. If these prove commercially successful, the company intends to build a large plant in the south.

DENVER—Nov. 6

Manufacture of Ferro-Alloys is the latest important venture of the Vindicator Consolidated Gold Mining Co., of Cripple Creek. In purchasing the property of the Ferro-Alloy Co. of Denver, the Vindicator has followed the policy of other well-established mining companies that have found it advantageous to make use of an efficient business organization and technical staff in the development and exploitation of new enterprises. During the last year this company's mining operations in the Cripple Creek district have been seriously restricted by the continual and increasing shortage of underground labor, and the advance in wages and cost of supplies. For the last few months there has been a marked decrease in tonnage from the mines, and ore of lower grade has been drawn from the stopes. The shortage of labor has occasioned the cessation of nearly all development work, thereby causing a constant reduction in ore reserves. The directors have deemed it wise to conserve the company's resources by a reduction in the amount of the usual dividend. The results of the development work during the last two years impressed the directors with the need of acquiring additional property with which to extend the operations of the company. Among the numerous propositions which were presented to the company for consideration was the Ferro-Alloy Co. of Denver, which had been operating for about a year at a moderate profit, but found its operations greatly curtailed by lack of sufficient working capital with which to carry its stocks of raw materials and of finished products until their sale. After a satisfactory investigation of the outlook in the ferro-alloy trade, the Vindicator company concluded the purchase of the Ferro-Alloy Co. on Sept. 18, 1918. The basis of the purchase was the payment of the debts of the Ferro-Alloy Co., amounting to $900,411.15, which amount was more than covered by the liquid assets of the company; and a further payment, together with 6% interest, to be made when realized from the profits of the Vindicator company's operation of the ferro-alloy plant. This acquisition was accompanied by the purchase of a lease and option on a chrome ore property near Glenrock, Wyoming, as a source of supply of chrome ore for the manufacture of ferrochromium by the company. This purchase amounted to $12,743.60. It was found that ample supplies of crude ore of manganese, tungsten, silicon, uranium, and vanadium are available in Colorado and adjacent states for the manufacture of ferro-alloys of these metals. The Vindicator company's engineers estimated that the purchase and installation of additional equipment at a cost of about $25,000 would double the capacity of the present ferro-alloy plant, and thereby effect a substantial reduction in the cost of the manufactured products. This installation has been authorized by the directors, and should be completed in about four months. The completion of the payments for the purchase of the chrome ore property, the installation of adequate equipment for the economical handling of the ore, and the continuation of the development as planned will involve an additional estimated expenditure of $20,000, which the company has decided to make. The net earnings of the Vindicator company for the third quarter of 1918 amounted to $95,000. The company has a cash reserve of $225,000.

PHOENIX, ARIZ.—Nov. 8

Voters of Arizona refused to pass a new workmen's compensation amendment at the late election. The movement was backed especially by the small mine owners, represented by the Association of Arizona Mining Men. There has been grave dissatisfaction with present conditions in Arizona, allowing full scope to the "ambulance-chasing attorneys," who all worked hard to defeat the proposed measure. Damage suits are increasing despite all "safety-first" regulations, and now are a serious tax upon the time of the Arizona courts.

The Mines of Arizona not only pay 62% of the taxes of the state and furnish most of the market for agricultural products, but they have proved of large direct financial benefit to the local organization that is in charge of the Salt River Valley reclamation project. For more than a year the Inspiration Consolidated Copper Co., of Miami, has been paying more than $1000 a day for electric power transmitted from the Roosevelt power works of the project, under contract that calls for a maximum of 8000 kw., from works that have about 11,000 kw. maximum productive capacity. Owing to low water back of the dam, the works now are turning out only 3000 kw., of which the Inspiration is getting only 1200, necessitating recourse to its own power plant for almost all electricity needed.

JOPLIN, MO.—Nov. 2

Drilling for Oil and Gas is to start soon west of Baxter Springs, Kan. The campaign is the result of several shallow strikes made while drilling for zinc and lead in the last year. The first hole is to be put down on the Thomas land, where oil was struck a few weeks ago. No deep drilling has been done in the vicinity.

The First Ore Warehouse at Picher, Okla., will be ready to receive ore by Nov. 10. The promoters of the plan are not discouraged by the fact that an agreement between smelters and producers is about to be completed, whereby prices will be definitely fixed, removing the need of a warehouse to store zinc ore for higher prices.

HOUGHTON, MICH.—Nov. 8

Former Copper-District Miners are beginning to return, and larger numbers may be expected soon if the reports of those coming back are to be credited. They explain that most of the men who have been attracted by higher wages in war work now fear that they will have no jobs at all when the war is over. And they also have learned that living conditions in the copper district have advantages that may not be secured elsewhere and that chances for a permanent job are always better here. One thing that impresses the men who left to take war jobs is the difference in house rent. Most of them lived here in corporation houses which rented at $5 or $6 a month. The same houses in the city cost them from $30 to $40 a month. Besides, they were so far from their work that they spent a couple of hours daily on the street cars, to say nothing of the cost of the transportation.

Copper Stocks at Smelteries are low. No copper is being put up for storage, and the close of navigation finds every dock cleaned off. Shipments by rail, by express and by preferred freight continue to go East. Practically all of the output of this district is now going directly or indirectly to the Allied governments. The bulk of the shipments from the Dollar Bay smeltery, which handles the product of the subsidiaries of the Calumet & Hecla, is sent to the French government for war purposes, some being sent abroad in big cargo lots. To obtain any large amount of copper that will be called for in reconstruction work will necessitate a speeding up of production, for the mines today are running not over 80% of normal, with no hope of betterment until the soldiers return from Europe and bring some change for the betterment in the labor situation. Automobile factories in Michigan are reported practically without any copper or brass stocks, excepting those which are required to complete Government contracts upon which they are now working.

COBALT, ONT.—Nov. 9

Mines of Northern Ontario have done their share toward making the second Canadian Victory Loan a success. In addition to an endeavor to get as many of the employees as possible to subscribe, the mining companies themselves have contributed large amounts. The known subscriptions are: Nipissing, $1,000,000; Kerr Lake, $500,000; Temiskaming, $400,000; La Rose, $100,000; Coniagas, $90,000; Lake Shore, $80,000; Buffalo, $50,000; McKinley-Darragh, $50,000; Trethewey, $25,000; making a total of $2,265,000. A number of the mines have not yet been heard from, and when all the returns are received this total is expected to be largely augmented.

VICTORIA, B. C.—Nov. 8

Mining Development in the northeastern mineral district has not been as active during the last year as its mineral possibilities warrant, according to J. D. Galloway, provincial resident mining engineer. This is due to the high cost of labor and mining supplies, especially powder and machinery, and though capital has been available for mining, the advanced price of development has hindered investment in properties in the prospect stage, which necessarily is speculative. Undoubtedly when the war is over many men will return to the northern country, and prospecting, which has practically ceased, will be revived, and important discoveries may be made. Referring to the Keithley Creek section of the Cariboo district, Mr. Galloway says that it is virtually deserted, although considerable placer ground remains, which may be worked at a profit. With the revival of gold mining, which should take place after the declaration of peace, he expects the district will attract more attention.

The Snowstorm Group, which comprises five highly mineralized copper-silver-gold claims situated in Highland Valley, Yale district, will be prospected by the Provincial Department of Mines by diamond drilling under the terms of the Mineral Survey and Development Act, according to the Hon. William Sloan, Minister of Mines, and bids are being asked for 10,000 ft. of drilling. The property has been inspected and reported on by several engineers, among whom are R. W. Thomson and F. B. Freeland, resident engineers with headquarters respectively at Kamloops and Grand Forks; William Brewer, now resident engineer at Nanaimo, B. C., and the late Dr. C. W. Drysdale, formerly of the Geological Survey Branch, Ottawa. Mr. Brewer in 1915 stated, after an examination of the Highland Valley Camp, that though there is considerable tonnage of high-grade bornite and chalcocite copper ore on several of the mineral claims, the future growth and prosperity of the camp will eventually center around the apparently extensive bodies of low-grade copper ore. To systematically and thoroughly prospect and develop these deposits, diamond-drilling would appear to offer more advantages than the slower and more expensive method of opening up the mineral-bearing zones by working openings.

The Mining News

ALASKA

KENNECOTT (Kennecott) — October production was 13,286,000 lb. of copper. These figures include the production of South American properties. The tunnel between the Mother Lode and Kennecott mines is nearing completion.

ARIZONA

Cochise County

PHELPS DODGE (Bisbee)—Fire of unknown origin destroyed the supply house of the Copper Queen branch on October 31.

SHATTUCK ARIZONA (Bisbee)—October production was: Copper, 744,069 lb.; lead, 535,009 lb.; silver, 19,347 oz.; gold, 123.51 oz. Production for 10 months in 1918 was: Copper, 7,991,972 lb.; lead, 1,504,970 lb.; silver, 128,428 oz.; gold, 1048.11 ounces.

HILLTOP EXTENSION (Paradise)—Shipments of lead-silver ore to be made from the company's Chiricahua mountain property. Two carloads a month to be delivered at Rodeo. Property managed by John Gaughran and John Blumberg.

CALUMET & ARIZONA (Warren)—Smeltery production during October amounted to 7,172,000 lb. of copper, of which 4,712,000 lb. was available for Calumet & Arizona.

Coconino County

NAVAJO COPPER (Flagstaff)—Building 100-ton leaching plant. A. A. McCullough is manager.

Gila County

INSPIRATION (Miami)—October copper production was 8,125,000 pounds.

MIAMI COPPER (Miami)—The 100-ton mill to treat carbonate ores has been placed in operation. Mill to be operated jointly with Bureau of Mines.

Greenlee County

SHANNON (Clifton)—Copper production during October was 800,000 pounds.

Maricopa County

ABE LINCOLN (Wickenburg)—Shaft down 700 ft. Have driven a tunnel several hundred feet and cut sulphide vein. E. W. Gettin, of Omaha, is manager, and Charles Mathorst superintendent.

Mohave County

CERBAT SILVER MINING AND MILLING (Chloride)—Has taken over Elkhart and Argyle mines, which it will operate soon.

HUGHES COMPANY (Chloride)—Opening ore encountered in drifting at the Bay State mine. Mine situated near the Midnight and other well-mineralized veins of the district.

HACKBERRY (Hackberry)—Mill expected to begin operations Dec. 15, and will handle 250 tons daily. Shaft is down 900 feet.

WALNUT CREEK (Kingman)—Shaft down 800 feet.

Pima County

NEW CORNELIA (Ajo)—October production was 3,644,000 lb. of copper.

Yavapai County

OCTAVE (Congress Junction)—Begun construction of 250-ton gold reduction plant in Arizona. Shaft down 1300 feet.

UNITED VERDE EXTENSION (Jerome)—To sink shaft to 1700 level. Permanent electric-power lines have been installed in the shaft. Smeltery at Verde treated 12,688 tons of ore in September.

GRUBB (Senator)—C. H. Hooker, A. G. Baker, and A. H. Favour have incorporated the Grubb Mining Co., with a capital stock of $1,000,000. Development of copper property begun.

Yuma County

SWANSEA LEASE (Swansea)—Have laid off 75 miners and discontinued underground work until completion of a 500-ton concentrator on which construction has begun. Lease has been shipping heavily to Clarkdale works of the United Verde company.

ARKANSAS

Independence County

PUGH HOLLOW (Anderson)—Erecting 200-ton washing plant. Operated by Everton Mining and Development Company.

DR. TOOKER (Batesville)—To build manganese plant soon, and will purchase log washer, belts, pulleys, and shafting.

REEVES (Batesville)—Installing third steam shovel. Recenty purchased machinery for 300-ton washing plant. Producing high-grade nugget ore and have considerable wash ore for treatment at the plant as soon as it is completed.

ROBERTS (Batesville)—Operating two manganese properties on the Bayou, and making a good production of high-grade manganese.

WACO (Batesville)—Begun operation of one of the largest and most modern washing plants erected in this region.

DENISON & HANFORD (Cushman)—Sinking shaft, and will start drifting at once, and require underground tracks, cars, and other equipment. Stanley Hanford is superintendent.

ROGERS (Cushman)—Recently taken over by Stanley Hanford and Walter Denison, of Cushman, who have sunk shaft 94 ft. and will do extensive underground work. Have installed power hoist and later will put in underground tracks and cars.

CALIFORNIA

Shasta County

MAMMOTH (Kennett)—Smeltery production during October is estimated at 910,000 lb. of copper.

IDAHO

Boundary County

IDAHO CONTINENTAL (Porthill) — Shipped 77 carloads since July 17, of net value of $231,000. Mine operating two shifts and mill three shifts. Tram, 2000 ft. long, ordered from Riblet Tramway Co. to span Kootenai River.

Idaho County

OROGRANDE GOLD (Orogrande)—New incorporation succeeds older one of same name, and will take over properties here. Judge George Turner, of Spokane, Wash., is chairman of directors.

Shoshone County

BUNKER HILL & SULLIVAN (Kellogg)—Litigation with American Smelting and Refining Co. regarding smelting rates has been settled.

KANSAS

Joplin District

AMERICAN METAL (Joplin, Mo.)—Pumping started nine months ago at mine west of Baxter Springs has lowered water to 100 ft. Several holes drilled and three Pomona pumps in place. Pumping at rate of 2800 gal. per min. Fourth pump being installed to drain ground to 300 ft. Company has already pumped 70,000,000 gallons.

MICHIGAN

Copper District

SENECA (Calumet)—All stock of the Seneca Mining Co. has been taken over by the Seneca Copper Corporation. Shaft now down 110 ft. beyond the turn at the lode.

FRANKLIN (Demmon)—Shortage of labor continues to impair operations. Four machines are stoping north from the 30 level.

MOHAWK (Gay)—Shaft reached 110 ft. depth, and crosscutting has started.

WOLVERINE (Kearsarge) — Removing pillars and widening old 12-ft. stopes where the rock looks promising.

MICHIGAN (Rockland)—Nine stopes opened in commercial ore.

MISSOURI

Joplin District

HARTFORD (Joplin)—No. 2 mine at Carthage closed on account of influenza.

MONTANA

Cascade County

ANACONDA (Great Falls)—Fire destroyed dust mill at zinc plant recently. A temporary mill was erected and operations were continued.

Flathead County

IRON MASK (Kalispell)—Work started on 3000-ft. crosscut tunnel.

Jefferson County

MINAH (Wickes)—To be reopened. Property is silver-lead.

Lincoln County

SNOWSTORM MINES (Troy)—Handled three-fourths of average tonnage during October, owing to influenza epidemic. Cutting out for a side-track at mine, and timbering is being done at No. 7 tunnel.

Powell County

BIG DICK (Elliston)—Driving new tunnel 1200 ft. Preparing road for shipment of ore.

NEVADA

Lander County

AUSTIN-MANHATTAN (Austin) — To resume operations on some of its old properties, and leases are being made. Charles Lyons has secured lease on upper levels of Patriot mine, and work is now being done on 100 level. Work by company in progress in Diana and Belle Wilder mines. Surface equipment will be installed at incline shaft of Diana, and crosscut driven on 200 level toward Trojan shaft. Main shaft of Diana has been retimbered and equipped with gasoline hoist. Development work will be pushed on 120 level first, where good-grade silver ore has been cut. Deeper development is also planned.

Mineral County

SILVERADO (Sweetwater)—Silver ore being opened in development work, and cyanide plant being built. An all-sliming process will be used. Some high-grade ore has been shipped. Silver occurs as argentite and cerargyrite.

Nye County

TONOPAH DISTRICT ore production for the week ended Nov. 2 was 8839 tons, of an estimated gross milling value of $150,263. Producers were: Tonopah Belmont, 2117 tons; Tonopah Mining, 2000; Tonopah Extension, 2293; West End, 930; Jim Butler, 246; Montana, 79; Tonopah Divide, 267; Midway, 74; Halifax, 108; Rescue, 66; North Star, 59; and the MacNamara, 400 tons.

OKLAHOMA

Joplin District

BLACK EAGLE (Picher)—Sinking third shaft, and will install new compressor.

FOCH (Picher)—Name selected for old Sheridan-Adams property, northwest of Picher, recently taken over by employees of Eagle-Picher Lead Company.

OREGON

Jackson County

GOLD HILL MINING ASSOCIATION (Medford)—Installing 10-stamp mill. Operating properties known as the Sylvanite group and large body gold-hearing ore has been cut in 750-ft. drift on 450 level.

UTAH

Box Elder County

SALT LAKE POTASH (Bingham City)—Potash reported to have been found in lake water in Hansel Valley near Snowville. J. Nibley and associates are interested.

Juab County

APEX-STANDARD (Eureka)—Shaft recently started is down 200 ft. Compressor and hoist have been installed and are operating successfully. L. Merriman is general manager.

CHIEF CONSOLIDATED (Eureka) — New shaft down 300 ft. Good progress is being made, although surface water has been a handicap. Manganese ore being hauled from the Homansville section of the property, under lease to Huish and Beane.

COPPER LEAF (Eureka)—New shaft has been sunk 910 feet.

EUREKA-LILLY (Eureka)—Repairs being made to hoist and shaft. Shaft to be sunk to greater depth. R. L. Edwards is superintendent.

GEMINI (Eureka)—Development being done on 1600 and 1800 levels. On 1800 level, new drift is being driven north in ore. Stoping of silver-lead ore is being done by the company and lessees.

GODIVA (Eureka) Spriggs lease has opened a new orebody below the 700 level.

LIBERTY MANGANESE (Eureka)—This company, which owns manganese claims in the Erickson mining district, or West Tintic, has recently made a shipment of manganese from another property near Marysvale, in Piute County.

NORTH STANDARD (Eureka)—New company incorporated to work group of claims in East Tintic, north of Tintic Standard and Copper Leaf. New shaft is to be sunk.

RIDGE AND VALLEY (Eureka)—New ore opened in the Hope lease on the 1600 and 1700 levels, and several cars of silver-lead ore have been shipped recently. New work being done at the No. 2 winze on the 1600 level. An air hoist is being installed here, a headframe has been put up, and the winze is being retimbered. Present depth 80 ft. and will be sunk further. Property operated through the Gemini. John H. McChrystal is superintendent.

TINTIC STANDARD (Eureka)—Main working shaft now down 1400 ft. and in good ore.

TINTIC SHIPMENTS for the week ended Oct. 25 amounted to 126 cars, compared with 144 cars the week previous. For the week ended Nov. 1, 150 cars were sent out by 18 shippers. The wagon road between Eureka and Silver City is being repaired by the county.

Morgan County

NATIONAL POTASH CORPORATION (Devil's Slide)—Company incorporated Oct. 22, under laws of Nevada, to recover potash from leucite rocks of Sweetwater County, Wyo. Have leased Union Portland Cement Co.'s large plant at Devil's Slide, near the Wyoming state line, and will make such changes as are necessary to fit it to produce potash from silicates, using the Edwards process. Company is capitalized for $100,000. Salt Lake, Ogden, and Idaho men are interested. Aman Moore is president and general manager.

Salt Lake County

MICHIGAN-UTAH (Alta)—Bins at platform at the mine and at Tanners Flat are full of ore which has accumulated owing to transportation difficulties. The Triangle Leasing Co. has six cars ready for shipment. Ore carries copper, silver, and lead.

UTAH COPPER (Bingham)—October production estimated at 19,000,000 lb., as compared with 17,785,000 lb. in September and 19,920,000 lb. in August.

ALTA TUNNEL AND TRANSPORTATION (Salt Lake)—Raising on one of the mineral-bearing fissures recently cut to reach contact of shale and ore-bearing limestone. Raise is up 40 ft., and following silver-lead ore. Main tunnel being driven west on the fissure to reach the white limestone underlying the shale.

Summit County

PARK CITY SHIPMENTS for the week ended Oct. 25 amounted to 3,816,090 lb. of ore and concentrates. Shipments for the week ended Nov. 1 amounted to 3,509,050 pounds.

JUDGE MINING AND SMELTING (Park City)—Some additions and improvements being made at the zinc plant, and will be completed by Dec. 1. Capacity will be 30 tons.

NEW QUINCY (Park City)—Development work has recently been started again, through the Daly West. W. B. Cole is superintendent.

PARK UTAH (Park City)—New strike reported. Developing claims covering a portion of the Ontario quartzite not far from the famous old Ontario mine. New fissure vein has been opened and carries some ore.

SILVER KING COALITION (Park City)—A meeting of the board of directors was held in Salt Lake City on Oct. 26, to fill the vacancy caused by the death of the late Thomas Kearns, formerly Senator. F. J. Westcott was elected to the board, and W. W. Armstrong was made president. An executive committee consisting of W. W. Armstrong, W. S. McCormick and W. Mont. Ferry was elected. No business relative to mine operations was taken up at this meeting.

SILVER KING CONSOLIDATED (Park City)—New 150-ton mill at the California-Comstock end of the property, in Thaynes Canyon, is being tried out. Will produce a silver-lead and zinc concentrate. Main drain and operating tunnel, being driven under Thaynes Canyon from Nigger Hollow, has been in lime and shale and is now entering the Park City limestone, which is the ore-bearing rock.

Tooele County

WESTERN UTAH COPPER EXTENSION (Goodwin)—Second compressor installed and placed in operation at property in Deep Creek. Main winze from the west crosscut of the tunnel is down 123 ft. in ore. A. E. Custer is general manager.

WASHINGTON

Ferry County

ADDISON COPPER (Keller)—Raise for ventilation completed from tunnel to shaft in Mammoth claim.

Okanogan County

CABA (Nighthawk)—Mine and Bender 75-ton mill being operated by J. W. Douglas, lessee. Mill operating three shifts.

COPPER WORLD (Nighthawk)—Contract let for two-mile tramway from Copper World and Copper World Extension mines to Palmer Lake. Will cut off eight-mile haul.

Stevens County

ELECTRIC POINT (Boundary)—Tram costing $45,000 has been completed by Riblet Tramway Co., of Spokane, and placed in operation. Length of tram three miles; descent 2800 ft. Bunker of 300 tons installed at upper end and 600 tons at lower end. Sinking in mine will be continued to 1000-ft. depth when men can be secured.

LEAD TRUST (Boundary)—First carload of high-grade ore being sacked for shipment in November.

UNITED COPPER (Chewelah)—October shipments, 14 carloads; net value, $25,000 to $30,000; operating cost, $8000 to $10,000.

NORTHPORT SMELTING AND REFINING (Northport)—Foundations being laid for drossing plant to cost from $50,000 to $75,000.

WISCONSIN

Zinc-Lead District

MINERAL POINT ZINC (Galena, Ill)—Hoskins mine on the Meloy land at Shullsburg, the youngest producer of this company's group of operating properties, has produced and shipped up to Nov. 9 of this year 13,830 tons of raw blende concentrates, and will probably set a new high record of annual production for the district. Property is equipped with a three-jig mill with a capacity of 35 tons an hour, and is operated on two 10-hour shifts. Mine is operated two 9-hour shifts. Depth of shaft is 150 ft. The 1917 high production record of the district was made by the Champion mine of the Wisconsin Zinc Co., with a shipment record of 15,727 tons of blende. The Coker mine, of the Mineral Point Zinc Co., with double mill equipment, was the largest producer in 1916, with a shipment record of 14,031 tons blende concentrates.

VINEGAR HILL ZINC (Platteville)—Derrick and outbuildings being assembled to develop the Jane Copeland tract at Shullsburg. Reassembling of the Kittoe mill has been completed on the Dale Rundell property at Livingston, and mine and plant will soon be placed in operation.

WISCONSIN ZINC (Platteville)—Results of extensive drilling operations assure the reopening of the once-famous Winskell producer at Shullsburg. Churn drilling on the Champion tract indicates the presence of an ore range separate and independent from the vein now yielding a heavy mine production of blende.

CANADA

British Columbia

DOLLY VARDEN (Alice Arm)—Railway and tram line are almost complete, and it is expected that transportation facilities will open tributary country.

FITZSIMONS GROUP (Green Lake)—To be developed under lease and bond by the Consolidated Mining and Smelting Co. Camp has been built and operations will be carried on during the winter.

SILVER STANDARD (New Hazelton)—Completed 50-ton mill and changes, additions, and improvements to power plant and surface buildings. No mining done this year until Oct. 1, all ore for the mill being taken from the dumps.

STANDARD SILVER-LEAD (Silverton)—Net profits in July were $8882 and in August $24,238. Surplus at end of August was $236,232.

LILY B (Slocan)—Shipped first car of high-grade silver-lead ore.

CONSOLIDATED MINING AND SMELTING (Trail)—Have acquired the Voight copper property, on Copper Mountain near Princeton.

ROCHER DE BOULE (Tramville)—Closed mine near Hazelton. May install 50-ton mill next year.

GENERAL HYDRAULIC (Twenty-mile Creek)—Experimental work on black sands has been carried on, although the question of the platinum return is still in doubt.

Manitoba

GOLD PAN (Rice Lake)—To be worked during winter. Shaft now 200 ft. deep and drifting being done at that level. A three-stamp mill will be installed when weather permits.

Ontario

DOME (Porcupine)—Developing on 1200 level near the Dome Extension boundary. It is understood that a new arrangement for the control of the Dome Extension is to be made soon. Rumors are circulated regarding the reopening of the Dome, but this is not likely to occur for some time.

McINTYRE (Porcupine)—Shareholders have approved purchase of stock of the Plenaurum by the directors.

PORCUPINE-CROWN (Porcupine)—Ore reserves said to be over $600,000, and it is expected that when the mines reopen a reasonable profit can be made.

SCHUMACHER (Porcupine)—A meeting has been called for Nov. 14 to ratify a by-law authorizing the sale of 100,000 shares of treasury stock at 45c. per share.

CHAMBER-FERLAND (Cobalt)—Exploration drift being driven near the boundary of the Genesee to prospect area where good results have been obtained by the latter company.

FOSTER (Cobalt)—Shipping weekly from old dump to Northern Customs concentrator.

LA ROSE (Cobalt)—Has taken an option on the Homestake silver property in the Kamloops district, British Columbia.

RELIANCE (Cobalt)—Being worked under lease by John Shaw. About 200 tons of ore has been broken down, and regular shipments to one of the custom mills are being arranged for.

TEMISKAMING (Cobalt)—Has cut new vein on Gans property, development of which is producing commercial ore.

PITTSBURGH-LORRAINE (South Lorraine)—Is expected to close down shortly. Company has been operating Currie property and Wettlaufer mine and mill under lease.

WRIGHT - HARGRAVES (Kirkland Lake)—Will proceed with the erection of a mill. Work is proceeding on the foundation. Machinery will be hauled in over the winter roads.

OTISSE (Matachewan)—Diamond drilling by Colorado-Ontario Development Co. has been satisfactory. Operations suspended pending installation of mine plant. Cost of transportation from Elk Lake during open season approximates $90 per ton, as compared with $15 per ton during winter months.

KNOX (Boston Creek)—Vein 4 ft. wide yielding satisfactory assay has been traced 400 feet.

MILLER - INDEPENDENCE (Boston Creek)—Extensive occurrences of gold tellurides are attracting wide attention. No complete assay plan has been made, and average return is uncertain.

PATRICIA (Boston Creek)—New vein has been cut on 100 and 200 levels.

WEBB CLAIMS (Bourke's Station)—Two good veins have been cut.

HURONIA (Gauthier Township)—Huronia Development Co. has been organized to develop property, under management of J. H. Hebert, of Montreal. Workings are being dewatered.

MEXICO

Sonora

GREENE CANANEA (Cananea)—Production in October was: Copper, 4,300,000 ft.; silver, 137,370 oz., and gold, 1080 ounces.

PERU

Junin

CERRO DE PASCO (Cerro de Pasco)—October production was 2918 tons of blister copper.

ASIA

Chosen

ORIENTAL CONSOLIDATED (Unsan)—October cleanings were $92,000.

The Market Report

SILVER AND STERLING EXCHANGE

Nov.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Nov.	Sterling Exchange	Silver New York, Cents	Silver London, Pence
7	4.7550	101⅛	49½	11	4.7600	101⅛	49½
8	4.7550	101⅛	49½	12	4.7600	101⅛	48⅞
9	4.7550	101⅛	49½	13	4.7600	101⅛	48⅞

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

Nov.	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
7	*26	†	8.05	7.75	8⅛ @8⅜
8	*26	†	8.05	7.75	8⅛ @8⅜
9	*26	†	8.05	7.75	8⅛ @8⅜
11	....	..	....	....	....
12	*26	†	8.05	7.75	8.15 @8.35
13	*26	†	8.05	7.75	8 @8⅛

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

† No market.

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

The 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 35c. per 100 lb. above St. Louis.

LONDON

Nov.	Copper Standard Spot	Copper Standard 3 M.	Copper Electrolytic	Tin Spot	Tin 3 M.	Lead Spot	Lead 3 M.	Zinc Spot
7	122	122	137	334	334	29½	28½	54
8	122	122	137	334	334	29½	28½	54
9	....	....	....	....	....	....	....	....
11	122	122	137	334	334	29½	28½	54
12	....	....	....	....	....	....	....	....
13	122	122	137	327	317	29½	28½	54

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

Metal Markets

NEW YORK—Nov. 13, 1918

Everybody is dazed over the sudden advent of peace and the realization that readjustment to new conditions involves grave problems, the full nature of which nobody is yet able to grasp. Most of the markets are best described as being for the moment stunned, and what with the continuance of governmental control and other interferences, they are unable yet to reflect anything.

Copper—There has been no cancellation of orders either by the United States or foreign governments, and none are expected. On the other hand, no new contracts have been made, though specifications have been received for shipments on old orders. The situation at the refineries seems to be becoming a little easier, especially in the matter of labor.

Consumers of copper who were caught by the unexpected change in price of July 2 are almost unanimous in their expressions of gratitude to Pope Yeatman for his effective intervention in the matter. The adjustments were obtained with much less difficulty than was expected. This was due partly to the fact that the quantity of copper involved was much less than was supposed. Though the exact figure has not been given out, it is said that such estimates as have been published were much too high.

Copper Sheets—The base price of copper sheets is 35½c. per lb. Copper wire is quoted at 28¾@29½c. per lb. f.o.b. mill, carload lots.

Tin—Plenty of tin seems to be available in this country, and some business was done in resale lots, which is permitted by the American Iron and Steel Institute. Banka was offered this week at 73½c., without finding buyers; but probably some business was done previously, for a large consumer was inquiring.

It is understood that the policy of the American Iron and Steel Institute will not be unreasonable. In well-informed quarters there is no expectation that tin will be allocated to consumers who do not want it, as to which there had previously been some fear. The Tin Importers' Association, recently organized, adopted resolutions under date of Nov. 4, 1918, protesting against the placing of the tin business of the United States in the hands of the U. S. Steel Products Co., which "is the largest individual tin importer in the United States, and at times is even a dealer in tin, and the U. S. Steel Corporation, of which the former is a subsidiary, is the largest tin consumer in the world." A. E. Winter is president of the Tin Importers' Association and E. W. Starke is secretary.

Both spot and three months London tin prices for Nov. 5 and 6 were £334.

Lead—The situation remains unchanged.

Zinc—Our quotation of the market this week is necessarily rather nominal, for there were few buyers, and we had reports of only a few transactions. Transactions on Nov. 12 were at a decided recession in price, business in prompt metal having been done around 8.30c. On Nov. 13 prompt was offered at 8.25c., December, at 8@8⅛c., and January, at 7¾ cents.

We quote high-grade spelter at 11 cents.

Purchasers of zinc ore in the Joplin market on the sliding-scale basis were rather small last week. Smelters who entered into this agreement paid the stipulated price for what ore they wanted. Many of them were previously well stocked up; therefore, they do not now buy at all. The arrangement between the miners and smelters is uneconomic in principle, and probably will not last long.

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

Other Metals

Aluminum—Unchanged at 33c. per lb.

Antimony—The demoralization in this market continued, and all kinds of prices were named. We quote spot at 9c. The statistical position of this metal is not good, although the stocks have been greatly reduced from the total of some months ago. A part of the stocks was held by persons who made haste to liquidate when peace came in sight, besides which there was some short selling, and there is probably still an uncovered short interest in the market. The Chinese producers cannot sell at present prices, it being estimated that their freights, duty, and other costs come to about 7c. per lb. for metal laid down in New York. One importing house quotes futures at 15½c., duty paid, but most of these houses do not quote at all.

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

Cadmium—Quoted at $1.50@1.75 per pound.

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

Quicksilver—Unsettled and easier. We quote $125, New York, for California virgin, and $122 for Mexican. San Francisco telegraphs "No quotation; market unsettled."

Gold, Silver and Platinum

Gold—The Transvaal gold output for September, 1918, amounted to £3,008,267, as compared to £3,135,807 for September, 1917, and £3,144,211 for August, 1918.

The government of India, under date of Aug. 31, according to Samuel Montagu & Co.'s letter, issued a rule prohibiting dealings in any legal-tender coin above its face value, the value of the sovereign being declared to be 15 rupees.

Silver—On Oct. 12, according to Pixley & Abell's circular, there were in Shanghai 25,400,000 taels of sycee and 12,100,000 Mexican dollars.

On Nov. 6 a shipment of $3,000,000 worth of silver bullion was made from the New York Government Assay Office to India.

The silver market has remained unchanged, with fixed quotations, with the exception that the London official price was lowered on Nov. 12 to 48¾d. on account of reduction in war insurance rate and in order to equalize the London price with the New York official price. Peace conditions are not likely to affect silver prices here so long as our Treasury regulations of silver continue.

Mexican dollars at New York: Nov. 7, 77½; Nov. 8, 77½; Nov. 9, 77½; Nov. 11, 77½. Nov. 12, 77½; Nov. 13, 77⅝.

Platinum—Unchanged.

Zinc and Lead Ore Markets

Joplin, Mo., Nov. 9.—Blende, per ton, high, $77.95; basis 60% zinc, premium, $75, Class B, $65@60; Prime Western, $55.67@50; Calamine, basis 40% zinc, $40@38. Average selling prices: blende, $54; calamine, $38.25; all zinc ores, $52.96.

Lead, high, $105.20; basis 80% lead, $100; average selling price, all grades of lead, $99.37 per ton.

Shipments the week: Blende, 7423; calamine, 531; lead, 1268 tons. Value, all ores the week, $547,300.

A majority of smelting agencies acknowledge to buying blende on the new schedule basis, thereby paying a basis price of $55.67 for Prime Western grades. One smelting agency, without instructions to pay schedule prices, bought 600 tons ranging from $50, $51.50 to $52.50 basis. Several of the heavier buyers were out of the market, and others were buying light. The Quinton Spelter Co., losing 10 furnacemen by influenza, was compelled to close. Other smelters are seriously affected in Arkansas and Oklahoma.

Platteville, Wis., Nov. 9.—Blende, basis 60% zinc, highest settlement price reported, $75.95; base price for premium grade, $75; base price for high-lead blende, $52 per ton. Lead ore, basis 80% lead, $100 per ton. Shipments reported for the week were 2398 tons blende, 410 tons galena, and 269 tons sulphur ore. For the year to date the totals are 109,949 tons blende, 7077 tons galena, and 38,374 tons sulphur ore. During the week 2968 tons blende was shipped to separating plants.

Other Ores

Chrome Ore—No market.

Manganese Ore—Buyers seem to be well supplied. They are not in the market.

Molybdenum Ore—No business reported.

Pyrites—Unchanged. There is probability of an embargo being placed on foreign imports of pyrites.

Tungsten Ore—This market was sharply depressed, owing to the desire of importers to sell supplies arriving. Buyers, however, were conspicuous by their absence. Offers for high-grade ore for shipment from South America were made as low as $21.

Iron Trade Review

PITTSBURGH—Nov. 12

All the steel mills were closed yesterday for the great celebration, which was vociferous in Pittsburgh and the surrounding mill towns. Impromptu parades were organized, the men carrying banners telling what they had made to help win the war. Fears were entertained that absence might be prolonged, but general reports today are that working forces are normal, and some mills have larger forces than a week ago, owing to the waning of the influenza epidemic. Homestead has about 1000 men away today, as compared with a maximum of 2800 recently. Much of the absence was caused by sickness in the family, rather than among the men, nurses and other help being almost unobtainable.

Cancellations of war contracts, of course, constitute the most interesting subject today. Thus far, steel mills do not report cancellation of important contracts on which they were working, but even for several days there has been cancellation of contracts on which work had not yet begun. There have also been a number of cancellations in connection with erection of the Neville Island ordnance plant, but it is positively asserted that the plans for this plant are modified, not annulled. The 16- and 18-inch gun portion is probably eliminated. The openhearth steel plant is not affected. With less occasion for speed, the construction work will be less expensive.

The belief in the steel trade is that in the course of a short time nearly all contracts for direct war material will be cancelled, the procedure being to attend to the latest contracts first. Production of railroad and ship material will not be affected, except that, on account of the existing surplus of ship plates, the weekly shipments may be reduced for a time. In a few months shipbuilding will probably be at a rate sufficient to absorb 50,000 net tons of plates a week, which has been the quota for the Fleet Corporation for several months.

Though the Government steel prices are about triple the lowest prices ever previously attained, the fair comparison is with average prices, for relatively little steel has ever been bought at minimum prices. Taking the 10-year average, 1904 to 1913 inclusive, present Government steel prices represent an advance of about 110%. Costs are much higher all along the line, and the standard wage rate of today is hardly likely to be reduced materially, even in several years, because the iron and steel industry has hitherto depended chiefly upon immigration for its labor supply, and immigration has been practically shut off for four years. Both the Washington authorities and the iron and steel producers desire to avoid a slump in prices, with a subsequent upturn, which would be the old-fashioned method of finding a fair level for the market, and prefer to see prices let down gradually to a stable basis. The prospective decline in that case would be a fraction of 50%, and possibly in the course of a year not more than between 25 and 35 per cent.

Pig Iron—The market continues quiet, consumers showing no disposition to take hold for forward deliveries. Current output goes out on contracts and allocations, as formerly. The pig-iron market may be affected less than the steel market by the end of hostilities; and, apart from temporary considerations, it is observed that there has been so much more expansion in the last three years in steel-making capacity than in blast-furnace capacity, that for several years to come the relative profits of merchant furnaces and steel works may be altered, the blast furnaceman getting a larger share of the total profits than formerly. The market remains quotable at the set limits: Bessemer, $35.20; basic, $33; No. 2 foundry, $34; malleable, $34.50; forge, $33, f.o.b. furnace, freight from the Valleys to Pittsburgh being $1.40 and from six detached furnaces somewhat less.

Steel—There is no activity in unfinished steel. The winding up of so many contracts will probably bring into the market much miscellaneous material in odd lots. The market remains quotable at the set limits: Billets, $47.50; sheet bars and small billets, $51; slabs, $50; rods, $57.

Ferro-alloys—Ferromanganese and spiegeleisen are quiet, but remain quotable at former levels, $250, delivered, for 70% ferromanganese and $75, furnace, for 16% spiegeleisen. As stocks are ample, and consumption may decrease, and as ore should come down with freer navigation, the market is generally regarded as facing a substantial decline.

Coke—The influenza epidemic has seriously curtailed production of beehive coke in the Connellsville region, and shipments of raw coal also, but blast furnaces do not report important coke shortage. By-product coke operations are well maintained.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1916	1917	1918	1916	1917	1918
Jan.	56.775	75.630	88.702	26.960	36 682	44.356
Feb.	56.755	77.585	85.716	26.975	37.742	42.792
Mar.	57.935	73.861	88.082	27.597	36.410	43.620
April	64.415	73.875	95.346	30.662	36.963	47.215
May	74.269	74.745	99.505	35.477	37.940	48.980
June	65.024	76.971	99.500	31.060	39.065	48.875
July	62.946	79.010	99.625	30.000	40.110	46.813
Aug.	66.083	85.407	100.292	31.498	43.418	49.077
Sept.	68.515	100 740	101.125	32.584	50.920	49.500
Oct.	67.855	87.332	101.125	32.361	44.324	49.500
Nov.	71.604	85.891	.....	34.192	43.584	.....
Dec.	75.765	85.960	.....	36.410	43.052	.....
Year	65.661	81.417	.....	31.315	40.851	.....

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

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

Tin	New York		London	
	1917	1918	1917	1918
January	44.175	85.500	185.813	293.227
February	51.420	92.000	198.974	311.525
March	54.388	(a)	207.443	318.875
April	55.910	(a)	220.171	329.905
May	63.173	(a)	245.114	364.217
June	62.053	(a)	242.083	331.925
July	62.570	(a)	242.181	360.347
August	62.681	(a)	243.978	380.900
September	61.542	(a)	244.038	343.905
October	61.851	(a)	247.467	335.543
November	74.740	.....	274.943	.....
December	87.120	.....	298.556	.....
Av. year	61.802	.....	237.563	.....

(a) No average computed.

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

Spelter	New York		St. Louis		London	
	1917	1918	19 7	1918	1917	1918
January	9.619	7.836	9.449	7.661	48.329	54.000
February	10.045	7.814	9.875	7.639	47.000	54.000
March	10.300	7.461	10.130	7.286	47.000	54.000
April	9.459	6.890	9.289	6.715	54.632	54.000
May	9.362	7.314	9.192	7.114	54.000	54.000
June	9.371	8.021	9.201	7.791	54.000	54.000
July	8.643	8.688	8..73	8.338	54.000	54.000
August	8.360	8.985	8.190	8.635	54.000	54.000
September	8.136	9.442	7.966	9.092	54.000	54.000
October	7.983	8.801	7.813	8.451	54.000	54.000
November	7.847	.....	7.672	.....	54.000	.....
December	7.685	.....	7.510	.....	54.000	.....
Year	8.901	.....	8.813	.....	52.413	.....

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

Pig Iron, Pgh.	Bessemer‡		Basic‡		No. 2 Foundry	
	1917	1918	1917	1918	1917	1918
January	$35.95	$37.25	$30.95	$33.95	$30.95	$33.95
February	36.37	37.25	30.95	33.95	30.95	33.95
March	37.37	37.25	33.49	33.95	35.91	33.95
April	42.23	36.15	38.90	32.95	40.06	33.95
May	46.94	36.20	42.84	33.00	43.60	34.00
June	54.22	36.36	50.05	33.16	50.14	34.16
July	57.45	36.60	53.80	33.40	53.95	34.40
August	54.17	36.60	50.37	33.40	53.95	34.40
September	46.40	36.60	42.24	33.40	48.58	34.40
October	37.25	36.60	33.95	34.40	33.95	35.40
November	37.25	.....	33.95	.....	33.95	.....
December	37.25	.....	33.95	.....	33.95	.....
Year	$43.57	.....	$39.62	.....	$40.83	.....

‡ As reported by W. P. Snyder & Co.

STOCK QUOTATIONS

N. Y. EXCH.† Nov. 12	
Alaska Gold M.	4⅛
Alaska Juneau	2⅛
Am.Sm.&Ref.,com.	89⅛
Am. Sm. & Ref., pf.	110⅛
Am. Sm. Sec., pf., A.	92½
Am. Zinc	15
Am. Zinc, pf.	48
Anaconda	71⅛
Batopilas Min.	1½
Bethlehem Steel	62
Butte & Superior	23
Butte Cop. & Zinc	11
Cerro de Pasco	38⅛
Chile Cop.	22⅛
Chino	42⅛
Colo.Fuel & Iron	39
Crucible Steel	55
Crucible Steel, pf.	88⅛
Dome Mines	14⅛
Federal M. & S.	12
Federal M. & S., pf.	42⅛
Great Nor., ore ctf.	32⅛
Greene Cananea	54
Gulf States Steel	65
Homestake	91
Inspiration Con.	54⅛
International Nickel	34⅛
Kennecott	39⅛
Lackawanna Steel	70⅛
Mexican Petrol.	165⅛
Miami Copper	28
Nat'l Lead, com.	61
National Lead, pf.	104
Nev. Consol.	20⅛
Ontario Min.	7
Ray Con.	24⅛
Republic I.&S.,com.	78
Republic I. & S., pf.	99⅛
Sloss-Sheffield	50⅛
Tennessee C. & C.	16⅛
U. S. Steel, com.	99⅛
U. S. Steel, pf.	11[illegible]
Utah Copper	87⅛
Va. Iron C. & C.	68⅛

BOSTON CURB* Nov. 12	
Alaska Mines Corp.	‡.12
Boston Ely	.90
Boston & Mont.	48
Butte & Lon'n Dev.	14
Calaveras	1
Chief Con.	3⅛
Contact	‡.15
Corbin	‡.10
Cortez	.15
Crown Reserve	‡.18
Crystal Cop.	‡.29
Eagle & Blue Bell	‡2⅛
First Nat. Cop.	‡1⅛
Houghton Copper	.40
Intermountain	‡.05
Iron Blossom	.42
Iron Cap	17⅛
Majestic	.31
Mexican Metals	.32
Mines of America	‡1⅛
Mojave Tungsten	.08
Nat. Zinc & Lead	.10
Nevada-Douglas	‡.35
New Baltic	1⅛
New Cornelia	17⅛
Oneco	.20
Pacific Mines	‡.35
Rex Cons.	‡.06
Yukon Gold	.90

SAN FRAN.* Nov. 4	
Alta	.03
Andes	.04
Best & Belcher	.01
Caledonia	.01
Challenge Con.	.03
Confidence	.10
Con. Virginia	.14
Gould & Curry	‡.01
Hale & Norcross	.02
Jacket-Cr. Pt.	.02
Mexican	.10
Occidental	.40
Ophir	.03
Overman	.01
Savage	‡.02
Sierra Nevada	.01
Union Con.	.06
Utah Con.	.01
Belmont	2.50
Jim Butler	.47
MacNamara	.21
Midway	.07
Mont.-Tonopah	.09
North Star	.06
Rescue Eula	.08
West End Con.	1.07½
Atlanta	.03
Booth	.02
Comb. Frac.	‡.02
Florence	.10
Jumbo Extension	.08
Kewanas	.03
Nevada Hills	.02
Nevada Packard	.23
Round Mountain	.16
Silver Pick	.02
White Caps	.11

COLO. SPRINGS* Nov. 4	
Cresson Con.	5.00
Doctor Jack Pot	.03½
Elkton Con.	.05
El Paso	.10
Gold Sovereign	‡.02
Golden Cycle	1.75½
Granite	.49
Isabella	.05½
Mary McKinney	.07
Portland	1.00
United Gold M.	.12
Vindicator	.30

BOSTON EXCH.† Nov. 12	
Adventure	‡.60
Ahmeek	.86
Algomah	‡.25
Allouez	.49
Ariz. Com., ctfs.	.16
Arnold	‡.20
Bingham Mines	‡.10
Bonanza	‡.16
Butte-Balaklava	.35
Calumet & Ariz.	69½
Calumet & Hecla	460
Centennial	13½
Copper Range	50½
Daly West	‡2½
Davis-Daly	4½
East Butte	11½
Franklin	4½
Granby	‡79
Hancock	‡7½
Hedley	‡12
Helvetia	‡.20
Indiana	‡.60
Isle Royale	27
Keweenaw	1⅛
Lake	6⅛
La Salle	13
Mason Valley	‡3⅛
Mass	5
Mayflower	4
Michigan	4
Mohawk	60
New Arcadian	2½
New Idria	‡13
North Butte	14½
North Lake	‡.40
Ojibway	.75
Old Dominion	42½
Osceola	60
Quincy	69
St. Mary's M. L.	‡49
Santa Fe	.50
Seneca	14½
Shannon	4
Shattuck-Ariz.	‡14
So. Lake	‡1½
So. Utah	‡.12
Superior	7
Superior & Bost.	4
Trinity	3⅛
Tuolumne	.95
U. S. Smelting	49
U. S. Smelt'g, pf.	47
Utah Apex	3
Utah Con.	9⅛
Utah Metal	2½
Victoria	3
Winona	1½
Wolverine	22
Wyandot	‡.50

N. Y. CURB† Nov. 12	
Big Ledge	1 1/16
Butte & N. Y.	‡.75
Butte Detroit	.02
Caledonia	.42
Calumet & Jerome	.50
Can. Cop. Corpn.	2 1/16
Carlisle	‡2
Cashboy	.07
Con. Ariz. Sm.	2
Con. Coppermines	5⅛
Emma Con.	‡.03½
Goldfield Con.	.19
Goldfield Merger	‡.01
Greenmonster	‡1/16
Hecla Min.	6 1/16
Howe Sound	4
Jerome Verde	.50
Louisiana	‡1/16
Magma	35
Marsh	.03
McKinley-Dar-Sa.	.49
Milford	‡.75
Mother Lode	.41
Nixon Nevada	.39
Ohio Cop.	‡
Rawley	‡2⅛
Ray Hercules	4
Richmond	‡.56
Rochester Mines	.33
St. Joseph Lead	14½
Standard S. L.	1/16
Stewart	.12
Success	‡.09
Tonopah	‡2⅛
Tonopah Ex.	1
Tribullion	‡
Troy Arizona	‡.09
United Eastern	4⅛
United Verde Ext.	‡37
United Zinc	‡
Utica Mines	‡.08

TORONTO* Nov. 12	
Adanac	.10
Bailey	.03
Beaver Con.	.33
Cbambers Ferland	.09
Coniagas	3.00
Hargraves	.02
Kerr Lake	5.87½
La Rose	.31½
Min. Corp. of Can.	2.00
Nipissing	8.37½
Peterson Lake	.08
Temiskaming	.32
Wettlaufer-Lor	‡.02
Davidson	.50
Dome Exten.	.29
Dome Lake	.17
Hollinger	5.75
McIntyre	1.68½
Newray	.12½
Porcu. Crown	.25
Teck-Hughes	.20
Vipond	‡.18
West Dome	.15

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