Engineering and Mining Journal

McGraw-Hill Co., Inc.

New York, July 6, 1918
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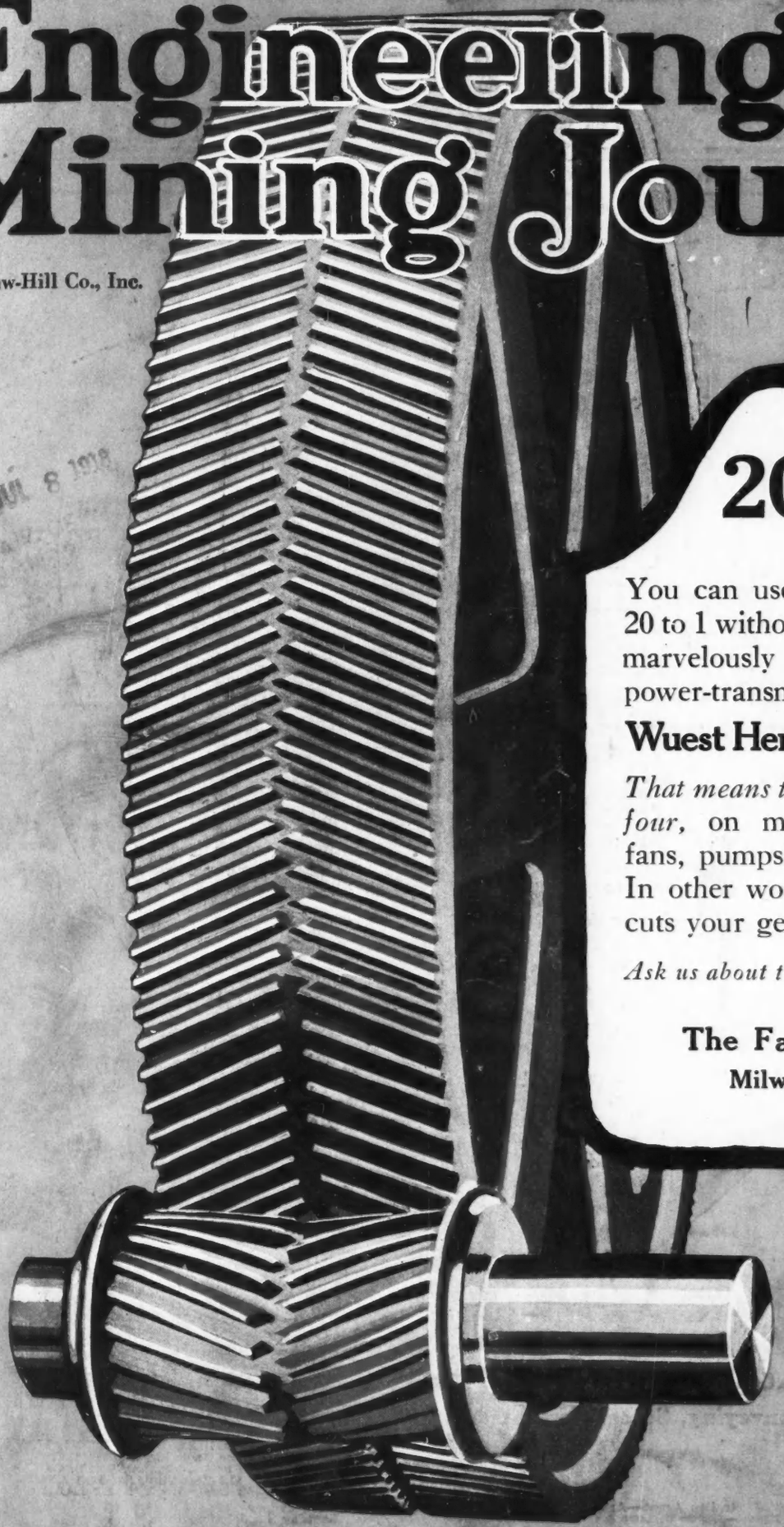

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Volume 106 *Number* 1

FIG. 1. TWO 16-FT. SPLICED STULLS FOR THE NEXT SET AHEAD IN THE CAVED PORTION OF A STOPE ARE TEMPORARILY SUPPORTED ON STRINGERS EXTENDED FROM UNDER THE CAPS OF THE SETS IN PLACE

Recovering Caved Stopes in Narrow Veins—II

BY CLAUDE T. RICE

The threatened collapse of a stope, timbered but unfilled for five floors, was prevented by quickly reinforcing the middle floor with heavy stulls cushioned at each end with headboards 15 in. thick. A caved stope which was filled mainly with large slabs of ore was reopened by taking the ore out in vertical slices from the top down, though in another cave in which the ore had broken small, and so would run easily, the stope was reopened by slicing the caved ore down on its angle of repose. In still another rather high cave that had been caused by falling of a large mass of ore from the back, with the result that the working had been stripped of timbers, the ore was recovered and the stope reopened, by building a truss across the top to support the back, and then drawing the ore from below this truss without providing other support for the walls, and with little shoveling.

AT THE Hecla mine a year or two ago a stope, approximately 600 ft. long and five floors, or 45 ft., high, in one of the veins on the 1200 ft. level, suddenly began to take weight and to give trouble. This was not surprising, for that part of the stope had been open to a height of five floors for several months, as the mine had been short of waste filling for some time. The mining of the top floor of this stope had been permitted to lag greatly, owing to the fact that this working was in ground that appeared to be well able to wait indefinitely for filling.

The back of ore was strong enough; it was the walls that had begun to give trouble, for the span of five floors, or 45 ft., as shown in Fig. 2, had proved too much for them, and they were suddenly showing signs of great weight. The stulls of the lower part of the stope began to snap and pop; especially those upon the middle floor. Something had to be done immediately, or the stope would surely be lost.

With 600 ft. of stope threatening to cave, it was a formidable problem. Yet the loss of the stope was averted in a simple way, as the men who had the condi-

tion to contend with understood what was really happening. Large stulls, many of them 24 in. in diameter, were put in at 5-ft. centers on the middle floor of the stope, which varied in width from 7 to 14 ft. Nothing else was done; yet these stulls prevented the stope from caving and held the working open until it could be filled.

Stope Saved by Putting in Stulls and Exceedingly Thick Headboards

The reason that this line of stulls held the stope open, even after the weight from the walls had begun to break fairly large stulls, is indicated by the fact that these new stulls were almost immediately driven into their headboards several inches. In other words, it was the initial creep of the walls, as they tried to arch themselves across this wide span, that was causing the timbers to fail. The walls, therefore, were prevented from coming in not so much by the size of the stulls that were used as by the especially thick headboards—five 3-in. planks at each end—that were put in between the stulls and the ground to act as cushions. With 30 in. of crossgrain timber, exclusive of wedges and filling pieces, between the walls and the stulls, sufficient cushioning timber had been provided to take care of the creep of the ground until arches of equilibrium had been established, in both walls, across the span of five floors.

Providing for the initial creep of the ground is a most important point in the timbering of any working, and it is because many mining men do not have a clear conception of what really happens when ground begins to take weight that hundreds of posts, stulls and caps are broken in mines each year that should not be broken and would not have been if put in with sufficient provision for taking care of the initial creep of the ground. It therefore may not be amiss to digress slightly in order to explain just what occurs when ground takes weight, and precisely what did happen in this large Hecla stope when the walls began to cave in, as the whole subject is rather intimately entwined with the matter of caved stopes and their occurrence.

It seems extraordinary, especially after the weight of the walls had begun to break stulls 18 in. in diameter and only from 7 to 14 ft. long, that a stope 45 ft. high and 600 ft. long which was threatening to cave could be saved simply by putting in a series of large stulls at 5-ft. centers along the middle floor. Yet to one who understands just what happens when ground takes weight it is not surprising that such a simple reinforcement was sufficient to hold the stope. The reason why this line of stulls, which was put in with exceedingly thick headboards on the middle floor of this stope, prevented the working from caving, even after the weight had become so great that it was breaking stulls 18 in. in diameter (and ground is pretty heavy that will break such stulls when they are only 7 to 14 ft. long), was simply that the 30 in. of crossgrain timber in the headboards of the new stulls was amply thick enough to continue to yield until the initial creep of the walls had stopped. When that was over, these new stulls, 2 ft. in diameter and placed at 5-ft. centers, were strong enough to hold in place the ground that had not keyed itself up.

If these stulls had failed, the ground that had not been able to key itself up into position in the walls would have come in. The footings from which the "dry" arches or sub-arches of self-support were springing would have failed. The ground that had keyed itself in place would then have come in. The failure of the footings of the arches would have increased the space of the major arch, and that would have caused the solid rock of the walls again to become beams, and they would have had to slab off under tension and shearing stresses until they had again assumed the arched shape proper for carrying the weight entirely in compression across the increased span. By that time the working would have been filled with broken material from the walls, and probably the span across the top of the opening would have been increased so greatly that the back itself would have begun to cave. The stope would have been filled with broken material from the back and walls, and the working would finally have been lost in spite of everything that could be done. That is the mechanics of caves.

Sometimes it is walls, at other times it is the back, occasionally it is both the walls and the back that give the trouble. It all depends upon the conditions and the strength of the ground. But practically all caves, if the truth were known, could be traced back to the fact that when the working was first opened up, and also when it was subsequently retimbered, the sets or posts or stulls were put in without any provision for keeping the weight of the ground from becoming excessive on the main members of the sets during initial creep. The timbers have consequently failed much sooner than they should have, and so the working has had to be retimbered much oftener than it should have been, ground has had to be taken out at each retimbering, and this has made the working larger and larger, and therefore even harder to hold. Finally, as the result of this improper handling of the timbering of the opening, the ground in the whole vicinity has got in motion, and the working has probably caved.

Cave Filled Mainly with Large Slabs Reopened by Taking the Ore Out in Vertical Slices

The first caved stope the reopening of which will be discussed in detail is that which occurred between No. 4 and 6 chutes on the 1200-ft. level in the main Hecla orebody. As shown in Fig. 3, this cave was 60 ft. long and did not catch itself up until it was about 38 ft. above the tramming track of the slice that was being mined. Throughout most of its length this cave had a width of 24 ft. In caving, the back had come down mainly in large slabs, so that the pile of caved ore showed little tendency to run, even in rather steep faces. Consequently the ore was taken out in vertical slices from the top down, supporting the walls with spliced timbers as fast as sufficient room was made for a stull to be positioned properly with respect to the sets in the uncaved part of the stope.

At the time that the cave occurred, the back had been stoped up 10 floors, or 90 ft., above the 1200-ft. level. The customary horizontal slice three floors high had been taken out across the top of the stope, the stope tramming tracks had been raised from the sixth to the ninth floor, crossboard lagging had been put in on the floor above, and the stope tightly filled with waste below the ninth floor in preparation for resumption of stoping, when suddenly the back for 60 ft. along the vein began to take weight. So little time remained for putting in reinforcing timbers that only the tramming floor could be attended to before the stope caved. But

fortunately the stringers put in on both sides of the track and the helper posts stood on them to catch up the stull caps of the crossboard floor had proved sufficient reinforcement to hold the tramming floor open, although the rest of the stope closed in completely.

As soon as the back had stopped caving and the stope had become quiet, reopening of the working began. Beginning on the crossboard floor in the uncaved part of the stope, and two sets back from the end of the cave that was nearest to a chute, the back was stoped up a floor and advanced to the edge of the cave, timbering the new floor securely with stull sets as the face was carried ahead. As the end of the cave was still going up almost vertically, the stope was again raised a floor two sets back from the face, advanced to the edge of the cave, and timbered securely. On this floor the stope broke into the open space above the pile of caved ore, and as the back over the cave was only three or four feet higher than the back over the stope, it was decided to work in from this floor in catching up the cave.

Spliced Stulls Used in Catching Up Cave, as Stope Was 24 Ft. Wide

As the caved stope was 24 ft. wide, even right under where the back had caught itself up, spliced stulls had to be used in making the back secure. In order to facilitate the handling of these catching-up stulls, stringers 16 ft. long and extending 6 ft. out into the cave were put in on the top floor of the stope. These stringers were securely carried at the stope end by being blocked down tightly upon false posts from the stull cap above, being held in position the while by means of collar cleats from the stull cap, as shown in Fig. 1. At their outer ends the stringers were blocked up to the proper height from the pile of caved ore. Four stringers were put in, so that there was a stringer under each end of the two stulls that were to be butted together. One of these stulls was 16 ft. long—the greatest length of timber that could be got into the stope conveniently. The other was 8 ft. long.

As soon as they had been lifted up on the stringers, the two stulls were toenailed together with 120-penny spikes. This having been done, the spliced stull was rolled out into proper position at 5-ft. centers from the last stull cap in the stope. Headboards of 3-in. planks, three deep and 5 ft. long, were put in at each end, and the spliced stull was then securely blocked in place. In blocking all the stulls in these caves, the bottom wedges were driven in much further than the upper ones, so as to bend the headboards out considerably at the bottom. Then, in case the top weight should come again on the stope before side weight had nipped the stulls securely into their headboards, the timbers would be much less likely to give way.

As soon as the first catching-up stull had been got in, and the back caught up securely from it, the miners began to carry down an approximately vertical slice across the end of the pile of caved ore, so as to make room for a line of stulls from top to bottom of the cave. The ore from the slice was allowed to run down to the crossboard floor, where it was drawn into a car, with a minimum of shoveling, and then run to the nearest chute.

In carrying down the slice, little trouble was had in keeping the face almost vertical, owing to the boulders that were scattered through the pile of caved ore. Occasionally one of these boulders would give trouble, and then it would be drilled half-way through with a Jackhamer drill and blasted with just enough dynamite to split it open, shaking the pile as little as possible. But if the boulder could be skidded down to the crossboard floor without much difficulty, this would be done before the boulder was block-holed.

As soon as enough wall was exposed to permit of positioning a spliced stull properly at 5-ft. centers horizontally and 9-ft. centers vertically from the other timbering in the stope, four stringers would be put in on that floor, with their outer ends carried from the pile of caved ore. Then the spliced stull, after having been toenailed together, would be rolled into position on these stringers and securely blocked in place, just as in the

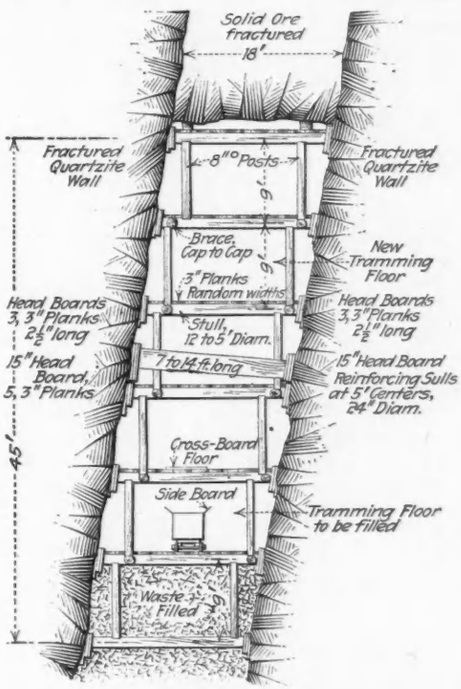

FIG. 2. CAVING WAS AVERTED BY QUICK ACTION IN PUTTING IN HEAVY STULLS WITH THICK HEADBOARDS ALONG THE CENTER OF THE STOPE

case of the catching-up stull, except that the headboard planks of the lower stulls were only 2½ ft. long—the length of headboard used in the stull caps of the stope. As soon as a stull had been got in below one above, not only would the two be braced from the stull caps adjoining, but posts would also be put in between the lower and the upper stull, so as to tie them together into a stull set and make the timbering in the cave more secure.

In this manner the vertical slice was worked down until the crossboard floor was reached. Then, as the place of the ore had been taken by a series of stull sets which were tied to the timbering of the uncaved part of the stope adjoining, and the walls were securely supported, the miners went again to the top of the cave, moved the stringers ahead a set, again carrying their outer ends on blocks from the pile of caved ore, and put in another catching-up stull, just as before. As soon as the back had been securely blocked up from this catching-up stull, which, of course, had 5-ft. headboards, as did the first catching-up stull, the miners

would begin to carry down another vertical slice across the end of the cave, timbering it as fast as they took out the ore. In this way the pile of caved ore was worked out in a series of vertical slices.

As soon as all the ore had been got out of the cave, the uncaved part of the stope on the end at which the reopening of the cave had begun was stoped across to the nearest waste raise, the 13th floor mined across the stope, and the back over the far end of the cave squared up. Then, after the far end of the cave had been lagged so as to keep the waste filling from becoming mixed with the ore when mining of the block next that end of the stope began, the tramming track of the stope was raised to the 12th floor, the crossboard lagging was put in on the 13th, the stope filled tightly with waste up to the new tramming floor, and everything made ready for the resumption of stoping, just as though there never had been a cave.

The stope that caved between Nos. 10 and 12 chutes of the 1400-ft. level had to be reopened in a somewhat different manner, as the ore had broken small in caving, and so ran easily. The vein had been stoped to a width of about 20 ft. between these chutes, and the

Stulls with 5-ft. headboards were put in at the top to catch up the back, starting at one end and working ahead and up the cave. Generally the headboards of these catching-up stulls were put in three 3-in. planks deep at each end and planks 5 ft. long were always used as headboards on the catching-up stulls. When these catching-up stulls could not be got in near enough to the back to block the ground up directly from them, sprags, and even small false sets, were stood on top of them to catch up the ground. In places where the stulls, owing to the shape of the walls, had to be placed rather far apart, bad ground between was also caught up by lacing old planks across from stull to stull.

When the top of this cave was reached, an Ingersoll-Rand tugger hoist was mounted on a 3-in. crossbar and used for "snaking" stulls and other timbers up the pile, for as soon as the near side had been caught up securely, catching-up stulls were also put in down the other side of the cave and the back at that end also made safe.

As soon as the back had been securedly caught up and the sides trimmed down carefully, the miners began at the end nearest a chute to run the ore in the pile down

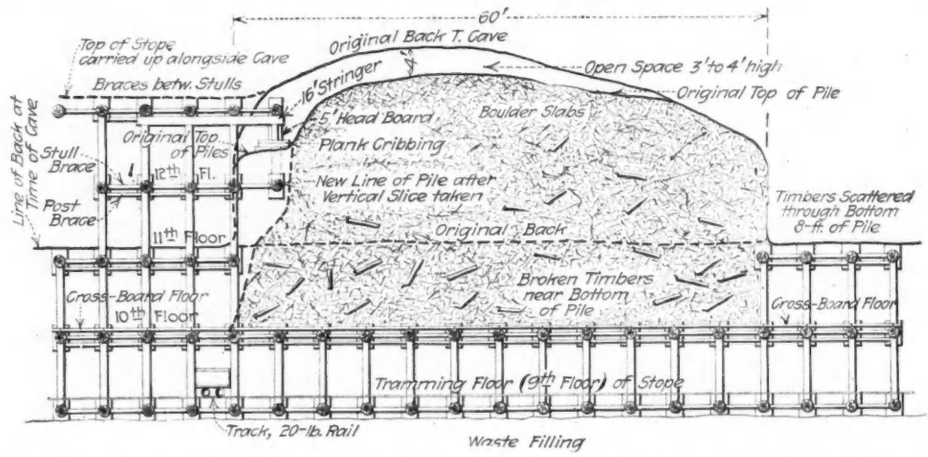

FIG. 3. LONGITUDINAL SECTION OF STOPE ABOVE 1200-FT. LEVEL THAT CAVED BETWEEN CHUTES NOS. 4 AND 6, 60 FT. LONG, 38 FT. HIGH AND 24 FT. WIDE

working carried up seven sets above the level. The tramming tracks of the stope had just been raised to the sixth floor, the crossboard lagging put in on the floor above, and the stope below filled, when the back began to cave for a length of almost 100 ft. along the vein. Stringers and helper posts were rushed in on the tramming floor, and these proved sufficient to hold that floor open. But most of the stope above was stripped of timbers, and the stull sets at the edge of the cave were smashed down at the center, even on the crossboard floor.

This cave, as shown in Fig. 4, was more than 90 ft. long and had eaten up for more than 50 ft. above the tramming track of the stope before it stopped. Throughout most of this height the cave was 20 ft. wide, but at the top the vein was only 7 or 8 ft. wide. The ore had broken fine in caving and had run down at the ends at a fairly low angle of repose. As the stope had arched itself in the plane of the vein, and an open space from 5 to 7 ft. high had been left between the back and the top of the caved pile, it was easy to enter the cave from either end after the ground had become quiet.

at its angle of repose through the crossboards into a car, and then trammed it to the nearest chute practically without any shoveling. In this way the pile of caved ore was removed, and the walls were supported with spliced stulls as soon as enough wall was exposed for placing these permanent stulls at 5-ft. centers horizontally, and 9-ft. centers vertically, from the timbering in the uncaved part of the stope adjoining.

The stope being 20 ft. wide, these stulls had to be spliced. First a stull 16 ft. long was blocked up into proper position on the pile of caved ore, and then a butt-block stull 4 ft. long was put in to splice it out across the stope. Headboards 2½ ft. long and of the usual thickness were put in at each end between the spliced stull and the ground, and, in order to enable these stulls to carry top weight better, they were put in a little high at the splices.

As fast as the stulls were got in they were braced sideways from the nearest stull on the same floor both at their ends and at the splice, and as soon as a stull had been put in under one above, posts were stood under the splices as well as under the ends of the stulls, so as to tie the timbering together securely into stull

sets, and these posts, in their turn, were also braced sideways from one another, so that if a boulder should roll down the stope it would not knock out a post.

As rapidly as the pile of caved ore was worked back at the bottom, and stull caps that had been crushed down at the center were uncovered on the crossboard floor, new spliced stulls were put in over them, blocking the splice up from the crushed-down stull at the same time that posts were put in both at the ends and over the splice to tie the new stulls to the stull cap above so as to form new stull sets. By the time five or six of these new spliced stull caps had been got in on the crossboard floor, the walls had pinched the stull caps on the different floors above sufficiently into their headboards for the old crushed-down stull caps of the crossboard floor to be taken out with perfect safety. Of course, as soon as the crushed-down stull caps, some of which were 18 in. low at the center, were taken out, posts were stood under the new caps, both at their ends and under the splices. This leaving of the crushed-down stull caps in until the ground had nipped the spliced stull sets above securely into their headboards was much better practice than to have taken out the crushed-down stull caps as fast as they were uncovered.

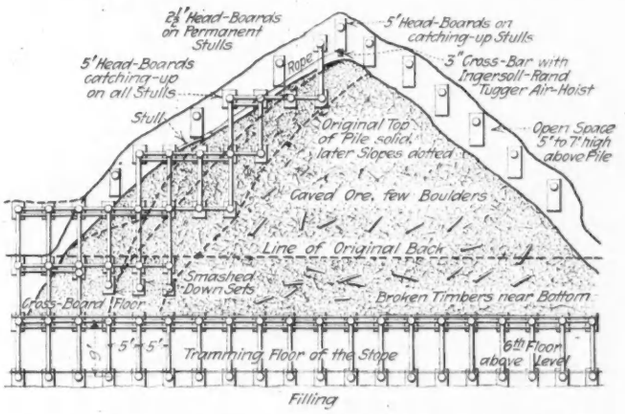

FIG. 4. LONGITUDINAL SECTION OF STOPE ABOVE THE 1400-FT. LEVEL THAT CAVED FOR A LENGTH OF 90 FT., BETWEEN CHUTES NOS. 10 AND 12. THIS CAVE WAS 55 FT. HIGH AND 20 FT. WIDE

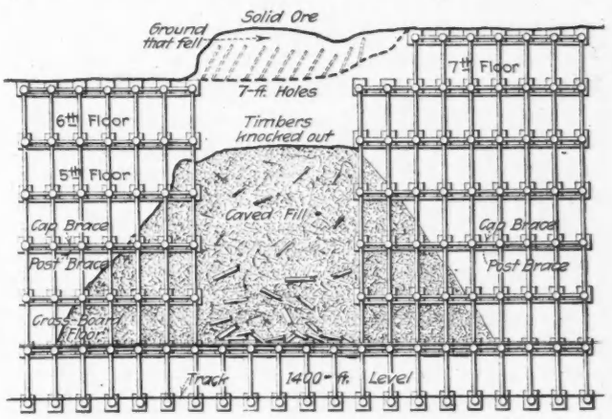

FIG. 5. LONGITUDINAL SECTION OF STOPE ABOVE 1400-FT. LEVEL THAT CAVED FOR A LENGTH OF 30 FT., A WIDTH OF 32 FT. AND A HEIGHT OF 50 FT. BETWEEN CHUTES NOS. 30 AND 32

In this way, as fast as the ore was drawn down at its angle of repose into cars on the tramming track of the stope, and taken to the nearest chute to be sent to the level, new stull caps were put in to support the walls, and then as soon as they could be, these stull caps were tied to those above, and to the side, with posts and braces to form a series of stull sets.

When all the ore had been got out of the cave, and the working had been timbered securely, stoping was resumed at the end that was nearest to a waste raise, and the different floors were carried through to this waste raise and manway. Often, when that had been done, the tramming track of the stope was raised to next to the top floor, the crossboard lagging put in on the top floor, and the floors below the tramming track were filled tightly with waste in preparation for resumption of stoping.

Before filling the stope, the little ore that had been exposed in the walls by the slabbing resulting from the caving of the working was drilled, either with a stoper or a Jackhamer, and shot out carefully with a minimum of dynamite. Generally so little ground had to be taken out in mining this ore that blocking could be used to fill in behind the headboards of the stull sets, but occasionally so much ground had to be shot out in getting the ore that a new butt stull had to be put in. Fortunately, owing to the way in which both the stull caps and the posts are braced from one another in the Hecla stull-set system of timbering, there was little possibility of the timbers collapsing when the ground was shot out, and it is just to prevent that possibility that both the posts and the stull caps are so securely tied to one another by collar braces. Of course, the ore could have been shot out of the walls while working the ore out of the cave, but waiting until the stope is all caught up and everything is ready for filling, before the ore is shot out of the walls, is much better practice, as there is then much less danger of starting the stope to caving again.

Another cave, if such it may be called, that presented a somewhat different problem, occurred in the stope between Nos. 30 and 32 chutes on the 1400-ft. level. The stope had been carried up six floors, but as the mine was temporarily short of waste filling, the seventh floor was being worked out. At that time only drilling was being done by the miners, and the blasting of the holes was left for a special crew to do after the night shift had left the mine. As a result, often 100 holes would have to be blasted at a time in one stope. In this particular stope about 60 holes 7 ft. deep had been drilled in the back, and were ready for blasting. The ground, although breaking well, required considerable dynamite to break the holes to bottom, and the blasting crew loaded the holes a little heavier than usual. As a consequence the holes not only broke to bottom, but, going all at one time, they shook the back so badly that a block of ground about 6 ft. deeper than had been drilled fell out of the top of the stope. The back was thus several feet higher than the seventh floor, as can be seen by referring to Fig. 5, though, as there had been considerable muck on the different floors at the time the holes were blasted, the pile of broken ore in the stope came almost up to the fifth floor. This pile of broken ore gave excellent support to the walls and probably prevented a more serious cave, as this great mass of ore, falling all at one time, had stripped

the stope of timbering down to the crossboard floor.

When the shift came on in the morning the bosses found a stope, 32 ft. wide, stripped of timbers to a height of about 55 ft. and for a distance of 30 ft. along the vein. Both back and walls appeared to be strong.

The plan adopted for catching up the back was to build a trussed structure of spliced stulls 16 ft. long across the top of the stope. Then, after the back had been caught up by bulkheads from this truss, the ore was to be drawn out of the stope, and waste filling run in without putting in additional timbers to hold the walls. In Figs. 6 and 7, which are sections through the top of this stope, the method that was used in building the truss is shown.

Putting in the truss to catch up the back was not such a simple operation as might appear from the drawings. Stringers were laid lengthwise with the stope. At the cave end they rested on the pile, but at the stope end they were carried by the stope timbers. The stringers, which were 16 ft. long, were round timbers slabbed off

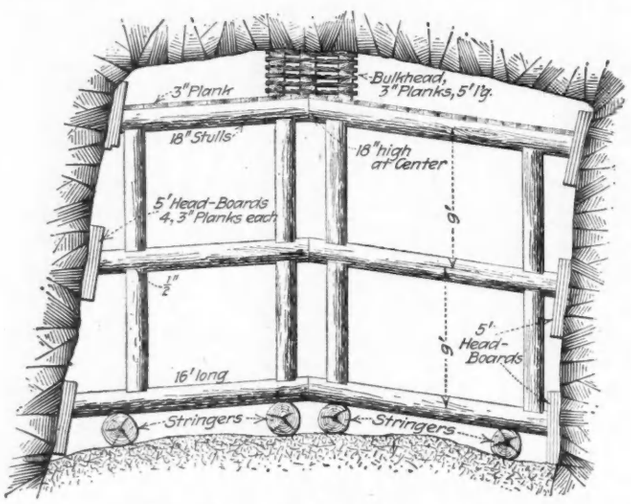

FIG. 6. THE BACK IS CAUGHT UP BY A TRUSSWORK OF SPLICED STULLS SUPPORTED ON STRINGERS BELOW AND BY DEEP BANKS AT HEADBOARDS AT THEIR ENDS

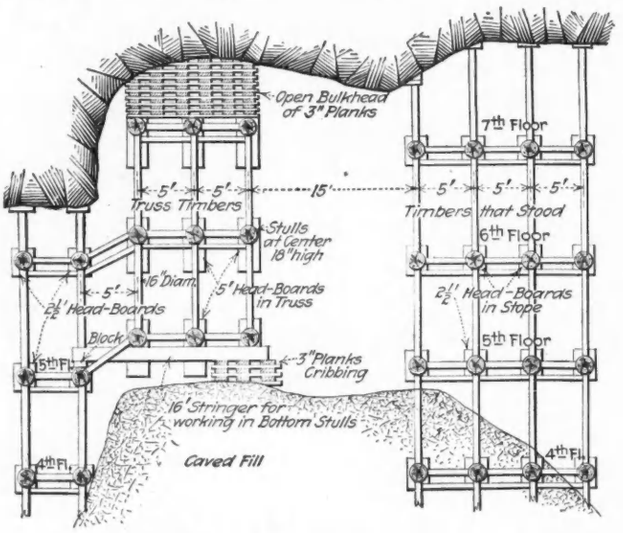

FIG. 7. AT THE TOP OF THE CAVED FILL THE TRUSSWORK OF SPLICED STULLS IS SUPPORTED ON CRIBBED PLANK, WHICH ALSO CATCH UP THE BACK ALONG THE TRUSS RIDGE

on their top and under sides, put in to carry the stulls that were to be trussed together to support the roof. To enable the stulls to carry a considerable top weight, they were put in about 18 in. higher at the center than at the walls.

The four stringers which were to carry the bottom trusses of the structure were therefore put in so that the outer ends of the stulls of the trusses came level with the stull caps of the stope, and the inner ends where the stulls butted against one another were raised about 18 in. higher than the outer or wall ends. This required that the stope ends of the stringers which were next the walls should be carried from false posts, so that they came just under the stull caps, and in order to keep them from moving while the stulls of the trusses were being rolled out on them, these stringers were wedged down securely on the posts from the stull cap above. The stope ends of the two stringers that were to carry the center or spliced ends of the trussed stulls were blocked up from the top of the stull cap, and posts were put in on top of them, so as also to wedge them securely in place, in order to prevent their moving while the trusses were being positioned upon them.

As soon as the stringers had been blocked securely into position at their stope ends, and their outer ends had been blocked up from the pile of caved ore to the proper heights, three stulls were rolled out upon each pair of stringers and positioned at 5-ft. centers from one another and the stull caps of the stope. These stulls, 16 ft. long, were butted against one another and then made ready for blocking in place by putting headboards made up of 3-in. planks, three deep and 5 ft. long, between them and the walls. But until the whole structure was in place, the wedges of the headboards were driven just tight enough to keep the timbers from moving out of position, as if they were driven tighter the stulls would ride on one another at the center.

As soon as these three pairs of trussed stulls had been put in, posts were stood on them in daps cut about ½ in. deep, a post being stood at each end of each of the stulls of the three trusses. Then, on top of these posts, stulls with daps cut in them at the proper points were placed so as to form a second series of trusses across the stope, with headboards 5 ft. long put in between them and the walls, and the wedges again driven just tight enough to hold the trusses in position. As soon as these upper trusses were in, both the stulls and the posts were braced girtways from one another and from the timbering of the stope, so as to prevent the trusses from swinging sideways. This having been done, posts were again stood upon these stulls in properly positioned daps, and stulls for another series of trusses lifted on top of them. Headboards, 5-ft. long and made up of 3-in. planks three deep, were put in between them and the walls, with the wedges again driven just tight enough to hold the trusses in position. In this way, as shown in Figs. 6 and 7, a trussed structure three sets long and three sets high had been erected across the top of the stope. But before the structure could be blocked into place, a cribbed bulkhead had to be built along the top of the structure to catch up the back and keep the stulls from riding on top of one another at the splices when the structure was blocked from the walls.

The top trusses were therefore lagged with 3-in.

planks, and a cribbed bulkhead was built along the ridge of the truss to catch up the back as well as to hold the trusses down and prevent the spliced stulls from riding on one another when they were being blocked in place. Three-inch planks were used in building this bulkhead, because they could be put in place much more easily and cheaply than larger timbers, even if many more of them had to be used, and because, when stoping was resumed, the planks could be used for flooring in the stope. These planks were 5 ft. long, and three planks were used to each course of the bulkhead, one at each end and one at the center. One of these cribbed bulkheads was built at each end of the structure, butting the planks of each bulkhead against the planks of the other over the center truss.

Blocking the Trussed Structure in Place

When everything was ready, men were stationed at different points in the trussed structure so that the wedges in the bulkheads and the various headboards could all be driven home at the same time, as otherwise the stulls of the trusses would begin to ride on one another while the wedges in the different headboards were being driven, and the whole structure would become distorted, and would then have lost much of its strength. A man was stationed on each side of the two bulkheads that had been erected on top of the trusses, and a man placed at each of the headboards of each of the three trusses upon the three floors of the structures, so that it required 11 men to drive wedges and one man to watch while the timbers were being blocked in place. Then while the wedges in the bulkheads and in the various headboards were slowly and carefully driven home, the man in charge of the work watched the various trusses closely so as to keep any of the trusses from being tightened faster than the others. In this way the several trusses were seated firmly against their headboards without developing tendency to ride at the splices, and the back over the structure was keyed into position.

As soon as this first trussed structure had been completed, another was built, two sets wide, to catch up the rest of the back over the top of the cave, and to tie the first structure to the timbering of the uncaved part of the stope on the other side. Then, when a bulkhead had been built on top of the second truss, and the structure securely wedged in place by driving the wedges of the different headboards and the bulkhead home at the same time, the back was carefully picked down and caught up with sprags and blocking from these trusses wherever it was weak.

When the back had been made secure in this manner drawing of the ore from under these trusses through the crossboards into cars on the stope track below began. As the ore was withdrawn, close watch was kept of the trusses to see how they were taking the weight, and the walls were carefully picked down as fast as they were exposed. In this way the ore was drawn out of the stope without accident and with little shoveling.

As soon as all the ore had been got out of the stope, the tramming track was raised to the fifth floor of the stope, waste brought in from the nearest waste raise, and the stope below the fifth floor tightly filled. Then, when crossboards had been put in on the sixth floor, mining of the seventh floor was resumed.

(To be continued.)

The Gulf Coast Domes in Relation To the Sulphur Supply

By Kirby Thomas*

The geological history of the "dome" phenomena peculiar to the Gulf Coastal Plain of Texas and Louisiana and of a small portion of the shore of the Mexican Gulf is a subject of controversy, but certain facts of economic importance are generally admitted. The increasing demand for sulphur for industrial and war purposes justifies greater attention to these domes than has heretofore been accorded them.

Two of the most important sulphur deposits in the country are directly associated with these dome formations. One, worked by the Union Sulphur Co. in Calcasieu Parish, La., has been yielding extensively for more than 10 years, and the other, at the Freeport sulphur mine, at Bryan Heights, Tex., at the mouth of the Brazoria River, has more recently become a producer. There are known in the region upward of 50 domes, more or less defined. Many have been drilled for oil, and in most cases some sulphur has been found, but so far no public record has been made of any deposits as rich or as extensive as the two properties mentioned.

Some of the domes, as at Spindle Top, Sour Lake and Humble, in Texas, have been practically sieved in exploring for oil. It is possible that in some instances, particularly in the early drilling for oil, important sulphur bodies were encountered without being noted. But many of the domes have not been completely or systematically drilled, and some promising sulphur deposits have not been exploited, either because of market conditions or the excessive valuation placed upon them by their owners. It is entirely probable that other important deposits will be disclosed in connection with the domes, either in exploring for oil, salt or, possibly, potash, or because of the higher price and greater demand for sulphur.

The acceptance of the dome theory as applied to these deposits and the interpretation of the conditions and nature of the domes implies a limitation and localization of the individual deposits and a correspondingly short life for operation. This is contrary to the earlier idea held by some geologists, and the later "arguments" by many promoters, that these known sulphur deposits in Texas and Louisiana were of great horizontal extent and practically of unlimited tonnage possibilities. As is now known, the domes are from a few acres to a few hundred acres in extent individually, and the sulphur is definitely confined within the boundaries of the dome structures and is not continuous within the boundaries, but varies greatly in amount and availability in different domes.

Lost time in the Bunker Hill & Sullivan mill at Kellogg, Idaho, during 1917, totaled nine days, distributed by causes as follows: Oiling motors, 36 hours; screens, elevators and rolls, 25 hours; holidays and miners' picnic, 92 hours; pumps and power off, 15 hours; Hardinge mill, 1 hour; classifiers, 5 hours; belts, conveyors and shafting, 6 hours; slush ice, 6 hours; general repairs, 15 hours; transmission rope, 12 hours; and high water, 3 hours. During the year 493,030 tons of ore was concentrated, making the average work of the concentrators 1385 tons per 24 hours of actual operation.

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Notes on Shaft Relining With Concrete

By G. G. STONEMARK*

Shafts "A" and "C" at the Tener Mine, Chisholm, Minn., were relined with concrete, two methods being employed in sending the concrete down from the shaft collars. At "A" shaft, the mixture was dropped 300 ft. through a 4-in. pipe; at "C" a specially made car was filled with the concrete and lowered on the cage. Steel panel sections were used as forms when concrete was poured.

IN AMERICAN mining methods, permanent lining of shafts with concrete has established a procedure of maintaining the alignment with permanent stability and for fire-resisting qualities, and the development of concrete shaft lining has been rapid and progressive. In Europe, brick, steel and cast-iron linings are common, and there is a scattering of concrete linings of unit construction. The influence which concrete lining has exerted upon the design and upon the problem of choosing a shape has made it unnecessary for the engineer to adopt the cross-section to limitations imposed by rigidity of lining material, and the thickness of the lining and reinforcement can be varied to meet local conditions of changeable stresses.

Profile of Shaft Timber Determined by Plumbing Methods

In most shafts constructed of timber, unless the conditions are unfavorable to the fungus growth which causes rot, the sustaining power is so diminished as to force the original alignment out of plumb. To reëstablish this, some means of determining with approximate accuracy the position of the shaft must be resorted to, and the most efficient way I know of is by the use of line and plumb bob, similar to the method used in plumbing a shaft to establish lines underground. Four lines are essential, one in each corner, or as nearly so as possible, that they may hang free and be placed in reference to a proposed or actual axis of the shaft. The next step will be to determine the profile of the shaft timber by measuring the distance down from the collar of the shaft as a base vertically, and the distance from each wire to each end piece and wall plate. These points, plotted in four planes, will determine the inclination and an accurate condition as to the alignment of the existing timbers. Where a careful alignment was made when the sinking operations were in progress, it may be a simple matter to determine the original alignment, because of the fact that part of the old timber still remains in its original position or a portion of some section may be in such condition as to hold its original alignment

Permanent Lines Necessary to Exact Alignment

The plotted points representing these timbers will show themselves on the profile by their parallel to the plumb line, but, should this not be the case, an average can be plotted so as to conform with the headframe, so that a small movement either way from the original axis of the shaft is negligible, both from a standpoint of excavating new ground or that of moving or shifting the sheave wheel to conform to the new alignment. Of course, judgment is necessary as to what amount of shifting is possible.

Having determined the alignment by placing the plumb lines with respect to the proposed or original alignment, it becomes necessary to make the lines permanent, so that the placing of the concrete forms can be done with accuracy. For retaining the lines in the shaft diagonals, sprags can be nailed across the end piece and wall plate, and a nail or spud driven directly in the plumb line and at distances about 40 to 50 ft. apart. Then when one spud is destroyed by the removal of the old timbers in the lining operation, it will only be necessary to go to the one higher up and hang the plumb line. These lines should always be referenced on surface in some manner, because when the operation of lining approaches the surface, somewhere near the top there will always be more or less settlement of the timber remaining, and one can therefore reset new lines with little trouble.

Methods of Lining Two Minnesota Shafts

The following methods were used in lining with concrete the Tener shafts "A" and "C" of the Oliver Iron Mining Co., at Chisholm, Minn. The headframe at "C" shaft, Tener mine, is higher than usual above the collar and higher also than is general practice on the Mesabi range, and has an ore pocket of ample dimensions. Inside of the pocket was built a temporary partition, dividing it so that sand could be placed in one-third of the space and the remainder allowed for rock. The cement was stored in a temporary shed constructed in the framework beneath the pocket, but was placed at an elevation over the mixer. The loading track was next moved as near as possible to the headframe, an opening between the rails excavated, and a launder used as a chute was built to extend down to the nearest compartment of the shaft. This compartment was bulkheaded and boarded up to form a skip pit, having an opening over the wall plate and with the end of the launder chute extending through.

All the aggregate was loaded in ore cars, so that it was an easy matter to dump the contents into the launder, from which it could be drawn off into the skip and hoisted in the same manner as ore. A temporary hoist was installed for this purpose, because the other hoisting engine consisted of a single drum and was used to hoist the cage in the other compartments. If sand was to be hoisted, it would be dumped directly from the skip into the pocket. An inclined chute, built on an ordinary stock pile trestle car truck and wide enough to accommodate the full width of the skip, was used when rock was hoisted, and a skip loaded with rock dumped on this chute would simply slide across the sand compartment and into the rock compartment.

The quarter pans in the pockets were taken out, the chute was reversed, and a temporary covered chute built

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to hold the different aggregates which led down to the measuring hopper. This hopper was situated over the mixer and on the same level as the shed for the storage of cement. Each chute was provided with a quarter pan, so that the workmen could run out the required amount of the different aggregates. Two workmen were stationed here to fill the measuring hopper and another workman whose function it was to open the cement sacks, pour them into the measuring hopper, trip the outlet and chute it down to the mixer. Two men were stationed on the mixer floor to look after the water and dump the mixer into a specially made car, which was placed on the cage and lowered to the forms below. When the pouring was completed, the car was taken off and the cage used to hoist all material taken out of the shaft, such as old timbers and lagging, and also for lowering and hoisting the men.

No Time Gained in Sending Concrete Through a Pipe for Short Distances

Before the work was started, I thought probably that the method of dropping the concrete through a pipe would be speedier. If the depth had been greater, this might have been so, but not in this instance, because, comparing the working time with that consumed at "A" shaft, in which all concrete was dropped through a pipe for a depth of 250 to 300 ft., the time taken to lower 45 to 50 batches at "C" averaged 3½ to 4 hr., the same as at "A." On timing several batches sent down 250 ft., it took on an average of 2½ to 3 min., with less time for shorter distances.

Elbow Used to Stop Force of Concrete Dropped Through a Pipe

Comparing the two methods of conveying the concrete from the collar to the forms below, certain conditions will have to be met successfully, such as stopping the concrete when it is dropped through the pipe. At "A" shaft, where all the concrete was dropped through a 4-in. pipe, a hopper built at the top of the pipe at the collar conveyed the concrete to the pipe from the surface car. At the bottom of the pipe, in order to convey the concrete to the car on the cage, and regulate the flow, a long sweep elbow was screwed to the column pipe. This elbow reduced the force of the rush of concrete to a medium flow, but so quickly did the concrete wear a hole through the elbow that it had to be replaced at every pouring, and finally an extra heavy cast-steel elbow, with a short piece of pipe screwed on, was tried, with better success.

In depositing the concrete in the forms, essentially the same methods were used in both shafts. The door at the bottom of the hopper-shaped car on the cage was opened, and the concrete flowed through a hole in the cage floor into a section of a funnel-shaped pipe. This pipe had an opening about 18 in. in diameter at the top, tapered with a slight curve, and was reduced in section to about 8 in. at the other end, so as to fit a light steel pipe having lengths of 1, 2 and 4 ft., and so made as to telescope into each other by means of a pair of eyes riveted at one end and a pair of hooks at the other. This arrangement made a flexible pipe that would reach any part of the forms and in almost any position desired for depositing concrete.

Among the difficulties encountered in dropping concrete through a pipe is the liability to clog, for care is not always taken to see that all large stones are removed. Several times during the pouring in "A" shaft, the column pipes had to be disconnected to determine where the clog was situated, and it was necessary to hammer the pipe until the concrete was loosened, in which case all the material remaining in the pipe was wasted.

Six Men Per Shift Lower and Distribute Concrete

At "C" shaft all the concrete was lowered with the cage, using the same car as employed at "A," down to a sill placed across the shaft on the wall plates for each consecutive pouring. The same flexible pipe was used to distribute the concrete to any part of the forms. A shaftman, stationed on a platform built level with the sills, opened the door of the hopper-shaped car as soon as the cage came to rest on the sills, and it was a matter of a few seconds for the contents of the car to flow out. The cage was then hoisted to the surface, where another batch was in the mixer and ready to be dumped into the car. The process continued until a form was completely poured. The men knew their respective duties, and became more proficient as the work continued, so that extra help was not necessary. Of the six men employed, including the foreman for each shift, three were generally required in the shaft and the other three at the surface, although an additional man was always at the shaft to look after the odds and ends and to run the mixer when concreting was being done.

Manner of Placing First Form at Shaft Bottom

If the lining is to start at the bottom of the shaft and the lines, surface plant, and all else is in readiness, the shaftmen first clean the bottom of the shaft of all dirt and remove all the old lining sets for 10 ft. or more, depending on conditions. If the bottom is in rock, no bearers will be required, but if not, hitches must be cut in the sides of the shaft to permit the placing of steel bearers, the length of which depends on the size of the shaft. These hitches should be at least from 1 to 1½ ft. deeper than the bottom of the shaft, so that a spread footing can be secured. In order to get the full benefit of the steel used for the bearers, concrete is slushed in and reinforced with short steel rails or other rods that can always be found in the scrap pile, and placed so as to form a grillage which is built to the level required for the bearers. The first form in the shaft is built as high as the top of the bearers. This is made of plank, set carefully to line and leveled up and the bottom of the form made to fit the profile of the shaft bottom so that the concrete will not flow out. After the form is poured, it is allowed to stand for a few days, and during this time the sides of the shaft are trimmed out to the next line required for the thickness of the lining.

Wooden Forms Superseded by Steel

Until the regular forms arrived, a few sets were placed by means of wooden forms in "C" shaft, but these were found to be uneconomical. The steel forms used by the Oliver Mining Co. were panel sections of such dimensions as to be easily handled by rope and block, and made of $\frac{3}{16}$-in. plate stiffened at the edges by 2½-in. x 2½-in x $\frac{3}{16}$-in. angles. The panels varied in size, the

smallest being 6½ in. x 12 in. and the largest 2 ft. 11 in. x 5 ft. 11½ in. In all, 46 panels were required for one complete 6-ft. set, and 32 for a 4-ft. set. In forming an end lining, six panels, and for a wall plate lining eight panels, were used above the dividers and end pieces, with nine small filling panels in between the end pieces and dividers. In between the panels were placed insert keys of ½ in. x 4 in. flat steel that were made a little short of the required height of a full panel. If these keys had not been so placed, it would have been next to impossible to remove the panels. So the keys were first removed, and this gave the panel an additional space, so that all panels could readily be removed, and whenever one panel was removed in a tier, the others were simply unbolted in consecutive order.

Reinforced Concrete Dividers and End Pieces Secure Shaft Rigidity

To give the shaft line a greater stability and a means by which the skip guides could be fastened, cast concrete dividers and end pieces, reinforced by steel rods and of sufficient length to be well imbedded in the lining, were placed at intervals and the reinforcement was allowed to extend beyond the end. These end pieces and dividers also supported the steel forms in rigid alignment by means of cord holes so spaced that a bolt of short steel rod could be inserted through the angles of the forms and into the end pieces or dividers. A set of end pieces and dividers was first placed on the bearers previously set and leveled up, and the first set of forms placed and bolted together, the slab reinforcement having been previously fabricated by wiring together vertical and horizontal reinforcing rods.

Inside the shaft forms, braces made of 2 or 2½-in. pipe were placed transversely. These braces were flattened and had holes made in each end, so that when they were fastened at an angle the correct dimensions necessary to hold the forms rigid could be secured. The braces were also used to support staging planks. Another set of spacers was required to keep the end pieces and dividers in alignment, and these were made of 3-in. x 6-in. plank, armored at each end, with strap steel securely fastened and of such length as required between the end pieces and dividers. The forms were then shifted to conform with the plumb lines, and temporarily wedged to keep them in place during the pouring of the concrete. The reinforcing was held in place by a steel template fastened to the top of the forms. The lower end of the forms was tied to the rods of the preceding sets, which were cut long enough to extend 3 or 4 in. out of the concrete.

Everything being ready for the pouring of the concrete, temporary sills were laid across the shaft on a wall plate 8 to 12 ft. above and used to support a funnel-shaped spout having an 18-in. opening and slightly curved and reduced at the other end to telescope into the short section of the light steel pipe, which has been previously described. A number of shaftmen were then sent to surface to handle the mixing, and other work. The hopper-shaped car was placed on the cage, the first batch of concrete started in the mixer, and when the desired consistence of the concrete was obtained it was sent on its way to form an integral part of a lasting structural unit. Immediately after the forms were placed, the concrete was covered with planks, and the work of removing the old timber and trimming for another set of forms was begun. Removing the old timber was dangerous, and care and watchfulness were absolutely essential, for paint rock and the other materials which have little or no support are generally loose, and it seemed at times that little was required to bring down a mass of the ground.

Void Behind Shaft Lining Filled with Excavated Material

All unnecessary material was hoisted to the surface in a bucket hung underneath the cage. In case too great a space between the form and the wall was left, a back form was built, and the space filled with the excavated material. When the sides were trimmed to the required dimensions, the work for the next form was placed and lined up the same as the preceding one.

Six complete sets of forms were used in both shafts, making a section of 24 ft. of lining, and this gave sufficient time for the concrete to set and become strong enough to support the superimposed load.

Six-Foot Sets Used in Uniform Ground

During the progress of the work some unfavorable ground was encountered, and room for a 6-ft. set was impossible. In these cases, a 4-ft. set was poured, and the same method as for the 6-ft. set used. Several such cases were encountered in the "A" and "C" shafts when working the surface above the ore. At every third set, when the sets were spaced 6 ft. apart, an extra divider was inserted to support a steel solar deck, which had an opening for a ladderway. Steel ladders long enough to reach from one solar to another and bolted at the foot to the deck and stiffened by struts fastened to the wall were used. These ladders are made of 1½-in. x 1½-in. x ¼-in. angles, using ¾-in. pipe spaced 12 in. on centers for rungs.

The table shows the comparison in progress made at "A" and "C" shafts:

PROGRESS MADE AT "A" AND "C" SHAFTS, TENER MINE, CHISHOLM, MINN.

	"A" Shaft	"C" Shaft
Number of weeks worked.....	18	19
Average progress per week, ft..	16½	15½
Average progress per month, ft..	75	68
Greatest progress per week, ft..	30	48
Greatest progress per month, ft..	112	132
Depth of concrete, ft.....	304	292

At "A" shaft, column openings were made at the pump station and at the level. At "C," a skip tender's drift and small pump station were concreted; also column openings for two levels. In both shafts, concrete covered I-beams were used, 15-in. beams for columns and 12-in. beams for caps.

Steam Shovels could be used to mine brown coal at a low cost at Morewell, Australia, where there are extensive deposits, writes Consul General Brittain from Sidney. The veins are said to run from 150 to 200 ft. in thickness. It is claimed that motor spirit, benzine, illuminating oil, paraffin, and other byproducts could be profitably extracted. At present it costs about $1.92 per ton to mine the coal, but an American interested in machinery is endeavoring to place steam shovels at the disposal of the coal company, with which, he claims, the coal could be mined at $0.12 per ton by stripping the surface soil and taking the coal out direct with the shovels.

Belt Concentrators and Wet Concentration

BY ALEX. McLAREN*

The prevailing tendency in the use of the riffled table in place of the belt concentrator or vanner is not always based upon a consideration of the limitations of either type. The author describes the work for which each type is best suited, and advocates the return to the use of the vanner for the treatment of unclassified or fine pulps and for pulps in which specific gravity difference between gangue and concentrate particles is small.

IN RECENT years there has been a marked tendency to use riffled tables for all purposes and kinds of wet concentration, and to abandon the use of vanning machines. In some cases, riffled tables may have been chosen because of their comparative simplicity and large capacity and frequently because tables of the same type had been used in similar positions in other mills. But there has been in instances too little consideration given to the special requirements of the particular case in hand. The first requisite for wet concentration is a pronounced difference in the specific gravity of the metalliferous mineral and the gangue in which it occurs. The second requisite for satisfactory separation by means of tables is that every particle of metalliferous concentrate must have sufficient mass to facilitate its movement along the table riffles and to prevent it from being washed sidewise over the riffles by a water stream of sufficient force to move every particle of gangue (in the same pulp) over the riffles and to waste.

The second requirement referred to takes into account both the difference in specific gravity of the concentrate and of the gangue, and the "settling coefficients" of the individual particles of each. These "settling coefficients" determine the resistance to stream flow of particles of different specific gravities, or of different sizes and shapes but of equal specific gravities. More exactly, the "settling coefficient" may be said to express the resultant of existing conditions, as shown by the rate of settling of the particle under observation. The rate of settling will equal the rate of vertical flow required to hold the particle in suspension, and it becomes a factor in any expression of stream flow required to move the particle in any direction.

SPECIFIC GRAVITY DIFFERENCE AND MASS NECESSARY

It seems unnecessary to state that the metalliferous concentrate must have a specific gravity greater than that of the gangue to cause it to settle beneath the gangue on the table, and that its particles must have sufficient mass to cause them to travel along the table and to hold them to the table while the heaviest grains of gangue are being washed away. But is the latter point sufficiently considered when a riffled table is specified to handle a mixed feed containing all sizes and shapes of grains, or unclassified material containing slimes that have not sufficient mass in their individual particles to move along a table?

The vital difference between riffled tables and vanning machines is in the method of recovering the concentrates after they have been settled and roughly separated from the gangue. The former depends for its action upon the inertia of the concentrates to cause them to travel along a fixed practically horizontal surface by successively jerking this surface from under them, while a stream of water washes transversely across the direction of this motion, over the settled concentrates, and carries away the barren gangue. The vanning machine is equipped with a traveling belt, upon which the concentrates are settled and on which they lie in fixed contact, while the traveling surface is slowly moved uphill, beneath the gradual flow of the pulp feed. The settled concentrates, both because of their weight and because of their stability upon the moving surface, are carried to the concentrate discharge. The belt-surface may be practically smooth or it may be ribbed or pitted so as to increase this stability.

TREATMENT OF GRANULAR PARTICLES AND PARTICLES OF SMALL SPECIFIC GRAVITY DIFFERENCES

An ore in which the metalliferous particles occur in coarse grains, so that a truly granular structure is maintained after crushing, and where the grains are considerably heavier than the grains of gangue material of equal size, can be treated with high efficiency on riffled tables having the proper design and adjustment. An ore in which there is only a slight difference between the specific gravity of the concentrate and that of the gangue, or one in which the metallics occur in exceedingly fine particles, or in which a considerable portion crushes into fine particles, presents a different case. The resistance of the fine particles to stream flow is less than that of coarser particles of lower specific gravity. In order that these particles may travel along a reciprocating deck, they must be in partial suspension at least during each forward move. In order that suspension might be maintained at a minimum, even glass tops have been tried, with indifferent success. The principle remains, and the grains of concentrate must be of considerable weight and size in order to make a satisfactory recovery on this type of machine.

The ordinary vanner separates and settles the heavier material onto a moving surface of rubber, canvas or similar material, and the settled concentrates remain in contact with this moving surface and move practically in unison with it until drawn up over the head end and finally washed off in the concentrate box, in which the belt is immersed in an inverted position. The weight of the particle is made use of only to secure its settling and separation from the lighter gangue particles and to hold it in contact with the belt from the moment it touches it until it is saved in the concentrate box. The lighter gangue particles, by the constant motion of the machine, are kept more or less in suspension, and naturally float downhill to waste. It is true that the larger heavier particles will settle more quickly than the smaller, lighter particles, but the length of the machine

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and the adjustment of its slope are such that even the lightest particle that it is desired to save is given time to settle on the belt, and, once settled, it is saved.

The above description applies particularly to an unclassified feed from which it is especially desirable to save the finest values. The coarse, rich material can be saved readily. It is the fines in which the serious loss is likely to occur. But even after having saved the richer concentrates, both coarse and fine, there remains a middling product composed of chemical compounds of lower specific gravity, or of grains containing both heavy and light minerals. The riffled table usually makes such a product, which is discharged separately from the concentrates and tailings. What is to be done with this product? Obviously, the grains consisting of both concentrates and gangue must be ground finer and reconcentrated. This means practically a "slime" treatment to insure a high recovery.

Experimental Investigations

I made investigations to determine whether the tables in the mill that I was operating were actually saving all of the concentrates worth saving in the fine unclassified mill feed, and to determine whether the vanner could save fine rich mineral that the table could not save from the same feed. The material was a silver-gold ore and not amenable to satisfactory concentration. The results, therefore, illustrate the principle more clearly than would have been the case with an ore in which all the concentrates were heavy and crystalline. The ore was crushed through a 30-mesh burred slot screen, passed over amalgamating plates and then to riffled tables, adjusted, and riffled to secure the best results. The entire tailings and wash water from the tables were thickened in dewatering cones (not classifiers) to a pulp of four parts of water to one part of ore (by weight). This was then delivered to standard Senn panning-motion vanners. The results of the test appear in Tables I and II.

TABLE I. SCREEN ANALYSIS OF PULP AND CONCENTRATES

Mesh	To Tables Per Cent.	Table Concentrates Per Cent.	Senn Concentrates Per Cent.
+ 40	16.15	8.67	3.70
+ 60	24.08	22.63	1.81
+ 80	11.28	5.44	0.55
+100	10.28	12.14	1.59
+150	5.73	7.89	0.91
+200	9.51	14.40	8.45
—200	22.06	26.07	79.08
Loss screening	0.91	2.76	3.92

TABLE II. ASSAYS OF TABLE CONCENTRATES

		Au, Oz.	Ag, Oz.	Total per Ton (a)
Product as made		1.56	284.36	$273.96
Product + 200 mesh		1.10	146.42	147.21
Product — 200 mesh		6.20	1,688.50	1,561.77
Senn Concentrates				
Product as made		0.86	143.82	$140.03
Product + 200 mesh		0.62	122.22	116.70
Product — 200 mesh		1.02	147.94	146.80
Product, Concentrates Made on Tables				
Sp.gr.	3.00			
Tons (concentrates)	0.44			
Oz. Ag per ton	396.19—(175.12 oz. at 85c.		$148.85)	
Oz. Au per ton	2.57—(1.136 oz. at $20.67		23.48)	
				$172.33
Product, Concentrates of Senn				
Sp.gr.	2.67			
Tons (concentrates)	0.60			
Oz. Ag per ton	141.40—(84.82 oz. at 85c.		$72.10)	
Oz. Au per ton	1.18—(0.708 oz. at $20.67		14.62)	
				$86.73

$86.73 is 50.3% of $172.33.
(a) Silver at 85c. per ounce.

The investigations show that the tables are saving a satisfactory concentrate, and that they are saving the richest of the fine material, but the amount and value of concentrates made by the Senn vanners out of the table tailings are equivalent to one-half the total value of the table concentrates.

The screen analyses show that the minus 200-mesh concentrates made by the vanners are of practically the same value per ton as the average of all the plus 200-mesh concentrates made by the tables, and these minus 200-mesh concentrates are 79% of the total weight of the vanner concentrates. The minus 200-mesh particles did not have sufficient mass to move along the table deck and, at the same time, to escape the wash water. The richest of the fine material was saved on the vanners. It requires little argument to prove that tables in the above case were not the best selection for the maximum saving unless followed by vanners. But why not use the vanner for the entire treatment?

In spite of the many tables that have been given the name of "slime table" and of claims that have been made of high recoveries of fine concentrates on riffled tables, the practice is questionable. The tests quoted show that tables can recover fine material if it is sufficiently clean. That it must also be granular may be taken for granted. The vanner is not out of date, and it continues to be one of the best appliances for handling unclassified or fine feeds, or feeds in which there is only a small difference in specific gravity between the particles of concentrate and gangue. It can recover the medium-grade slime concentrates as well as the rich concentrates and the coarser granular material.

"Platino," a Platinum Substitute

Various tests were made on "Platino," an alloy made by Drijfhout & Son in Amsterdam, says L. B. van der Marck in *Pharm. Weekblad* 55, 149-51, 1918 (Chem. Abstr. May 20, 1918). It is made of 11% Pt and 89% Au approximately. It showed no loss in weight after 20 minutes' treatment each with 25% HCl, 65% HNO_3, 96% H_2SO_4 and fused $Na_2B_4O_7$; after 15 minutes with a fused mixture of K_2CO_3 and Na_2CO_3; nor after evaporation of 10 c.c. of HF. A dish weighing 41 grams lost 1 mg. with fused $KHSO_4$ and 0.2 mg. with fused KNO_3 (20 minutes each); 7 mg. with fused KOH (15 minutes), and 20 mg. with a mixture of 96% H_2SO_4 and 2% HNO_3 (5 minutes). It was unaffected by heating one-half hour in a smoky petroleum gas flame. Except for the high loss in a H_2SO_4-HNO_3 mixture, it is equal or superior to platinum ware.

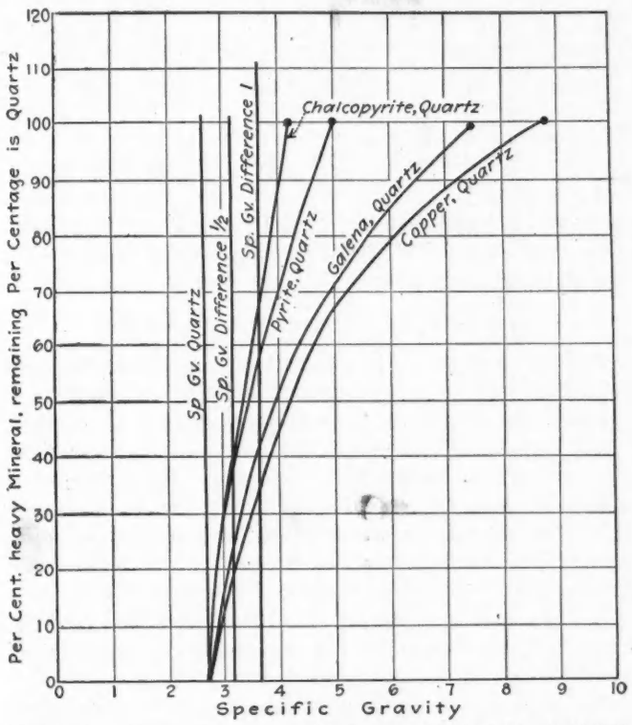
Pyrites in Huelva, Spain

The Province of Huelva, Spain, is the greatest producer of pyrites in the world. There still exists, according to the calculations of mining experts, says *Commerce Reports*, about 250,000,000 tons, of which the present exportation is about 3,000,000 tons per annum. In normal times the United States takes 1,000,000 tons; in 1917 the tonnage reached was 755,991 only, from the following mines: Rio Tinto, Tharsis, and Esperanza (British), 614,317 tons; Perrunal and San Platon (French), 122,091 tons; and La Joya (Spanish), 19,583 tons.

Remember the Comfort Fund of the 27th Engineers.

Middlings

In the wet concentration of ores the term middlings is applied to a crushed product the individual grains of which are composite; that is, they contain, attached to or imbedded in the gangue, particles of valuable mineral. Theoretically no free grains of valuable mineral are present, but practically there will always be a varying proportion of such grains. This proportion will depend upon the efficiency of the separating machine and upon the care and skill of the operators. The crushed product of practically all ores, even though crushing be carried to an extreme, will contain middlings, the proportion being dependent upon the degree of crushing and the nature of the association of the valuable mineral with the gangue. If crushing is carried out to a limited degree, a large proportion of middlings product is to be expected from ores wherein the valuable mineral is finely disseminated. In graded crushing and stage concentration, it is expected that middlings products will be made at each step in the separation. Stage concentration presupposes the separation and rejection of clean tailings whenever possible, but the middlings product is retained for further crushing and separation if the recovery made is greater than the cost.



SPECIFIC GRAVITY OF COMPOSITE MINERAL GRAINS

Very little discussion of the subject of middlings separation has appeared, although every millman and mill superintendent has had to contend with the problem. The separation of free mineral grains where the difference in specific gravity between the heavy and the gangue mineral exceeds two or more points can be readily effected, but the question of the feasibility of separation when the specific gravity difference is less than this limit is an open one. What should be the specific gravity difference for separation by wet-concentration appliances? This question cannot be answered definitely. In a general way it can be stated that a specific gravity difference of at least one is desirable and that where the difference is less than one the separation is apt to be indifferent.

Disregarding the question of the size and shape of the mineral particles, and considering only specific gravity, the question arises: What is the specific gravity of the composite particles (middlings)? The specific gravity of composite mineral particles can be determined directly by the specific gravity balance, or by calculation from the mineralogical analysis. A simple formula for a composite of two minerals is: A = sp.gr. (1) mineral; B = sp.gr. (2) mineral; C = % of (1) mineral; D = % of (2) mineral;

$$\text{Sp.gr. of composite grain} = \frac{100AB}{AD + BC}$$

From the formula, the accompanying chart has been constructed for several heavy minerals associated with quartz. On the chart, three vertical lines have been placed, one indicating the specific gravity of quartz, the next a specific gravity difference of one-half, and the third a specific gravity difference of one. It is evident from the chart that there must be a relatively high percentage of heavy mineral in the composite grain in order to exceed a specific gravity difference of one. For native copper 35% copper content is necessary; for galena, 42%; for pyrite, 57%; for chalcopyrite, 66%. For a specific gravity difference of one-half the percentages are: copper, 18%; galena, 21%; pyrite, 35%; chalcopyrite, 38%. The probability of the separation of composite grains, based on the fundamental principle of difference in specific gravity, can thus be approximated from the chart.

An example may be taken to illustrate specifically. Assume an ore composed of 10% galena and 90% quartz. Suppose that in crushing to a given size 90% of the galena is liberated and 10% is in the middlings; that 80% of the free galena is recovered (72% of original) and that the remainder is in the slime. If it is assumed that all of the galena is uniformly distributed as composite grains, then the specific gravity of the composite grains containing 10% galena and 90% quartz will be 2.78, or only 0.24 greater than the specific gravity of quartz. Obviously few middlings could be separated. If the 10% galena in the middling was associated with one quarter of the quartz grain in the ore, the percentage of galena in the composite grain would be 40% and the specific gravity would be 3.58, or a difference in specific gravity between galena and quartz of 1. This would be sufficient for separation. Assuming that a recovery of 80% of these grains is made, there would be secured in a middlings product 8% of the original galena. If all of these middling grains were then crushed sufficiently fine to liberate clean galena, and 80% was recovered, there would be only 6.4% of the original galena recovered. The total recovery would be 72 + 6.4, or 78.4 per cent.

The case assumed is a favorable one. With minerals of lower specific gravity, such as chalcopyrite, blende or pyrite, the specific gravities of composite grains, even where the proportion of heavy mineral is high, would be so near to that of quartz that only an indifferent separation of middlings could be effected. Only the largest middlings grains would be secured, and the proportion of such grains as compared with the whole would be relatively small.

The difficulty that confronts the millman is to save

a relatively large percentage of middlings for retreatment. This, as has been shown, is not easy to do, and success depends largely upon the nature of the association of the valuable material with the gangue. Where the valuable mineral occurs in moderately coarse particles, the composite grains may be expected to contain a sufficiently high percentage of heavy mineral to make their separation easy, but where the heavy mineral is in fine grains and uniformly disseminated, the recovery of composite grains must necessarily be small. This explains why, in the treatment of disseminated copper ores, only 60 to 70% of the copper content is secured.

Finer crushing suggests itself as a solution, but only partly remedies the difficulty, for with finer crushing the composite grains are also finer and more difficult to separate by wet-concentrating appliances. The proportion of valuable mineral in the slime is also increased. Until the advent of flotation, fine-crushing and the use of slime-concentrating appliances afforded the only means for increasing recovery and for reducing the loss of metal in middlings. Flotation has removed, to a large extent, the restrictions upon fine-crushing, and with fine-crushing the proportion of middlings product becomes greatly reduced and is no longer a serious obstacle to the attainment of high percentage recoveries from disseminated ores. Even with fine-crushing and flotation, there will be a small part of the middlings product, that portion consisting of particles containing valuable mineral completely enveloped by gangue, which cannot be recovered.

Grinding of Ore in Ball-Mills

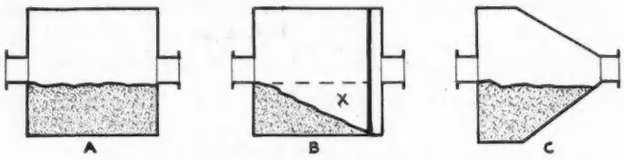
By Algernon Del Mar. *

Modern metallurgy requires ore ground to certain degrees of fineness, from which concentrates may be floated. The supply of such ore must be constant and uniform and must be produced at the lowest cost per ton. Too often the metallurgist is constrained from giving opinions that may vary from those generally accepted for fear of being thought behind the times. At the risk of being tabulated in this class, I purpose to show that present-day ball-mill practice is open to discussion, and that the modern ball-mill which is characterized by a diaphragm grating and discharge lifters is not always so efficient as the older central-discharge ball-mill. To many this statement will be rank heresy; to others it has been proved beyond dispute.

It may be taken for granted that when grinding a coarse unclassified feed, say a rock-breaker product, the quick discharge, as exemplified in the Marcy, Allis-Chalmers and Chalmers & Williams ball-mills, will produce a greater tonnage per hp. of finished product than a central-discharge mill, because, in the first place, the rock is retained in the mill until small enough to issue through the diaphragm, and, in the second place, the unclassified ore may include a proportion of fines that needs no further grinding, and so should be rushed through the mill to prevent overgrinding. If the ore delivered to the mill, however, be a classified feed in which all the particles must be ground, and, particularly, if the greater part of the ore is small enough to pass through the diaphragm orifices, there is no advantage in the quick discharge, and, in fact, its action may cut down the capacity of the whole mill by causing the return of an excess of oversize. It likewise causes an excessive wear on the liners and an abnormal consumption of balls.

The greater consumption of balls with the quick discharge is due to the fact that at the discharge end of the mill the pulp level is low and the balls strike against each other with little pulp between the faces, thus wearing on one another instead of on the pulp. The liners wear abnormally at the discharge end for the same reason, and should therefore be thicker there than at the feed end.

The first point to notice in connection with the main argument is the level of the pulp in the central-discharge mill, in the quick-discharge mill and in the conical mill,



PULP LEVEL IN DIFFERENT MILLS
A—Central Discharge Mill; B—Quick Discharge Mill; C—Conical Mill

if I may be pardoned for bringing this into the discussion as showing a similarity between it and the quick-discharge type of mill.

Effect of Pulp Level in Different Mills

Referring to the diagrams *A*, *B* and *C*, it may be seen that in the central-discharge mill the pulp level varies little from a horizontal line, so that a constant depth of pulp is retained in the mill; that in the quick-discharge mill, *B*, the pulp level decreases toward the discharge end, that the balls at this end have only a thin layer of pulp to act upon and the space x is therefore useless for grinding; likewise, that the space occupied by the diaphragm is useless, which in a mill four feet long cuts out one-sixth of the possible grinding space. The conical mill *C* shows a pulp line decreasing in depth toward the discharge end. The two rival mills, then, the quick-discharge cylindrical and the quick-discharge conical mill, both show varying depths of pulp thickness, while the now neglected central-discharge mill maintains a constant pulp level, with a greater volume of balls acting on the pulp to be ground.

SCREEN ANALYSES OF 4x4-FT. BALL-MILL DISCHARGE
All percentages cumulative except for —200 mesh

Mesh	A	B	C	D	E	F
+ 4	9.5	...	.....	....	....	..
6	12.6	...	.....	....	....	..
8	18.1	...	.....	....	....	..
10	24.1	...	.....	....	....	..
14	28.8	...	.....	....	....	..
20	33.5	...	.....	....	....	..
28	38.2	...	1.2	....	....	..
35	45.4	6½	2.1	.....	....	..
48	53.7	35	3.7	0.5	....	1
65	59.9	58¼	5.0	4.5	....	8
100	71.6	76	18.75	36.0	7.9	33
150	85.7	89½	63.75	70.0	31.7	58
200	90.3	93	81.25	82.0	40.0	75
—200	9.7	7	18.75	18.0	60.0	25

A—Lifters set at maximum. B—Central discharge. C—One lifter operating; three taken out. D—Same condition, except all four lifters taken out. E—Flotation feed with lifters. F—Flotation feed without lifters.

Now refer to the screen analyses, A, B, C, D, E and F, being discharges from a 4 x 4-ft. ball-mill and representative of many samples taken at regular intervals. A and B are screen analyses of the mill with and with-

*Sandon, B. C.

out the quick discharge. Contrary to the generally accepted idea, the central-discharge mill does not slime any more than the quick discharge, but it is apparent that in the central-discharge product the coarser sizes are absent. This is a characteristic of all screen analyses made and indicates plainly that while the central-discharge mill produces as much finished product as the other, it does not produce more slime nor as much oversize which must be returned for regrinding.

Columns C and D show the same effect, but less pronounced, for in C only one lifter was operative, while in D all were eliminated. E and F show the flotation feed from the mill arranged with and without the quick discharge after classification and indicate that the central-discharge mill, if of the right diameter and length, with the correct volume of feed, does not slime beyond what may be expected from this class of grinding.

As to the capacities of the two classes of mills, the ball-mill under consideration had a maximum capacity (original feed) of 56 tons a day with the quick discharge and 62 tons a day and at times as high as 84 tons a day without the quick discharge. This is explained by the fact that the returned oversize indicated in screen analysis A was sufficient to cut down the capacity of the mill by occupying the space that should have been filled with fresh feed, the total possible space in the mill was not filled with pulp and the balls were not acting at their full efficiency at all parts of the mill.

The following extracts from letters show evidence in favor of the adoption of the central discharge:

An operator at Cobalt writes that the adjustable quick discharge was taken out for the following reasons: "(1) Too much oversize circulating; (2) it consumed about three times as many pebbles as another tube-mill running without the quick discharge; (3) with the quick discharge there is no ore in that end of the mill (it being discharged near the periphery) and the pebbles grind on themselves and perform no useful work; (4) the quick-discharge diaphragm and linings in that end of the mill get excessive wear on account of having no ore to grind on."

From Wallace, Idaho, I have the following: "The 5 x 4-ft. central-discharge mill at the X mill will grind 125 tons a day from crusher size to pass 60 mesh, while the one here (quick discharge) was always choking up on 60 tons a day from ½ to 20 mesh. I had so much trouble with screens and liners in the mill here that the screens were taken out and the end lined the same as the feed end." The mill is now taking 120 tons a day.

From Mullan, Ida., comes the following: "We could not get feed into mill without excessive water, which made too much oversize. To reduce the oversize, we removed the adjustable (quick-discharge) feature. At this stage of our experiments we found that the mill without the adjustable (quick) discharge, ground more ore with less power and with less oversize, and we speedily changed the other 6-ft. mill. We have just purchased a ball-mill without the quick discharge."

What an operator at Kellogg, Idaho, says: "I got an increased tonnage of about 18% of a finished product for table feed, all minus 80 mesh. Before making the change (from quick to central discharge) the discharge from the ball-mill was all sizes and caused a large return feed."

Oxygen and Sulphur in the Melting Of Copper Cathodes*

The absorption of sulphur during the melting of cathode copper, 99.98+% copper, requires a long and expensive refining process, and the final product is inferior in purity and lower in electrical conductivity than the original cathode copper. The sulphur absorbed comes from the reduction of the sulphate of copper left on the cathode sheets in the tank houses and from the fuel used for melting. As it comes from the tank houses, even well-washed cathode copper will contain from 0.002 to 0.004% of sulphur. The fuel, whether oil or coal, always contains sulphur.

By melting cathodes under a coke oven and taking samples at half-hourly periods, the cathode copper at the end of the oxidizing period and the beginning of the poling period was found to contain practically no sulphur. Toward the end of the poling period the samples began to show copper, the percentage of which slowly increased during the casting period until a maximum content of 0.0031% S was present close to the close of the casting period. The final product analyzed 99.93% Cu, and the average conductivity of the samples was 100. The experiment demonstrated that the residue sulphur, amounting to only 15 lb. on the whole charge, came from the fuel used and the coke-covering charge. By melting under a charcoal cover, containing only 0.03% S, the final product obtained analyzed 99.966% Cu, and the conductivity was 100.5. The lower content of sulphur in the covering charcoal resulted in less absorption of sulphur by the copper.

The author compares the two changes and offers the following conclusion:

The comparison of the two charges shows not only a lower sulphur content of the charge refined under charcoal, but also lower oxygen content and a better quality of copper. It is becoming better understood that the "surface set" on the pitch of copper is directly controlled by the sulphur and perhaps certain reducing gases, such as carbon monoxide and hydrogen, rather than by the oxygen; that sulphur raises the "set" or overpoles the copper, thus necessitating a certain amount of oxygen, which therefore depresses the "set" to counterbalance the action of the sulphur. In these two charges the "pitch" of the copper was the same, yet, owing to the lower sulphur in product No. 2, its oxygen content is also much lower than that of No. 1, affording great improvement in the quality of the copper. The refiner did not know how much sulphur was present in his final product; he simply worked the copper to the desired pitch, and the sulphur present in each charge determined the amount of oxygen necessary to give the proper "surface set" on the copper. Samples taken at regular intervals during the melting and refining of copper cathodes show:

1. The total elimination of sulphur during the "oxidation" period and before poling.
2. The re-absorption of sulphur by the charge when the percentage of cuprous oxide is low enough to allow the reversible reaction

$$6Cu + SO_2 \rightleftarrows Cu_2S + 2Cu_2O$$

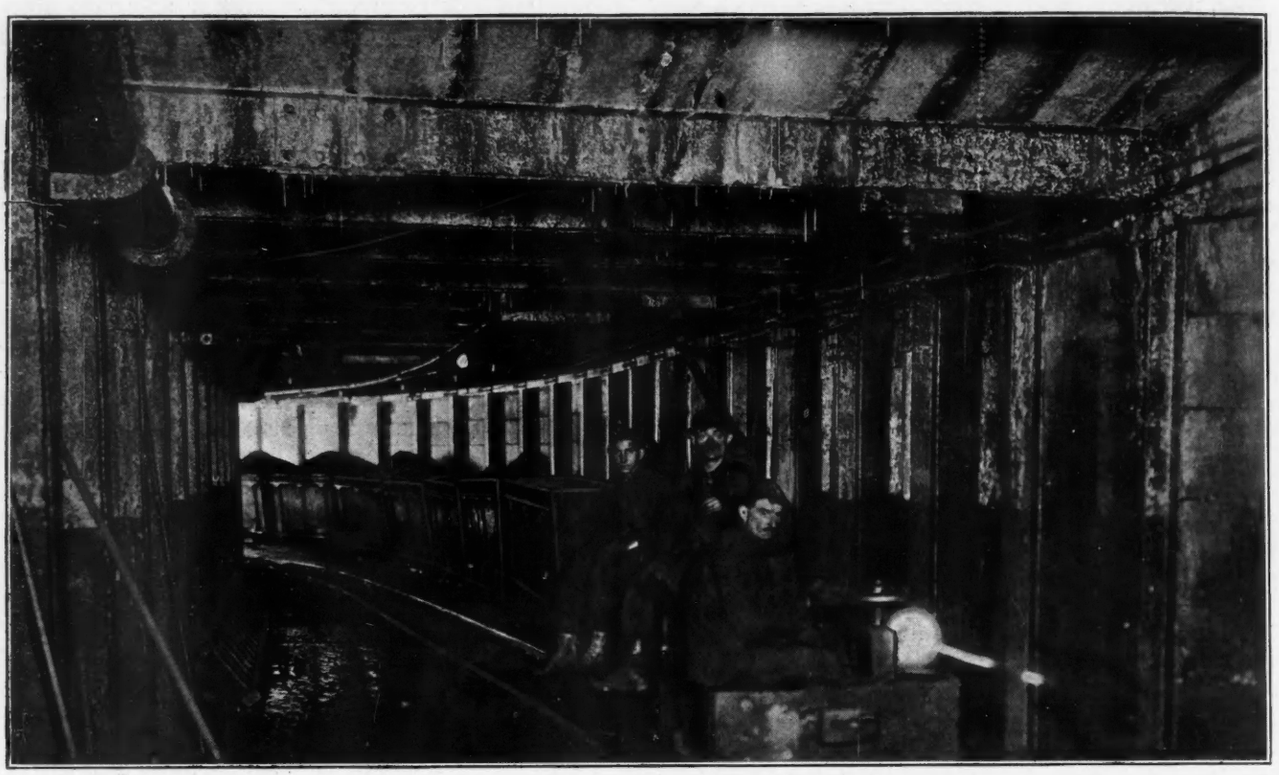
to take place.

3. The advisability and importance of using a low-sulphur coke or charcoal to cover the molten bath during the poling and casting periods.

Employees of Old Dominion Copper Co., of Globe, Ariz., were offered bonuses consisting of Liberty Bonds, according to the company's report for 1917, by allowing them to pay for a $50 bond in 12 installments deducted from their wages, with the understanding that those who completed 12 months' work would be given the bond and have their payments refunded.

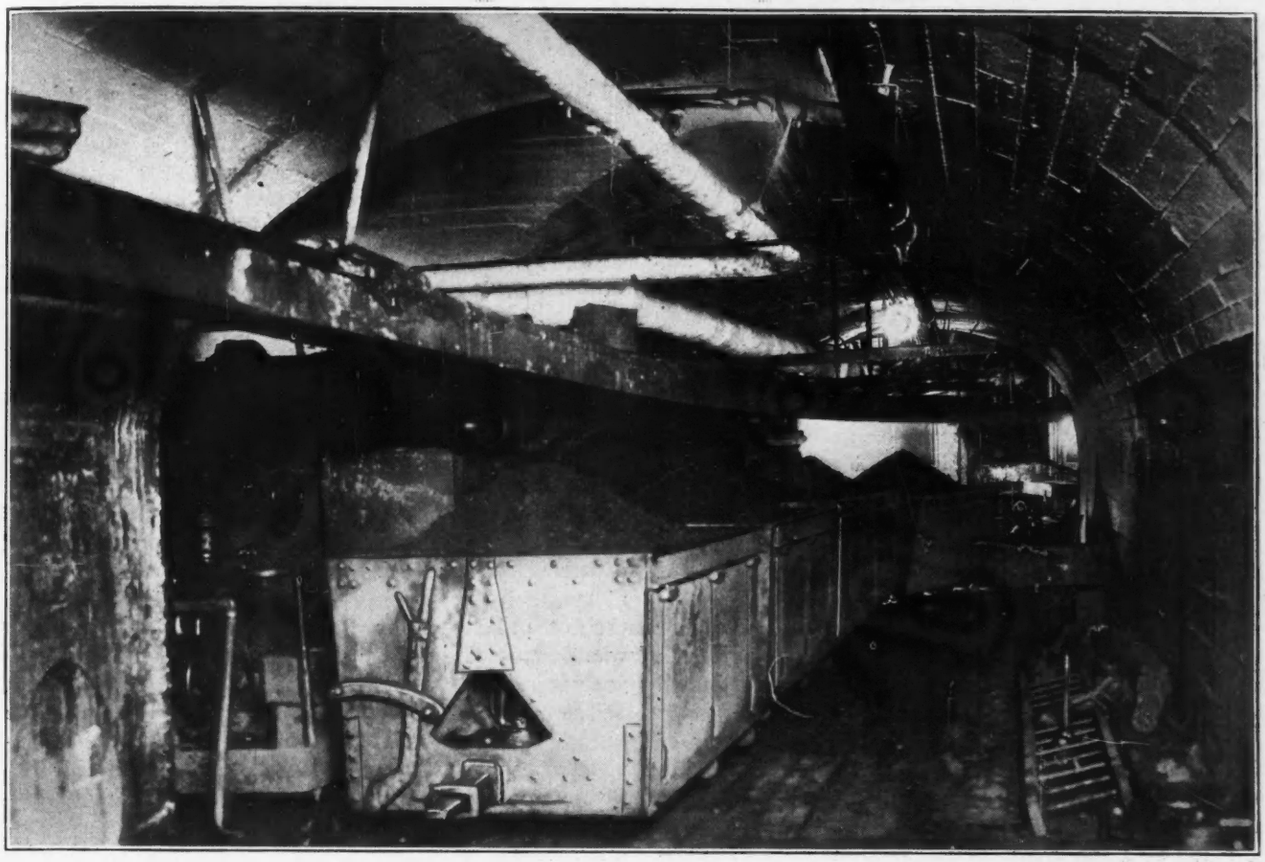
*Abstract of a paper by Stanislaus Skowronski; to be presented at the Colorado meeting of the American Institute of Mining Engineers.

Use of Concrete in Mesabi Range Mines



MAIN HAULAGE DRIFT AT THE LEONIDAS MINE OF OLIVER IRON MINING CO., EVELETH, MINNESOTA

STATION AND MAIN HAULAGE DRIFT AT LEONIDAS MINE



MAIN HAULAGE DRIFT AT PHILBIN MINE, HIBBING, MINN., SHOWING CONCRETE CONSTRUCTION

DRYING ROOM OF CEMENT MIXING PLANT, OLIVER IRON MINING CO., HIBBING, MINNESOTA

James Douglas

JAMES DOUGLAS, engineer, administrator, publicist, philanthropist and philosopher, died at his home at Spuyten Duyvil, on June 25, aged 81 years. After a life of extraordinary activity, which activity continued unabated until two or three years ago, failure of his strength finally compelling him to retire, and in view of his advanced years his death was not unexpected. His was a magnificent human mechanism that worked with strength finally compelled him to retire, and in view to most men. The funeral services were held in the Church of the Mediator, on June 26, after which the body was taken to Quebec, the old home, for burial in the family plot.

James Douglas was born at Quebec, Canada, on Nov. 4, 1837. He was the son of Dr. James Douglas, a prominent surgeon in the Dominion, who introduced the modern treatment of insanity into Canada when he founded the Quebec Lunatic Asylum, in the management of which for some time his son James participated.

Young Douglas followed in the footsteps of his father and studied medicine in Canada and abroad, partly in Scotland and partly in Germany. He was graduated from Queens University in Canada, studied medicine at Laval University, Quebec, and later was professor of chemistry at Morrin College, Quebec. After studying medicine for some years, young Douglas decided that he was not enthralled with the profession and began the study of theology, going to the University of Edinburgh, Scotland. In 1875 Doctor Douglas, who received his license to preach, but was not ordained, returned to Canada to assist his father, who had been unfortunate in his investments. For a time he managed the lunatic asylum in Quebec which was founded by his father.

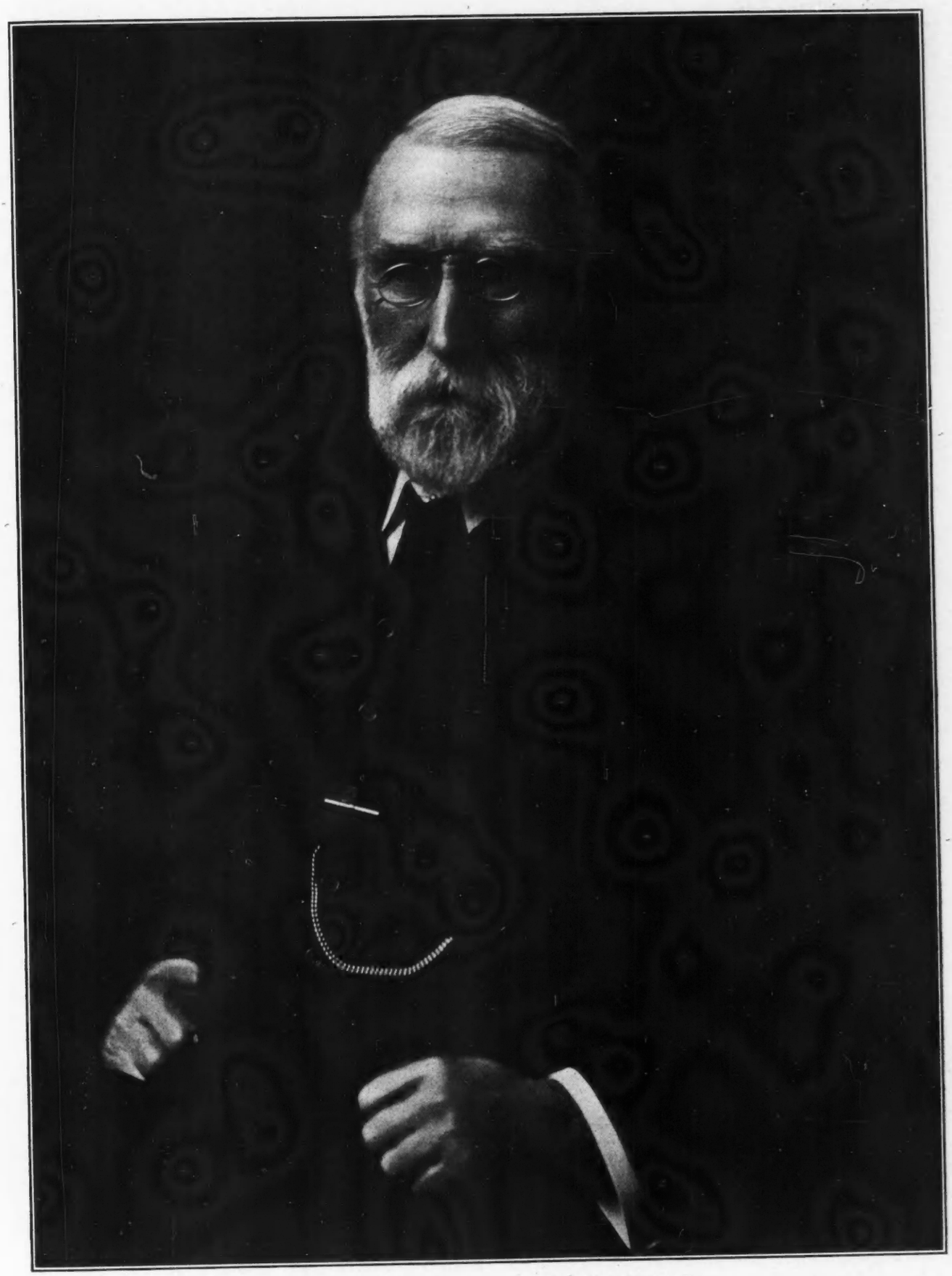
These were the years of finding himself. He had tried the professions of medicine and theology and had nearly reached the age of 40 without becoming really established or contented. What directed him into his proper field was a misguided investment that his father had made in the Harvey Hill copper mines, in Quebec. His father continued to have faith in them, and the son, becoming interested, set out to retrieve what had been lost in them. Those mines were not of a character to afford a great financial success to anybody, but they are historic, owing to their influence upon Doctor Douglas, and through him upon the mining industry of the world.

It was at this time that Doctor Douglas became associated with that brilliant scientist, Dr. T. Sterry Hunt. Together they worked out the beautiful Hunt & Douglas process of copper extraction, which was founded upon the solubility of cupric oxide in ferrous chloride, the original process being notably modified, however, in later years. This process obtained considerable, although not general, use in the United States and elsewhere. While speaking of Doctor Douglas as a metallurgical inventor, reference may appropriately be made here to his very ingenious revolving muffle furnace for ore roasting. These sidelights illuminate the versatility of this great man.

After a brief experience at the Harvey Hill mines, Doctor Douglas went to Phœnixville, Penn., to take charge of the copper extraction plant of the Chemical Copper Co., which was obtaining ore from some small and more or less uncertain mines. In the course of time, however, some parcels of cupriferous material came to the works from Arizona, which directed thither the attention of Doctor Douglas and led him to pay a visit in 1880 to that newly developing region, through which the transcontinental railways had but barely been built, and most of which was still infested by Apache Indians. The Copper Queen mine, at Bisbee, had been opened in 1880 by Martin, Ballard & Reilly, and the first copper furnace had been blown in on Aug. 20 of that year. Doctor Douglas, who, up to this time, had gained more experience than money, was attracted by the possibilities of this property and succeeded in interesting some of the partners of Phelps, Dodge & Co., an old firm of metal merchants in New York.

The story of the Copper Queen mine is a romance in itself, the telling of which would be beyond the scope of this sketch, and it is unnecessary, for it has been told at length in technical literature. Suffice it to say that the first orebody, after yielding 20,000,000 lb. of copper, was exhausted in 1884. The earliest months of that year were the gloomiest in the history of the district, of the mine, of its owners, and of Doctor Douglas. With only three months of ore supply in sight, the abandonment of the mine was in prospect. The Atlanta Mining Co., owning adjoining property, was in a similar predicament. It was wholly due to the geological studies of Doctor Douglas, his persistence and his persuasive influence upon his principals that further prospecting was prosecuted. His vision was justified by the striking of rich orebodies. His business sense led to a consolidation with the Atlanta company, which also had found more ore. From that time onward the history of the Copper Queen, which became one of the great mines of the world, was a record of unchequered success. When that assurance was realized Doctor Douglas was nearly 50 years old.

In the upbuilding of the Copper Queen company Doctor Douglas disclosed his qualities as a scientist, whose knowledge and perception ranged from economic geology to the art of metallurgy, and he added to them the gifts of a great administrator—a handler of men; one of those rare persons who can teach others to work and inspire them with the wish to do so—and, moreover, he exhibited himself as a financier, one of those who possesses the vision to promote new enterprises. It was not enough for him to make the Copper Queen one of the great mining and metallurgical companies, an immensely profitable concern. He spread out and led his associates into the Globe district, into Morenci, into Nacozari, into Tombstone, and into Burro Mountain. The fuel requirements of the several companies led to the development of a great colliery and coking plant at Dawson, N. M. The need for carrying the products induced the construction of the El Paso & Southwestern Ry., begun in 1886, which eventually became a great railway, operated in connection with the Rock Island, in which (the Rock Island) Phelps, Dodge & Co. acquired a large interest. Doctor Douglas became as eminent an authority on railway transportation as he was on mining and metallurgy. A few years ago all of these companies were consolidated in Phelps, Dodge & Co., Incorporated,



DR. JAMES DOUGLAS

of which Doctor Douglas was the president. Later the name of the operating company was changed to the Copper Queen Corporation, and Doctor Douglas resigned the presidency to his son, Walter, and became chairman of the board of directors.

Some biographer will write a great book about Doctor Douglas. This is inevitable, for he was not only a great man in our industry, but also he was one of the great men of the world. It may be left to that biographer to review the wide scope of Doctor Douglas's learning, the great list of books and papers that he contributed to literature, both technical and general, and the impressive series of honors that were bestowed upon him by scientific and technical societies.

Doctor Douglas was elected President of the American Institute of Mining Engineers in 1899 and again in 1900. In 1906 he was awarded a gold medal by the Institution of Mining and Metallurgy of Great Britain. In 1907 he received the degree of Doctor of Laws from McGill University. In 1916 he was given the John Fritz medal for humanitarian work. In 1917 he was elected an honorary member of the Mining and Metallurgical Society of America, and was elected Chancellor of Queens College, of which institution and of McGill University he had been a trustee for many years.

We of the mining and metallurgical profession know Doctor Douglas as the contributor of many of the most important papers in our technical literature. We do not know so well that he was an author of repute upon historical and philosophical subjects. Among his books of the latter character were "Canadian Independence"; "Quebec in the Seventeenth Century"; "New England and New France"; "Journals and Reminiscences of James Douglas" (his father). Besides these historical works, he was the author of many papers on economic and philosophic subjects outside of the domain of purely technical literature. Throughout his career he was a valued contributor to the *Journal*.

Doctor Douglas in 1860 married Miss Naomi Douglas, daughter of Captain Walter Douglas, of Quebec. Six children were born, of whom the following are now living: Major James F. Douglas, developer of the United Verde Extension mine, who is now serving in France; Walter Douglas, who succeeded his father as president of the Phelps Dodge Corporation.; Mrs. Edith M. Douglas, wife of Archibald Douglas, a New York lawyer of extensive mining interests; and Miss Elizabeth Douglas.

The attitude of Doctor Douglas toward his employees was ever friendly and helpful. By sympathetic treatment of the natives in Mexico, the Nacozari mine was shut down for no more than a month during the period of general disturbance a few years ago. When it became necessary to withdraw the American management and leave everything to native control, it was a source of great pride to Doctor Douglas that the natives whom he had trained were able to conduct operations as economically and as profitably as when the Americans were there. Doctor Douglas, as an economist and a philosopher, naturally avoided the mistake of pursuing a paternalistic policy. He had no sympathy with the socialistic ideas that disregard the extraordinary risks and wonderful achievements of the industrial pioneer and upbuilders of this country who reduced the cost of mining ores, extracting their products, and transporting them, together with other commodities, by railway, to phenomenally low figures. He was one of those who considered that such economic savings were for the general good, and ought to be applauded, not decried.

Doctor Douglas, through the success of the Copper Queen and of subsequent mining interests, acquired great wealth. His own tastes, however, were simple, and his mode of living was always modest. He needed relatively little money, and what he did not need he gave away. His philanthropies were many, but they were seldom heard of, for he preferred to give unostentatiously. Indeed, he seemed to be rather averse to allowing anything to be known about his gifts. But using only a small part of his income for personal necessities, he gave millions to colleges, hospitals, museums, charitable institutions, and to individuals and nearly a million for the study and alleviation of cancer.

We feel, however, that the world owes a greater debt to Doctor Douglas than for any of his philanthropies or for anything he did in upbuilding the mining industry and railway systems of Arizona and Sonora, no matter how important that feat may be regarded. Our own conception is that the world's great debt to Doctor Douglas is for his service in tearing away the veil of secrecy that used to shroud industrial operations. When everybody kept the details of his work to himself, progress was slow and more or less accidental. The chances were that in any mine or works where the doors were locked the practice inside of them ranged from indifferent to bad. The fancied secrets of the former generation were more mythical than anything else. The proper spirit was revealed by Doctor Douglas in his presidential address before the American Institute of Mining Engineers in 1899 in the following words:

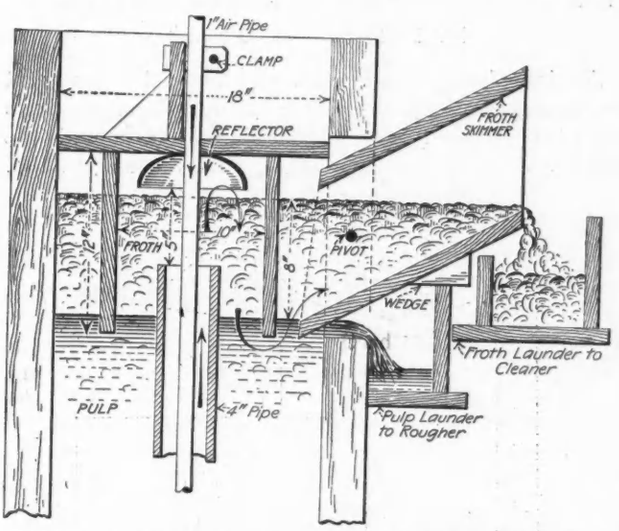
"The motives influencing the great body of writers who, without any pay, use the technical journals and such media of communication as our transactions, in order to give to the brethren of their craft the results of their often dearly earned experience, are various and complicated. But, in the majority of cases, the impulse originates in the desire for reciprocity, and in the hope that others will tell what they know, in return for what we ourselves communicate, and that therefore we shall learn at least as much as we can teach."

Doctor Douglas himself practiced what he preached. There was never any secret about operations at the Copper Queen, or at any of his enterprises. To every visitor and every applicant for information the helping hand was extended. This spirit spread among other managements. It is the time of the general acceptance of that idea that we date as the beginning of the great forging ahead of the American mining and metallurgical industry that soon put us in the position that we have held unchallenged for many years, namely, so far in the van that the rest of the world, including Germany, has been out of sight except in a few branches. Lately our French and British and Australian colleagues have been coming to us, and we have been glad to extend to them the same helping hand that we have done among ourselves. We repeat that we consider the birth of this spirit to be due more to Doctor Douglas than to anybody else, and with that inspiration he instituted an economic development for the improvement of the welfare of the world that is superior to any other one thing in modern times.

Details of Milling and Smelting

Baffling and Froth-Skimming Device for Pachuca Emulsifiers

The capacity of a flotation plant where pachuca tank emulsifiers are used can be slightly increased by the addition of a skimmer or baffle board at the top of the pachuca tank, as shown in the illustration. By removing the froth it can be sent directly to the "cleaner" unit, for the upper froth obtained in this way, at least when treating a lead ore, will be found to be as high in grade as that coming from the "roughers." This device was designed at the Sweeney mill of the Federal Mining and Smelting Co., Bradley, Idaho, by H. M. Throndson, mill superintendent, and consists of an inverted baffle-board box attached to the upper end of the air-lift pipe, and an adjustable skimmer pivoted at the



SECTION OF PACHUCA TANK SHOWING BAFFLE ARRANGEMENT AND FROTH SKIMMING DEVICE

discharge opening of the tank, which is of the square-box type. By means of a wedge the tilt of this skimmer is regulated so as to get the proper depth of skim or grade of froth desired. The bottom of the skimmer lip is made adjustable and can be depressed below the pulp level so as to skim off practically all the froth formed before the pulp discharges into the "rougher-" feed launder. The baffle device has a square close-fitting top connected above by uprights to a split-block guide that holds the baffle frame to the 1-in. air pipe at the proper elevation with respect to the level of the pulp. This elevation is determined by the maximum frothing produced by the splash against the bell deflector.

From the top cover board the side baffle boards extend downward below the pulp level as a square frame of 1 x 12-in. plank. The froth escapes from the baffle box below edges and, rising to the top of the pulp level, discharges over the skimmer into a froth launder that leads to the "cleaner" machine. The pulp overflows at the opening under the skimmer to the "rougher"-feed launder.

At the Sweeney mill this device is used in connection with two 24x24-in. pachuca tanks, in which the pulp is emulsified before going to the Callow flotation cells, and about one-fourth as much froth is obtained from the two as from a 2x10-ft. Callow pneumatic cell. The device is simple, inexpensive, and easy to make, requiring practically no attention, and adds appreciably to the frothing capacity of the plant.

Coal-Dust-Fired Reverberatory Furnaces in Chile

Up to the outbreak of the war, all smelteries in Chile were using blast furnaces, with coke, imported from the United States, England, Germany and Australia, as fuel. As the war progressed, freights became scarcer and the price of coke rose gradually to impossible heights, so that it finally became a serious problem not only to obtain it, but to get it at a price allowing a profit in smelting, even with the high price of copper. Experiments had often been made in Chile with a view to making metallurgical coke from native coal, but no satisfactory results had ever been obtained, and it was invariably found that this coal did not possess the necessary properties to make it a good coking coal for metallurgical work.

The Société des Mines de Cuivre de Naltagua, which had been smelting in blast furnaces for a number of years, in view of these adverse circumstances, determined to build two coal-dust-fired reverberatory furnaces, using native coal as fuel. These, with their accessory plants, were ordered in the United States in 1916 and installed in 1917. They have been working for several months with satisfactory results.

The furnaces were designed for direct smelting of green ores running about 6% copper. This was experimental, as no similar work had been done before, and it was not known what results could be obtained from the Chile coal in smelting. Two furnaces 55 ft. long by 17 ft. wide were built, with coal-grinding, ore-crushing and ore-drying plants. They were modeled after the reverberatories in the United States, using pulverized coal, and are identical except for their short length.

In the coal plant, the slack, after being dried, is passed through an Allis Chalmers No. 2 pulverator, and is finally ground down in a 5 x 5½-ft. ball mill, where it is reduced to such a degree of fineness that 65% passes through a 200-mesh screen. The coal dust is then taken to the furnaces in screw conveyors. The ball mill will grind from 2.5 to 3 tons of coal per hour, this being a maximum. The coal used contains 16% ash, 36% volatile matter and 47% fixed carbon, the calorific value being about 6000 calories. Three 300-hp. Erie City boilers are installed in the flues and furnish the power necessary to run the plant.

It has been found that the smelting capacity of these small furnaces is about 120 tons per 24 hours, with a coal ratio of 1 to 4 (dry coal). The ore is crushed to ½ in. and dried sufficiently to drive out the moisture. In summer, the ore is passed directly to the furnaces. It has been decided to change the crushing plant so as to crush the ore to ¼ in., as this will probably increase the capacity of the furnaces, with a better fuel ratio.

The silica brick necessary for constructing these furnaces was imported from the United States. A brick plant is being built at the smeltery to make all fire and silica brick required on the property. Excellent quartz can be obtained in the district. Once the brick plant is working, the smeltery will be entirely independent of outside difficulties affecting importation from the United States or Europe, and will be able to run continuously, using only native fuel and materials.

The change in operating method marks a great advance in smelting practice in Chile, as it is almost impossible to import coke and other materials necessary for smelting. The Société des Mines de Cuivre de Catemou has also recently built a similar plant.

Pure Zinc Dust for Precipitation

By R. Wheeler*

Before the war zinc dust obtainable for precipitation of gold from cyanide solutions contained around 10% impurities. Authors of books on cyanide practice, and many operators as well, generally looked askant at pure zinc dust containing little or no lead, and when it did not have any, recommended its addition in some form to obtain ostensibly better precipitation—all of which caused more or less expensive refining methods, if troubles with the mint were to be avoided due to low-grade bullion.

Since using the finest possible ground and purer zinc dust containing 98 to 99.8% metallic zinc, at the plant of the Hedley Gold Mining Co., at Hedley, B. C., bullion is produced running 850 to 950 points fine gold by the sulphuric-acid treatment of the press-precipitation product, which was obtained from the treatment of a heavy, finely ground arseno-pyritic ore. The consumption of the purer dust is 30 to 40% less than that of the 90% dust, thereby reducing the amount of acid, as well as reducing the time and difficulties of melting.

Results of Pine Oil Research in Canada†

Incident to the increased employment of flotation at Cobalt, Ont., the greater demands for pine oil, which had to be imported from the Southern States, led to the inevitable results, extremely high price and an adulterated product. Because of these conditions, attempts were made by Tom R. Jones, of Buffalo Mines, to produce a suitable oil from the stumps of the Northern Ontario pine. Some success was attained, and in conjunction with Arthur A. Cole, president of the Canadian Mining Institute, the Dominion Government was interested in the matter, and a plan outlined whereby the Mines Branch at Ottawa, working with the Forestry Branch, would attack the problem.

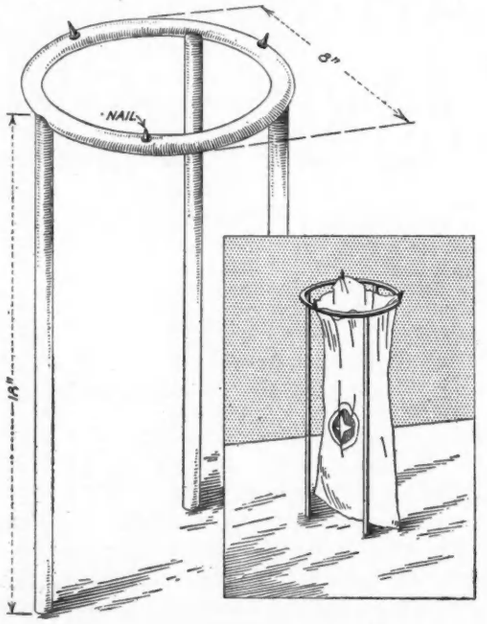
Careful experimentation and investigation of plants already established in Canada, and producing wood products, led to the conclusion that the establishment of such an interest in Canada would require a large capital outlay, and even under the most careful management an adequate financial return was not assured. Pine oil forms only a small percentage of the total products of distillation, and at present the markets for the other materials produced are very irregular. A company has been formed at Cobalt, and a small plant erected at Cassidy on the T. & N. O. Railroad.

As to a substitute, it was found that several of the hardwood distillation products made good frothing agents, and that two of the best frothing agents were products from hardwood distillation which had hitherto been wasted. These were two of the hardwood creosote oils. Recently several barrels of this material were shipped to Cobalt, and a test run under commercial conditions was made at the Buffalo mill. The full capacity of the mill was turned over to Messrs. Parsons and Gilmore, and 600 tons per day for a week was treated by flotation, using these oils exclusively. The results were entirely satisfactory.

Stand for Filling Concentrates Bags

By Frederick W. Foote*

An ingenious arrangement was noticed recently at an electro-magnetic separator plant. The products there are collected in metal containers and poured into sacks for shipment. The sacks, which usually weigh



STAND FOR FILLING CONCENTRATES BAGS

100 lb. when full, are rather heavy and inconvenient to hold open during the process of filling. An iron stand (similar to that used to hold evaporating dishes over a Bunsen burner), 18 in. high and 8 in. in diameter at the top, was made, and a few nails, with the points turned outward, were placed around the rim. The nails were soldered in place. The bag is suspended inside the holder and held in place by the nails. After it is filled it can easily be detached and sewed for shipment.

*Mill superintendent Hedley Gold Mining Co., Hedley, British Columbia.

†Twenty-sixth Annual Report of the Ontario Bureau of Mines, 1917.

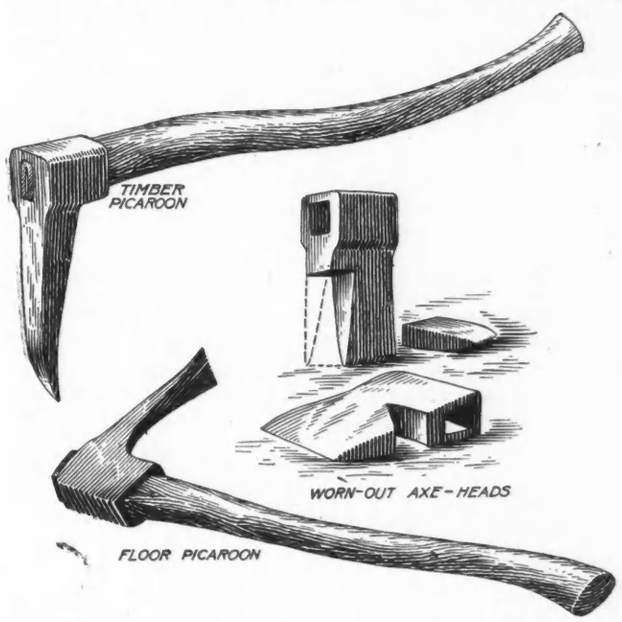
*Mining engineer, 80 Broadway, New York.

Details of Practical Mining

Picaroons and Picaroon-Adzes

Axes used around the mine are in time ground down to such extent that little steel remains in the bits, so that the cutting edge is gone and they are of no further use as axes. However, they should not be thrown away, as useful mining tools known as picaroons and picaroon-adzes can be made from what is left.

A picaroon is probably a new implement to most mining men, but a useful one and better for handling timbers or raising floors than a pick. It has a crook, so that a good purchase can be obtained in raising a plank when the floor has become wedged tightly between timbers. Owing to its hooked point, a picaroon will stick better in a timber when dragging or pulling it than a pick will. It is a tool for a special purpose and is kept sharp, while the pick, an implement of general usefulness in the stope, is usually dull, and not so well fitted for handling timbers or lifting floors. The picaroon also can be used as a hammer and is in reality nothing but a special type of light pole-pick. The type referred to, which is made by drawing the bit of a worn-out axe into a pick point with a slight hook near the end, has long been used in the mines of the Cœur d'Alene district, and it is thought to have originated at the Frisco mine, at Burke, 20 years ago.



PICAROON AND PICAROON-ADZE MADE FROM OLD AXES

The manner of making the picaroon depends upon the amount of metal in the axe head as well as the use to which the tool is to be put after it is made. That used by timbermen in handling timbers in the stope is made light and with a shorter point, so as not to pull out of the timbers too easily. Picaroons intended mainly for lifting floors are made with longer points and are heavier than those used for handling timbers. No new steel is welded into the axe metal to make a new point, but, instead, the metal of the axe blade is drawn out in such a manner that the bit of the axe will form the lower part of the point. Consequently, the lower part of the picaroon blade is made up of steel and iron welded together in a laminated manner so that it forms, when tempered, a tough and lasting point. If there is too much metal in the axe, part of it is cut out on the anvil before the new tool is shaped, as shown by the sketch. If there is likely to be a shortage of metal in the blade, a small V is cut in the lower side of the axe, just below the eye, and the remaining metal is driven down and drawn out to form the point, so that the steel of the bit will be kept in the lead as much as possible.

A picaroon-adze can be made from an old axe head in a similar fashion, but care is taken in drawing out the metal to keep the steel of the bit well in the lead, and all the metal is preserved so as to give weight to the tool. When the metal has been drawn out to form a point five inches long, an adze bit about an inch and a half wide is shaped, tempered and ground. A picaroon-adze will be found handy in chopping out a timber that cannot be removed with an axe or wood chisel.

Both the timber picaroon and the picaroon-adze are fitted with an axe helve for a handle, because it is curved and can be gripped securely and easily. The floor picaroon is fitted with an old pick-handle, for this is stronger and will permit of much more prying without danger of breaking while raising floors.

At the Bunker Hill & Sullivan mine, old pick eyes, no longer heavy enough to make good picks, are used to make picaroons. One end of the pick is cut off about 2 in. from the eye, and the other is drawn out to form a light slightly hooked pick-point, which has the same general appearance as the point on the axe-picaroon, just described.

Cutting Board for Sizing Fuse

By William Crocker*

Cutting a large number of fuses to a standard length may be accomplished with the aid of the cutting board shown in the illustration. The board rests on a bench made of 2-in. plank 12-in. wide. A 1-in. board 6-in. wide is nailed on edge to the top of the bench, acting as a back. At the right end of the board two pegs are set in the center line of the bench, separated sufficiently

TOP VIEW OF FUSE-CUTTING BOARD

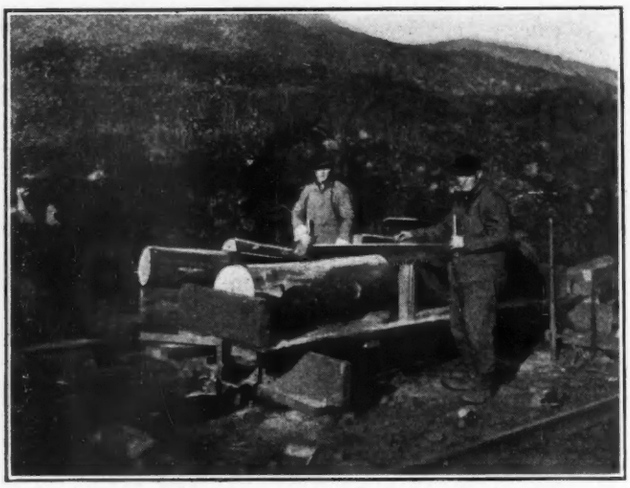
*Prescott, Arizona.

to take the inner and outer coils of a 100-ft. coil as shipped by the makers. At the opposite end a cleat is nailed to the bench and the desired length of fuse measured from the right edge of the cleat and well marked in the bench to the left of the coils. Two fuses, one from each coil, can be cut accurately at one time.

Cutting Round Timber Posts

BY L. D. DAVENPORT*

Recently it was necessary to repair one of our coal-dock trestles. The majority of the bents were of square timber, resting on a pile foundation. The piles were badly rotted at the surface of the ground, while the square timber was in good condition. The repair work consisted of holding up the square timber bents with false work and cutting off the piles 12 in. below



TIMBER CUTTING FRAME IN USE NEAR HIBBING, MINNESOTA

the surface of the ground, building forms, pouring concrete mud sills and retimbering. The bents were taken alternately, as the trestle was in daily use. When the concrete had set for 10 days, round timber posts were placed from the concrete sills up to the square timber sills. There were five posts in each bent. The three inside posts were plumb, and the two outside posts were battered 1 in. to the foot. The false bents were also made with five posts. The round timber used was mining timber from 10 in. to 16 in. diameter, and much of it was far from straight.

*Chief engineer, Oliver Iron Mining Co., Hibbing, Minnesota.

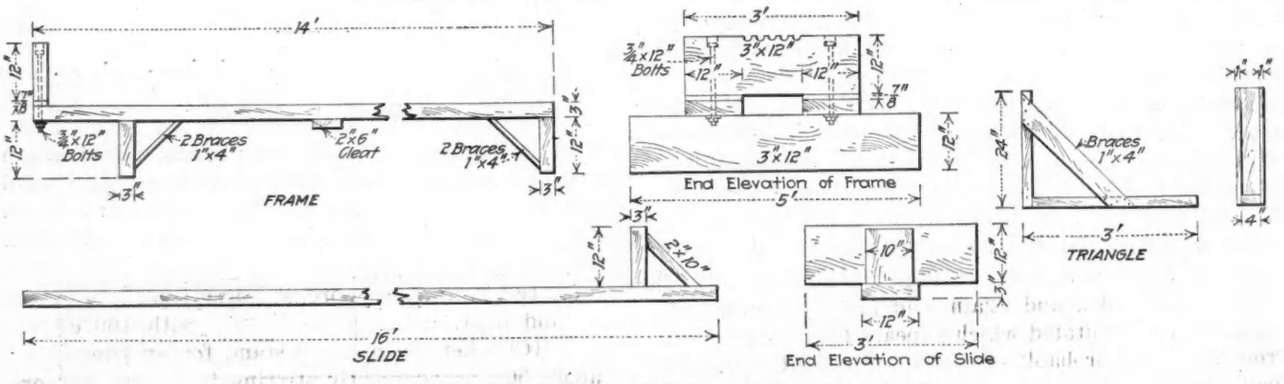
To facilitate cutting off the posts, either square or with the proper bevel, the device shown in the sketch was built and in effect is a large-size miter box. In operation, a ¾-in. hole is bored in the center of each end of the post to be cut off and a short pin of ¾-in. round steel placed in each hole, so that the steel projects about 6 in. The post is then put on the device with the pins resting on the notch in the slide at one end and on the center notch in the frame at the other end. The two triangles are then tacked on either side of the post, square with the frame, where they serve as a guide for the crosscut saw. One end of the post is then sawed two-thirds of the way through, and the triangles are moved to the other end, where a second cut is made. The post is then wedged up at each end, the pins are removed and the cuts finished.

When a batter post is to be cut, one pin is placed in the center notch of the slide and the other in one of the outer notches in the frame, according to the length of the post (before it is cut) and the batter desired. For example, with a 9-ft. post and a desired batter of 1 in. to the foot, the pin at the frame end will be set 9 in. from the center notch. This device is easily made, insures accurate cutting and saves considerable time, especially when the timber is crooked.

Making Grizzlies from Old Rails

In these days it is well to remember that efficient grizzlies can be made out of discarded rails. At mines where it is not especially important to get all the fines out of the coarse ore, the rails can be used just as they are by simply sawing them off to proper length. But even where it is important to get the fines out as thoroughly as possible when dumping over a grizzly, as at a lead mine, efficient grizzly bars can be cheaply made out of old rails.

At the Hecla mine, at Burke, Idaho, an oxy-acetylene blow-pipe is used to cut off the flanges of discarded 85-lb. rails coming from the railroads which serve the mine. The rails are cut to 15-ft. lengths, and then with the oxy-acetylene flame the flanges are cut off even with the line of the web, but so as to leave three wings to each grizzly bar, one at each end and one at the middle. These wings should be 6 in. long and the full width of the rail flange and should be bored for bolting the bars in place. The pieces of flange that are cut off in doing this are also bored, and then made to serve as bars on the fine grizzlies by stringing them on rods with washers between.



DEVICE FOR CUTTING ROUND TIMBER POSTS

Assayer and Chemist

Determination of Tin in Concentrates

BY A. M. SMOOT*

A new method of analysis for stanniferous tungsten concentrates by M. Travers was described before the Academie des Sciences, Sept. 24, 1917. The method, which was stated to have given satisfactory results even in the analysis of ores as rich in tin as 50%, is reported in abstract by *Génie Civil* as follows:

The finely pulverized ores are fused with anhydrous sodium sulphite. The attack is rapid and perfect, even for minerals containing 50% tin. The fused mass, dissolved in boiling water, is diluted to 780 or 800 c.c. and freely acidulated. The brown stannous sulphide precipitates, entraining a little silica and sulphides of iron or of manganese, but no tungstic acid. The stannous-sulphide precipitate is purified by dissolving in yellow ammonium sulphide, and on re-precipitation one has a yellow stannic sulphide which may be calcined to the state of SnO_2. Tungsten is determined simultaneously by fusion of another portion with anhydrous sodium sulphite. The melt is decomposed directly with strong aqua regia; if titanium is also to be determined, sulphuric acid is used. Most of the tungstic acid separates, mixed with silica. The filtrate is treated with ammonia in quantity insufficient to dissolve the tungstic acid. The ferric-hydroxide precipitate, containing the remainder of the tungstic acid, is washed free from sodium salts and dissolved in HCl (1:1). This solution is evaporated to dryness to render the tungstic acid insoluble and may then be separated from silica in the usual way.

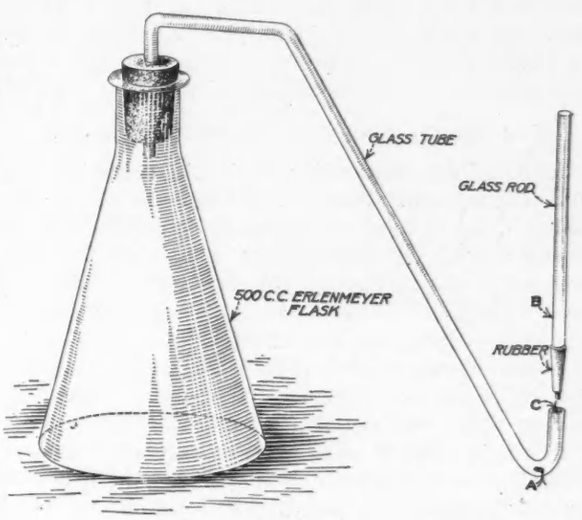
Not being familiar with the action of sodium sulphite as a fluxing agent for tin-tungsten concentrates, I have made a few tests, the results of which show that sodium sulphite is an excellent fluxing agent for tin-bearing tungsten ores. A rather high heat is required, but decomposition of the ore is rapid and complete, tin and tungsten passing into solution when the fusion is leached with water. Even high-grade cassiterite concentrates containing upward of 70% Sn are completely decomposed by a single 10-min. fusion and 60% WO_3 wolframite concentrates are equally well attacked.

The abstract in *Génie Civil* states that when the aqueous solution of the fusion is made slightly acid, brown stannous sulphide is precipitated, entraining a little SiO_2 and Fe and Mn sulphides, but free from WO_3. My experiments show that, in common with all other alkali sulpho-stannates, the solution yields stannic sulphide when it is acidulated, not stannous sulphide. The precipitate contains SiO_2, but only traces of Fe; considerable WO_3 is also entrained when large amounts of it are present in the solution. On dissolving the stannic sulphide in yellow ammonium sulphide, filtering off the iron sulphide, etc., and again acidulating, stannic sulphide is re-precipitated which appears to be nearly free from WO_3, but probably contains a little SiO_2. A test made on a mixture of cassiterite and wolframite concentrates containing 0.0880 gram SnO_2 gave 0.0900 gram SnO_2 by this method. The SnO_2 weighed was not quite pure and the results, as might be expected, are a trifle too high.

*Chief chemist, Ledoux & Co., 99 John St., New York.

The method could be improved by adding tartaric acid or sodium tartrate to the alkaline solution of the fusion before acidulating with a mineral acid; this tends to prevent, or at least diminish, co-precipitation of WO_3. In exact work, especially in the determination of small amounts of Sn in wolframite concentrates, it would be necessary to examine the final tin oxide carefully for impurities, particularly for SiO_2. Arsenic and antimony would also interfere, but they seldom occur in appreciable quantities in commercial tungsten ores.

The method is worth the attention of those interested in the analysis of tin-bearing tungsten ores. Similar methods based on fusion with anhydrous sodium thio-sulphate and with a mixture of sodium carbonate and sulphur are in use. The advantage of anhydrous sodium sulphite seems to be its more rapid and complete action on the ore, possibly due to the higher fusion



CRAIG'S IMPROVED CO_2 APPARATUS

heat required and to the fact that less free sulphur is produced when the solution of the fusion is acidulated, and there is less danger of entraining the tungstic acid.

The method practiced in Ledoux & Co.'s laboratory for the determination of small amounts of tin in tungsten ores and concentrates may be of interest in this connection. It depends upon the practically complete removal of WO_3 before separating tin and is conducted as follows:

Treat two grams of the ore, pulverized in agate to 200 mesh and finer, in a 350-c.c. beaker with 100 c.c. of strong HCl. Let the mixture stand for an hour or so at about 50° C., frequently stirring to prevent the ore from "caking"; slowly evaporate the solution to a volume of, say, 50 c.c. and then add 5 c.c. HNO_3 and again evaporate, with frequent stirring to break up crusts of WO_3, to a volume of about 15 c.c. The small amount of HNO_3 used is practically all decomposed by reaction with HCl and is expelled as nitrogen oxides.

By this method of attack the ore is decomposed more rapidly and thoroughly than by the conventional boiling with aqua regia. Tungsten is separated as hydrated WO_3, iron, manganese and lime pass into solution, silica and tin oxide (cassiterite) remain for the most part insoluble with the WO_3, but a little tin may pass into solution, especially if tin sulphides are present.

Add 100 c.c. of water to the solution and boil for a few minutes. Filter and wash the residue thoroughly with dilute (5%) HCl and save the filtrate, which may contain a small amount of tin. Wash the residue of tungstic oxide, silica and insoluble residue from the paper into the original beaker with a small stream from a wash bottle; add 15 c.c. of strong $NH_4(OH)$ and heat until the tungstic oxide dissolves; filter through the original filter paper and wash thoroughly with dilute $NH_4(OH)$ to remove as much tungstic oxide as possible. The remaining residue may contain a few miligrams of undecomposed tungsten mineral, but this makes no difference, as at least 95% of the tungsten is removed if the operations have been conducted properly. Ignite the residue in an iron crucible, add about ten times its weight of Na_2O_2 and fuse at a red heat. The fusion requires only a few minutes. Dissolve the fusion in water and boil to decompose the excess of Na_2O_2; then add 5 grams of tartaric acid and 20 c.c. of HCl. After a few minutes everything should pass into solution, leaving a clear liquid. Add this to the original filtrate from the tungstic oxide and insoluble residue.

Tin Precipitated with Hydrogen Sulphide

The solution now contains all the tin and only a modicum of tungsten. Pass a rapid current of H_2S into the liquid for 15 min. Tin sulphide is precipitated free from tungsten; it may contain copper or any other members of the H_2S group, together with a little silica and free sulphur. Filter and wash the precipitate with very dilute H_2SO_4. Ignite the precipitate in an iron crucible, converting tin sulphide to oxide. Add about 10 times the weight of Na_2O_2 and fuse again. This fusion requires about one minute. Cool and dissolve the fusion in water, boil to decompose the excess of peroxide and add 5 c.c. of HCl. The solution should be clear except for the possible separation of a little silica. Add 5 or 6 grams of pure granulated zinc and let the mixture stand for a short time. As the zinc dissolves, iron is reduced and tin is separated as metal. Before all the zinc is dissolved, filter the solution through a porcelain Gooch crucible containing a thin asbestos pad; wash once or twice with water. This filtration should be conducted rapidly. Remove the asbestos pad containing the tin and excess zinc to the beaker which contained it, wash any precipitate adhering to the crucible into the beaker, add 100 c.c. of HCl (1:1) and warm. The excess of zinc rapidly dissolves and also the tin, which passes into solution as stannous chloride.

Transfer the liquid to an Erlenmeyer flask fitted with a rubber stopper supplied with an outlet and inlet tube so that a current of CO_2 may be passed through the flask; dilute to 200 c.c., add a coil or two of pure nickel wire, close the flask and start CO_2 through it; heat to boiling and boil for 10 or 15 min. to insure complete reduction of all tin to the stannous condition. Cool, still maintaining a current of CO_2, and, as soon as the solution is cold, remove the CO_2 connections and the nickel wire coils. Add starch indicator and immediately titrate the stannous tin with $\frac{N}{20}$ iodine solution. If preferred, soft-iron wire rather than nickel may be used to reduce the tin. The boiling may be continued, in this case, until the iron is all dissolved, thus avoiding the necessity of removing the wire coils.

Craig's Improvement of CO_2 Apparatus

To avoid the complications of cumbersome CO_2 apparatus, and the paraphernalia connected therewith, the old method is used of boiling in a closed flask fitted with a single tube leading into a strong solution of $NaHCO_3$ (made with boiled water, free from oxygen). This plan was not without drawbacks until Archibald Craig devised a little modification.

The apparatus is shown in the sketch. At the point *A* in the outlet tube a small hole about 1 mm. in diameter is blown in the glass. A glass rod, *B*, is drawn out a little at the end to reduce the diameter and is covered with a small piece of rubber tubing to form a light-fitting stopper for the open end of the tube *C*. The solution to be reduced, together with the iron wire, is placed in the flask, which is then stoppered and placed on a hot plate. Steam from the boiling solution and hydrogen from the action of the acid on the iron rapidly displace the air in the flask, the gas and steam escaping through *C*. When the iron is nearly all dissolved, the solution meanwhile boiling rapidly, a small beaker containing 50 c.c. of strong bicarbonate solution is slipped under the bend of the tube *C*. When the iron is all dissolved and nothing but steam escapes, the plug is inserted in *C*, the apparatus is lifted from the hot plate and the flask is placed in a shallow pan through which cold water circulates. Condensation of steam immediately causes some bicarbonate solution to enter the flask through the small hole at the bottom of the bend. CO_2 is at once generated, establishing equilibrium. Small quantities of bicarbonate solution pass into the flask, generating CO_2 as condensation proceeds. The whole operation is smooth and automatic; it requires no attention whatever after the flask is placed in the cooling pan. A dozen or more flasks may be boiled and cooled at one time without the least trouble, whereas without the plug and the small hole at the bend the action is jerky and often violent because too much bicarbonate is sucked into the flask at one time, there is a sudden and violent evolution of gas and very likely the determination is lost. This simple little apparatus is most useful in all tin and many other determinations requiring reduction in an air-free atmosphere.

The method sounds more cumbersome than the fusion methods, but as a matter of fact it is not. A dozen determinations may be started and carried forward at the same time, since the rather long acid treatments and evaporations require little of the chemist's time. The fusions with Na_2O_2 are short, the filtrations required are only on small volumes of liquid, and are easily made, whereas in the fusion methods the volumes are large and the filtrations slow. On the score of accuracy the acid digestion method should be superior for determining the small amounts of tin usually found in tungsten ores and concentrates. Arsenic, antimony and small amounts of copper do not interfere with the iodine-titration method, and silica need not be considered.

Improved Test for Tungsten

By Roy F. Heath*

The usual test for tungsten is to flux some of the sample finely ground with sodium carbonate, leach with boiling water, acidify with hydrochloric acid, and add metallic zinc or tin, which, if tungsten is present, will cause a series of characteristic changes in color from blue and violet to wine and red. The first change is the most distinctive, namely, that of the solution nearest the metallic substance turning blue or violet. This often occurs so rapidly that it is imperceptible, and the other changes are often insufficient to lead to identification.

The test here described is characteristic and easily carried out: Grind the sample to 60 mesh, take five grams, add 25 c.c. strong nitric acid, digest and boil; add hydrochloric acid if necessary to decompose the ore further; boil, dilute with water, filter off insoluble silica, tin oxide, etc. The decomposition thus collected is usually sufficient for most ores. Take about 15 c.c. of the filtrate in a test tube, add 5-10 c.c. glacial acetic acid and add slowly 8-12 c.c. of test solution made as follows: copper sulphate, 5 grams in 15 c.c. water; stannous chloride, 5 grams in 10 c.c. water; and potassium iodide, 2 grams in 10 c.c. water.

Mix thoroughly and dissolve the precipitate that forms with ammonium hydroxide, which will require about 100 c.c. or more. A fine blue-white precipitate, a mixture of stannous hydroxide and cuprous ammonium sulphate, will settle out, which is soluble in the reagent. If tungsten is present, a characteristic red ring will appear below the solid precipitates. At times the ring is immediately next to the lowest precipitate, and again it may be one-half to one centimeter below. It shows up best against the light.

The test solution should be added slowly down the sides of the test tube. Do not shake the latter, but let the precipitates rise to their height, when, if tungsten is present, the red ring will appear. The usual metals present with tungsten ores do not interfere with this test. The test solution should be kept in a corked bottle and be shaken before using.

Taking Aliquots in Standardizing

The inaccuracy involved in taking aliquot parts of the standard when standardizing solutions, which is due to temperature fluctuations and unavoidable errors of manipulation in the use of graduated instruments, may be avoided, according to C. F. Miller (*Journ. Ind. and Eng. Chem.*, November, 1917) by the following method, which he claims is both convenient and practicable:

About five times as much of the standard as is desired for each titration is weighed out carefully and dissolved in a quantity of water slightly exceeding five times the capacity of the pipette to be used in taking the aliquots. (The pipette need not be standardized, nor is it even necessary to know its exact capacity.) Five portions of the solution are now carefully drawn in an identical manner, and the remainder, together with the rinsings from the pipette, is transferred to a tared platinum dish, evaporated, dried and weighed. A simple calculation gives the exact weight of substance used for each titration. The method can be used only for such substances as Na_2CO_3, etc., which are soluble and separate from the solution again in a weighable form upon evaporation.

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Determination of Tungsten

The following method of determining tungsten is given by A. H. Low in *Chemist Analyst* for February, 1918:

Weigh 0.5 gram of the finely ground ore into an 8-oz. pear-shaped flask (copper-flask). Add 2 grams of anhydrous sodium sulphate and 5 c.c. of strong sulphuric acid. Heat over a free flame, best with the flask in a holder, until the free acid is all expelled and the mixture is reduced to an almost red-hot melt. Allow to cool while rotating the flask slowly so as to cause the melt to solidify on the sides, to prevent cracking the flask. When cool, add 25 c.c. of strong hydrochloric acid and 5 c.c. of strong nitric acid. Boil until the bulk is reduced to about 12 c.c. Add 25 c.c. of hot water and 3 c.c. of cinchonine solution and cool under the tap, or otherwise, to room temperature, or cooler. The cinchonine solution is made by dissolving 25 grams of cinchonine in 200 c.c. of 1:1 hydrochloric acid (quinine may be substituted for cinchonine if desired). Filter the cold mixture through a 9-cm. filter, returning the first portions if at all cloudy. The flask may be rinsed out with cold water if done quickly while the filter still contains liquid.

Wash, filter and precipitate 10 times with dilute cinchonine solution (5 c.c. of the above solution diluted to 100 c.c.) contained in a small wash-bottle. The flask may still retain a little WO_3 adhering to the sides. Spread the filter on a watch-glass and wash the contents back into the flask with hot water, using as little as possible. Pour ammonia over the filter, to dissolve any adhering WO_3, and again wash into the flask. Add a little more ammonia to the mixture and then boil the whole to very small bulk, expelling all the free ammonia. Again filter through a 9-cm. filter, using hot water to rinse out the flask. Receive the filtrate in a similar flask. Now place sufficient warm dilute (1 : 1) ammonia in the original flask and use this solution to wash filter and residue 10 times, pouring on about 5 c.c. for each wash.

Boil the filtrate to very small bulk, even to dryness does no harm. Ad 1 gram of sodium sulphate, 4 grams of ammonium sulphate and 5 c.c. of strong sulphuric acid. Repeat the original heating until all organic matter is burned off and the ammonium sulphate is volatilizing freely. Cool as before and repeat the previous operations at this point until the precipitate is on the filter ready to wash. A little WO_3 may again adhere in the flask. Pour 5 c.c. of strong ammonia into it and boil until all the ammonia odor is gone. Now add 2/3 c.c. of hydrochloric acid, about 1 c.c. of the dilute cinchonine solution and cool under the tap. Dilute a little if thought necessary and pour through the still unwashed precipitate on the filter, then wash the latter 10 times with the dilute cinchonine solution. Ignite filter and precipitate in a weighed platinum dish until the carbon is all burned off. Cool, add a few c.c. of hydrofluoric acid and evaporate to dryness on a water-bath. Again ignite, cool and weigh as WO_3.

Events and Economics of the War

The effort on the part of certain Senators to extend the draft age limits has been abandoned, owing to the opposition of Secretary Baker. A plan for aiding Russia is said to have been determined upon by the President. Fuel Administrator Garfield asked that coal mine employees be exempted from further calls in the draft. The Army, fortifications and sundry civil appropriations bills, totaling $20,000,000,000, were passed by the Senate on June 29. Representative Kitchin, of North Carolina, reported a new bill to the House, authorizing an $8,000,000,000 Liberty Bond issue. Profiteering in various industries was charged by the Federal Trade Commission in a report to the Senate. Western Union Telegraphers have been instructed to strike on July 8. Eugene V. Debs, former Socialist candidate for President, was arrested on June 30 charged with sedition. The President asked for authority to take over all telephone and telegraph lines

Abroad, the Italians have held their ground after driving the Austrians across the Piave; with Allied aid they captured several positions on the mountain front; various other gains by local attacks were made by the Allies in France while awaiting a renewal of the German offensive. The death of ex-Czar Nicholas of Russia was reported but not confirmed. Kerensky is said to be in London. The Canadian hospital ship, "Llandovery Castle" was torpedoed on June 27.

Some Ramifications of Work of Army Ordnance Department

Few citizens have any conception of the various ramifications of the work of the Army Ordnance Department, the idea generally prevalent being that it has something to do with guns and ammunition. As a matter of fact, the Ordnance Department comes in contact and deals with practically every industry in the country, and is daily placing orders with firms all over the United States for materials needed for the successful prosecution of the war. These orders cover a wide range and are placed in quantities that are frequently staggering to the average mind. Commodities formerly ordered in hundreds are now ordered in millions; those formerly placed in ounces, now ordered by the ton. A detailed list of the orders placed even for a short period would occupy too much space, but it may be of interest to those connected with the machines and metals trades to learn of some of the items, orders for which are placed by the Ordnance Department with these most important industries:

Compressed gas reservoirs, openhearth steel, steel bars, pig tin, sheet brass and copper, steel wheels, miscellaneous light and heavy towers with anchors and templets, alloy sheet steel, 1½-in. manganese soft aluminum wire for manufacturing meat cans, copper tanks, gratings, angle iron frames, needle and globe valves, wire, cutter and stapling machines, aluminum sheets and rivets, copper-clad wire rope, screw stock, soft steel wire, brass discs, soft sheet steel, block tin, openhearth sheet steel, ingot and sheet aluminum, ingots of nickel-silver (formerly called german silver), hot-rolled low-carbon openhearth steel, Lake Superior copper, 62½-ton six-wheel switching locomotives, 38-ton 4-wheel saddle-tank locomotives, 40-ton 4-wheel saddle-tank locomotives, parts for locomotives, clam-shell buckets, locomotive cranes, gravity conveyors, 2-wheel dock trucks, 40-ton flat cars, 20-gallon chemical engines, 40-gallon safety fire-bucket tanks, storage-battery trucks, with adjustable and stationary crane hoists; sewing machines, bench skiving machines, and electric drills.

Bureau of Mines Work on Gases Taken Over by War Department

Acting upon his decision that measures for the use of gas in warfare should be coördinated under the War Department, the President on June 26 ordered the transfer to that department of the chemical section of the Bureau of Mines. The entire gas experimental work will be under the direction of Major General William L. Sibert, who has recently returned from France.

The Bureau of Mines has been intensely active in experimenting with new gases and gas masks and has established a special chemical laboratory at American University, in Washington. A large number of American chemists have given the Government the benefit of their experience in this respect. A tribute to Van. H. Manning, director of the Bureau, was paid by Secretary Baker in a letter to the President in which he said: "I do not know how the work could have been better done than Dr. Manning did it, and the present suggestion that the section now pass under the direction and control of the War Department grows out of the fact that the whole subject of gas warfare has assumed a fresh pressure and intensity, and the director of it must have the widest control, so as to be able to use the resources at his command in the most effective way possible. The proposal does not involve the disruption of the fine group of scientific men Dr. Manning has brought together, but merely their transfer to General Sibert's direction."

Would Save Steel in Big Gun Shells

According to a dispatch from Paris to the *Times*, General Percin, who commanded the Lille military district at the beginning of the war and is regarded as one of the leading artillery experts of France, emphasizes the advisability of economizing as much as possible the consumption of munitions, in view of the fact that America is now furnishing less and less steel, owing to the necessity of sending her troops abroad.

Before the war, he points out, Germany produced four times more steel than France, but now, since she has seized the French industrial plants in the north,

she is producing fifteen times as much and possesses 450 blast furnaces against 30 in France.

As a means of economizing steel, he urges the greater use of weapons like the Archer gun, instead of heavy artillery. The Archer gun, says General Percin, at a range of 600 yards, will hit a target 40 times as often as a six-inch gun firing at four-mile range. As the bomb fired by the Archer gun represents only half the weight of steel, though containing about the same quantity of explosive, it is evident, he says, that such guns produce the same destructive effect with one-eightieth of the quantity of steel.

On this basis General Percin argues that the destruction of 375 miles of trenches by Archer guns would cost only £6,000,000, as compared with £480,000,000 by heavy artillery. The necessary steel, he asserts, could be produced in a week, which is industrially possible, instead of two years, which is industrially impossible. General Percin argues that small guns should be used for the work of destruction and the heavy artillery devoted to the protection of advancing infantry, neutralizing mine-throwers, and disorganizing installations of machine guns in shell holes.

Fix Price for Sulphuric Acid

The War Industries Board announced on June 27 that, as a result of a meeting of the manufacturers of sulphuric and nitric acid with the price-fixing committee of the War Industries Board, maximum prices have been agreed upon and approved by the President, taking effect immediately, and expiring on Sept. 30, 1918, as follows:

Sulphuric acid 60° Baumé, $18 a ton of 2000 pounds.
Sulphuric acid 66° Baumé, $28 a ton of 2000 pounds.
Sulphuric acid 20% oleum, $32 a ton of 2000 pounds.
Free on board manufacturer's works in seller's tank cars.
In carboys in carload lots, ½c. a pound extra.
In carboys in less than carloads, ¾c. a pound extra.
In drums, any quantity, ¼c. a pound extra.
Nitric acid 42° Baumé, 8½c. a pound, free on board manufacturer's works in carboys.

A schedule of maximum prices on mixed acids is being prepared, and will be announced later. The above maximum prices are agreed upon for the public as well as the Government. It is understood and agreed that any deliveries made after Sept. 30 will be subject to any revision in price which the Government may make.

Tin Movement as Affected by War

A compilation made by the National City Bank of New York shows that many commodities from abroad that formerly passed through many hands before reaching the United States now come to this country in greater quantities direct from the countries producing them. Among the articles mentioned in the list is tin.

This metal, a product of the Dutch East Indies and the Malayan Peninsula, formerly arrived in large quantities from the Netherlands and England, but fell off markedly in more recent years, while the quantity received direct from the place of production shows striking increases. From the Netherlands, for example, the importation of pig tin into the United States in 1912 amounted to over 4,000,000 lb., and in 1913, 3,500,000 lb., and from the Dutch East Indies nothing. With the opening of the war, however, the imports of tin from the Netherlands fell to 750,000 lb. in 1914, 500,000 in 1915, and nothing in 1916, while the imports direct from the Dutch East Indies grew from nothing in 1913 to 3,500,000 lb. in 1915, 14,000,000 lb. in 1916, and 31,000,000 in the calendar year 1917. In the case of the United Kingdom and its colony, the Straits Settlements, the quantity sent direct from England to the United States fell from 66,000,000 lb. in 1912 to 40,000,000 in 1917; while the quantity arriving direct from the Straits Settlements, the place of production, increased from 33,000,000 lb. in 1912 to 82,000,000 in 1916, and 53,000,000 in 1917.

Storage of Fuel Oil Advised By Fuel Administrator

Companies using fuel oil for operating purposes are being asked by the Oil Division of the U. S. Fuel Administration to store all they can now and to create a reserve storage for the coming winter use, if possible. This does not mean, it is said, that delivery of all oil ordered now can be guaranteed, though an effort will be made to take care of essential industries attempting to secure such reserve supplies. Thirty days' storage is named as the minimum by C. G. Sheffield, assistant to the head of the Oil Division, and 60 days' supply of fuel oil is deemed preferable. Express movement of tank cars on the railroads is affording excellent service to the oil industry. In general, conditions are good for delivery of fuel oil during the summer.

Plans are being considered also by the Oil Division for determining the most satisfactory method of conserving gasoline. It is not expected that it will be necessary to restrict normal consumption for freight vehicles, and, provided there is reasonable conservation by all concerned, it is thought that it will be unnecessary to interfere seriously with pleasure cars and motor boats. However, it is emphasized that the paramount use for gasoline is for war purposes, all of which requirements will be supplied.

Power-Plant Efficiency in Charge of H. W. Knott

The U. S. Fuel Administration has announced the appointment of Henderson W. Knott to manage the field force of engineers and inspectors which is at work among the power plants of the country, carrying out a campaign of instruction and inspection designed to bring the use of fuel for the production of power to the highest possible efficiency and economy. Mr. Knott has been the general manager of the Morgan Crucible Company, of New York.

The appointment of Mr. Knott is a part of the plan, originated by David Moffat Myers, advisory fuel engineer of the Fuel Administration, to have each of the 250,000 steam plants in the United States visited by a competent man who can make suggestions and report in connection with the questionnaire originated by Mr. Myers, working with committees from the four great engineering societies. This work will naturally require a large number of inspectors who will devote their time to the work and visit the plants in person.

Industrial News from Washington

By Paul Wooton, Special Correspondent

Trade Commission Reports on Profits

Profits accruing to 21 copper-producing companies during 1917 ranged as high as 107% on the investment involved and averaged 24.4%, according to a Federal Trade Commission report to the United States Senate.

No unusual profits were made in the zinc industry, with the exception of the New Jersey Zinc Co. The International Nickel Co. is absolved of the charge of profiteering. The Union Sulphur Co. and the Freeport Sulphur Co. each "took advantage of the existing situation to raise their prices," says the report. The commission's reference to copper follows in full:

Very large earnings have been made in the copper industry on the whole, although it should be noted that they have been due in part to an unusually heavy demand for this metal, which is used almost exclusively for war purposes, directly and indirectly. The commission's figures show that 21 companies, including a large proportion of high-cost companies, made profits in 1917 which ranged from 1% to 107% on their investments. The average profit was 24.4%. Probably over 70% of the production is marketed at profits over 20% on investment. These same companies show an average profit of only 11.7% in 1913, which may be considered to be a normal year. Thus the average profit in the industry has more than doubled. The range of profits in 1913 was from 1 to 56 per cent.

The profits used in these computations do not include Federal income or excess-profits taxes, and, therefore, represent sums actually retained by the companies for addition to surplus or dividends.

There does not appear on the whole to have been any concerted action in this industry in putting prices up in the first instance. The war scramble among the Allies shot the prices of copper and other metals to almost unheard of levels. But there are certain strong interests among the producers and marketers which predominate in certain stages of production, and these appear to have taken steps to maintain prices at unnecessarily high levels. In the first place, the smelters, and notably the American Smelting and Refining Co., have continued to hold in force certain deductions for risk of carrying copper bought from mines, which risks have ceased to exist. These deductions were put in force during the early period of the war, before the price was fixed by agreement with the War Industries Board.

Their present maintenance amounts to profiteering at the expense of the miners, especially the small producers. On the other hand, some of the larger and richer mines have contracts entered into before the war running for periods as long as 20 years, which are extremely advantageous to them and which are now causing some refineries to operate at a loss.

With regard to zinc, the report says:

Most of the evidence in the commission's possession indicates no unusual profits in the zinc industry, with the exception of the operations of the New Jersey Zinc Company. Basing percentage on the capital stock issue of $35,000,000, the following net earnings and dividends are shown for the New Jersey Zinc Co., according to published statistics: 1916, profits, 72.5%, dividends 76%; 1917, profits 56%, dividends 46%. The Federal Trade Commission's figures as to these same net earnings and dividends are available only for 1916, and indicate profits of 95.9%, with dividends of 76 per cent.

These large earnings do not indicate excessive profits on metallic zinc. The company's profits on common spelter are very low, and on Grade A spelter, while high, are due to the fact that it possesses a natural monopoly of a certain high-grade ore, the product of which cannot sell for less than the zinc produced by competitors. In fact, the whole explanation of the New Jersey Zinc Co.'s large profits lies in its possession of an orebody of unusual richness and purity.

The operations of the International Nickel Co. are commented on as follows:

The dominating factor in the nickel industry is the International Nickel Co., which produces practically the entire output of that metal in this country. The profits of the International Nickel Co. in 1916 were $13,557,000, and the dividends were $10,575,000, which sums amounted to 40% and 31%, respectively, based upon the investment as computed by the commission. Taking the total capitalization and surplus of the company as a basis, the net earnings would be 20% and the dividends 15.6%. In 1917 the profits on the commission's basis were 30% and the dividends 24%, and on the basis claimed by the company the profits were 15% and the dividends 12 per cent.

This company has a natural monopoly based on the ownership of the Canadian mines from which the nickel ore is derived. It has, however, maintained prices on a pre-war basis. Consequently, while prices are high and the profits very large, the increase in profits has been due to the increased war output rather than to advances in price. Therefore it does not seem that any profiteering can be charged unless in a negative sense, that is, the company might have been satisfied with smaller profits in war times. This is especially worthy of consideration, inasmuch as practically the entire output of the company is taken for war uses.

The following information was presented in connection with the investigation of the sulphur-producing companies:

Two companies produce all the sulphur in this country—the Freeport Sulphur Co. and the Union Sulphur Co. The cost to the Freeport company in 1917 was $6.15 per ton; in 1918 it is estimated that increases will bring the cost up to not over $9.50 per ton. In the first half of 1917 the Union company's costs were $5.73 per ton. The average realization of the Union company in the first half of 1917 was $18.11 per ton, making a margin of $12.38 per ton. The manufacturers of sulphuric acid are paying in the neighborhood of $25, and some as high as $35 per ton, making margins of over $15 per ton for sulphur companies. The Freeport company's balance sheets show an operating profit for the 11 months ending Oct. 31, 1917, of $4,301,310, or 236% on investment. On Nov. 30, 1916, the company's balance sheets show dividends declared of $925,000; on July 31, 1917, $1,850,000; and Oct. 31, 1917, $2,600,000. Its surplus increased from $1,254,000 in November, 1916, to $2,543,000, in October, 1917.

These companies may be said to have a natural monopoly of sulphur. Since they have placed their operations upon an established basis, they have always made large earnings. They have taken advantage of the existing situation to raise their prices.

An effect of price-fixing is described as follows:

In the case of basic metals, as in steel, when the Government announced a fixed price, it was made so high that it would insure and stimulate production. This has resulted in giving a wide range of profits. Under the device of cost plus a margin of profit, these profits are necessarily great in the case of the low-cost mills. Thus while the market was prevented from running away, as it would have done undoubtedly if it had not been regulated by a fixed price, the stronger factors in the industry are further strengthened in their position and enriched by profits which are without precedent.

Employment Service for War Industry

Commenting on the present labor situation, Felix Frankfurter, chairman of the War Labor Policies Board, said: "Feverish competition for labor rushes men and women from place to place, with the result that the national energies are wasted and the patriotism of the individual workers is frustrated. The labor turnover

in the war industries has become intolerably great. Various departments of the Government, under the chaotic private labor-recruiting system, have been 'stealing labor' from each other. Essential industries have been bidding for workers employed in, and needed by, other essential industries. Only a national supervision of labor can destroy the menace.

"The War Labor Policies Board has decided to ask all employers engaged in war work to abandon competitive labor recruiting and to make the offices of the U. S. Employment Service their exclusive agents. At the outset, this arrangement is intended to be applied to unskilled labor. All war industries must first be supplied promptly and adequately with competent workers."

Taxation Discussed Before Committee on Ways and Means

A careful selection of witnesses representing a large number of industries has enabled the House Committee on Ways and Means to obtain some of the best thought in the country on taxation. The hearings were much more extended than is usually the case. Many urged a large income tax. Typical of these arguments was that of William Kent, a member of the Tariff Commission, an excerpt from whose statement follows:

"Revenue can come only from one source, if it is to be permanent revenue, and that is production. Therefore, in framing any tax legislation, the primary thing to render that source permanent is to see that production is not crippled or destroyed; that enough is left to continue that production and enough is left to furnish funds for the increase of that production. When, in a time like this, we come to applying what we might call the corrective, remedial idea of taxation, it should be along the line of driving people into production, of driving land into production and of increasing the fund thereby out of which permanent revenues can be obtained.

"It is my belief that one-third of the revenue to pay for this war can be raised. If more could be raised, I should be in favor of raising it, provided always that it can be raised without destroying production. I hope to see every means taken that will drive people and resources into production."

Representative Slemp, of Virginia, while appearing in the interest of the coal-mining industry, set forth clearly many incontrovertible facts which apply to all mining enterprises. Extracts from his remarks follow:

"Differing from manufacturing establishments, considerable capital expenditures must be made from time to time to maintain a coal mine at a steady rate of output. As the mine ages and the coal area nearest to the tipple is depleted of its minable coal, it becomes necessary to lay additional amounts of rail, to provide more copper, switches, frogs, timber and everything that goes toward extending the tram system. There must be additional cars and motors. As the mileage of the trips increases, the efficiency of the cars decreases. The turnover becomes lower

"There are new factors which all operators must face. It requires more housing today per unit of coal mined than it did three years ago. The single men who have been boarders with the married men no longer form so large a proportion of the mining force. They have been reduced by the draft and volunteer enlistments. They have been attracted in greater numbers to other industries than have the married men. The cost of houses has advanced. Standards of living have advanced. Miners are not content with the class of house which they were willing to rent in 1914. The coal-mine laborer of today does not want to live in a shack. Competition for mine labor has been so keen in the last two years that increasing rents has been out of the question.

"A standard three-ton mine car could be purchased in 1915 for $96. To replace that car late in 1917 took $240. Car repairs through the increase in labor and materials are affected at double the former cost. The electrical equipment situation is even worse. Any operator purchasing new mine machinery will have to depreciate its cost at least 50% before a reduction to normal prices comes, or he will find himself with equipment on hand that has been in use for a considerable period and yet stands on his books at a higher cost than he will be asked to pay for new equipment if prices decline to the 1916 basis. Unless operators are allowed to make some such liberal allowance for depreciation, they cannot afford to buy the equipment which is necessary, not to enlarge their output, but to keep their output up to its existing standard.

"If the operator is not permitted to make some reasonable allowance for advanced work, the temptation will be great for him merely to mine such coal as is obtainable with existing development and equipment. The mine operator has the problem of other lines of industry as well as those above outlined."

Training Engineer Officers

Training of the 2000 candidates for commissions as captains and first lieutenants in the Engineer Corps will be undertaken at Camp Humphreys, 17 miles south of Washington on the Potomac River. Facilities at Camp Humphreys, in addition to the military arrangements, include 15 special schools, at which men are instructed in such operations as mining, quarrying, gas and flame defense, barbed-wire fortification, water supply and railroad communication.

The candidates for commission will be given instruction at all the special schools, after which they will take a course in sapper work, so that they may be fitted to command sapper troops if the necessity should arise. A campaign is now under way to interest men of technical training and experience to enter the officers' training camp, to open about August 1.

Platinum Licenses Ordered in New Bill

If the conferees do not change a Senate amendment to the Sundry Civil bill, those handling platinum must be licensed. The licensing will be handled by the organization created to administer the Explosives Act. The wording of the amendment is as follows:

"Platinum and compounds of platinum are hereby made subject to the terms, conditions and limitations of said act of Oct. 6, 1917 (the Explosives Act), and the Director of the Bureau of Mines is hereby authorized, under rules and regulations approved by the Secretary of the Interior, to limit the sale, possession, and use of said material.'

What's a Regiment Without a Band?

Oh, the windjammers, the windjammers,
The regimental bands!
Their eager blare's one battle prayer
Each "doughboy" understands!
While they may use no bay'nets,
Throw no bombs, nor catch Von Hin,
It's the puffin', sweatin' bandsmen
That will lead us to Berlin!

Howard W. Gleason, in *The Sun.*

To Berlin—that's where they are headed for; so why not give then a band so they can do the trip in style worthy of the industry they came from? Marching gets humdrum after awhile. A band lightens the pack and shortens the way and drives all ordinary troubles into the limbo of forgetfulness. When the boys of the Twenty-seventh heard they were to have a band they became all puffed up in anticipation, for it is not customary for engineer regiments to have them. Just why this is we don't know, but, at any rate, with the new instruments received plus those they already have, the mining regiment will have a "very sizeable band," as Lieut. Col. Perry puts it. So eager were the boys for the music that they agreed to carry the instruments themselves in addition to their regular packs. The bandsmen of the Twenty-seventh will be fighters as well as miners, unlike Gleason's windjammers, cited above, and are equipped for the purpose. Their daily schedule will be exceedingly full.

Interest up to June 26 on bank deposits of the Comfort Fund has amounted to $82.61, which has been added to the following list of contributions. Let us add your contribution likewise to the list:

Previously acknowledged	$13,664.00
Students of Wisconsin Mining School	50.00
A. M. Plumb	5.00
C. W. Snow	2.50
Charles A. Mitke	5.00
A. A. Hassan	10.00
A. A. Hassan, Jr.	5.00
Emin A. Hassan	5.00
Bernard MacDonald	5.00
C. F. Rand	50.00
Calumet & Arizona Mining Co. and New Cornelia Copper Co.	400.00
Oscar Lachmund (fourth contribution)	10.00
C. N. Bell	10.00
C. S. Witherell	25.00
W. G. McBride	25.00
Karl Eilers	50.00
R. T. Hancock	5.00
E. E. White	100.00
S. Ringlund	10.00
H. Foster Bain	10.00
Marc Bailey	10.00
Charles le Vasseur (second contribution)	5.00
William Wraith	25.00
H. A. Wheeler	10.00
Nevada Mine Operators' Association	100.00
Louis R. Wallace	50.00
H. P. Bowen	5.00
H. L. Brown and M. W. Hayward	16.00
Iron Cap Copper Co.	50.00
W. N. Smith	10.00
E. S. Geary	5.00
H. J. Wolf	10.00
F. H. Siebold	10.00
H. A. Kee	10.00
W. S. Grepher	5.00
Marion L. Thomas	10.00
E. F. Eurich	10.00
Liberty Bell Gold Mining Co.	200.00
H. De Witt Smith	15.00
Francis Thomson	10.00
New Idria Quicksilver Mining Co.	100.00
F. P. Burral	25.00
Livingston Wernecke	5.00
Oscar Lachmund (monthly contribution)	10.00
E. P. Mathewson	50.00
Interest to June 26	82.61
Total	$15,285.11

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

Engineers' Response to War Demands

That the part which engineers are playing in the war is a great one was affirmed by Maj. Gen. William M. Black, Chief of Engineers of the United States Army, who recently spoke at a meeting of the American Institute of Electrical Engineers. At the outbreak of the war, there were in the Engineer Corps of the Regular Army about 300 officers and approximately 3500 enlisted men. At the present time there are about 8000 commissioned officers and 200,000 enlisted men who were formerly engaged in work of an engineering character. It is probable that this does not represent much more than one-half of the number of the profession now serving in the Army.

War was declared April 6, 1917. By the middle of July nine regiments of railroad engineers had been raised and organized and two had actually started for France. In each regiment were two officers of the Corps of Engineers of the Regular Army—the Colonel and the regimental Adjutant. The remaining officers were all from the Engineers' Reserve Corps, some receiving their commissions only when on the point of sailing. Of course, few of the officers had had any previous military training, and the tasks of organization were difficult.

Since then there have been organized five corps regiments, consisting of sapper, searchlight, and sound ranging troops; forty-three sapper regiments and trains, two mounted battalions and trains, five pontoon trains, four inland waterway companies, forty railway regiments and battalions, including all classes of standard gage and light railway troops necessary for the construction, operation and maintenance of railways; one railway transportation corps, one highways regiment, one gas and flame regiment, one gas training service, five forestry and auxiliary forestry regiments, one surveying and printing battalion, one military mapping service, two supply and shop regiments, one water supply regiment, one quarry regiment, one mining regiment, one electrical and mechanical regiment, two crane operating companies, one camouflage battalion, eighteen truck and auto companies, and forty-four depot detachments.

The great part of these organizations is now overseas. Some are serving with the British Army, some with the French, but the majority are with our own troops in service, both at the front and in the rear.

This service of the rear is of great importance and magnitude. Picture to yourself what is required to transport, house, supply and maintain a million men 3000 miles from home, producing nothing and in their work expending enormous amounts of materials.

Taking the question of storage alone, the provision of space required for an army of 1,000,000 for 90 days aggregates 20,000,000 sq. ft. of floor space of covered storage and double that amount of uncovered storage space, with the necessary railway tracks, for receipt and shipment and for classification yards aggregating about 650 miles.

Add to this an equal mileage of highways, adequate provision for water supply, sewerage, and electric lighting, and you can realize the work involved in this one item. Add to this, further, the constructions which have been built at the ports of debarkation, (at one of

which 375,000 sq.ft. of wharf space had to be provided), the hospitals, barracks, shops, and the lighting, water, and sewerage systems required, and some conception of the actual new construction work can be formed.

It is estimated that the supply of the Army requires the transportation to the front of 25 lb. a man a day. This makes heavy demands on the French railway systems, good as they are. These have had to be supplemented in all but the main-line trackage, and a large amount of motive power and of rolling stock has had to be supplied and operated.

Licensing of Engineers Interests Engineering Council

At the regular meeting of the Engineering Council on June 20, a special report by the public-affairs committee on the licensing of engineers was debated at length. It was decided to create a small special committee, with carefully selected membership, to study this important question thoroughly with a country-wide view. It is intended that the Engineering Council shall in due time be prepared to advise engineering organizations in any of the states upon this matter. Engineers who have knowledge of proposed legislation are requested to communicate with the secretary of the council. Information or rumor has already been received of possible action by the legislatures of Iowa, Ohio, Indiana and Michigan. As is well known, a few states have passed licensing laws.

Talc Production in 1917

The total output of talc in the United States during 1917 was 198,613 tons, valued at $1,889,672, according to figures compiled by the U. S. Geological Survey. Thirty-seven producers reported, of which seven were in California, six in Georgia, one each in Maryland, Massachusetts, and New Jersey; four in New York, six in North Carolina, two in Pennsylvania, five in Vermont, and four in Virginia.

Heretofore New York has been been the first state in quantity and value of talc produced, but in 1917 its output was less than that of Vermont, although on account of the fibrous character of the talc produced in New York and its consequent high value for making paper, the total value of the output in New York is still greater than that of any other talc-producing state.

The quantity of talc imported for consumption in 1917 was less than 10% of the domestic output, but a larger proportion of it is of high grade. More than half of the talc imported comes from Canada and is of a grade that commands a higher price than the domestic product.

June Mining Dividends

Dividends paid in June, 1918, by 40 United States mining and metallurgical companies making public returns amounted to $24,662,838, as compared with $38,365,938 paid by 49 companies in June, 1917. Holding companies allied to mining paid $323,433, as compared with $768,433 in 1917. Canadian, South American and Mexican companies paid $2,288,942 in June, 1918, and $1,892,601 in June, 1917.

The totals for the first six months of the year 1918 are as follows: Mining and metallurgical companies, $89,851,922; holding companies, $1,076,866; Canadian, Central American, South American and Mexican mines, $9,390,953.

U. S. Mining and Metallurgical Companies	Situation	Per Share	Total
Ahmeek, c	Mich.	$2.00	400,000
Allouez, c	Mich.	1.50	150,000
Am. Sm. and Ref., com	U. S.-Mex.	1.50	914,970
Am. Sm. and Ref., pfd	U. S.-Mex	1.75	875,000
Argonaut Cons., g	Calif.	.05	10,000
Caledonia, l. s.	Ida.	.03	78,150
Calumet & Arizona, c	Ariz.	2.00	1,284,960
Calumet & Hecla, c	Mich.	15.00	1,500,000
Centennial, c	Mich.	1.00	90,000
Chino, c	N. M.	1.00	809,980
Cons. Ariz. Sm., c	Ariz.	.05	83,150
Cons. Interstate-Callahan, z	Ida.	.50	232,495
Copper Range, c	Mich.	1.50	591,598
Cresson Cons., g	Colo.	.10	122,000
Davis Daly, c	Utah	.50	300,000
Eagle & Blue Bell, l. s.	Utah	.10	89,315
Federal Min. & Sm., pfd	U. S.	1.75	209,757
Golden Cycle, g	Colo.	.03	45,000
Homestake, g	S. D.	.50	125,580
Internat. Nickel	U. S.-Can	1.00	1,673,384
Iron Cap, c	Ariz.	.75	108,608
Is.e Royale, c	Mich.	.50	75,000
Kennecott, c	.....	1.00	2,787,028
Magma, c	Ariz.	.50	120,000
Nevada Con., c	Nev.	.75	1,499,593
New Jersey Zinc	U. S.	4.00	1,400,000
North Star, g	Calif.	.20	50,000
Old Dominion, c	Ariz.	1.00	297,071
Oroville Dredg., g	Calif.	.12	82,385
Osceola, c	Mich.	2.00	192,300
Phelps Dodge	U. S.-Mex.	6.00	2,700,000
Quincy, c	Mich.	2.00	220,000
Ray Con., c	Ariz.	.75	1,182,384
St. Joseph Lead	Mo.	.50	704,733
Tamarack & Custer, l.s.	Ida.	.03	53,287
Tintic Standard, l.c	Utah	.06	70,480
Union Cons., s	Nev.	.05	10,000
United Eastern, g	Ariz.	.05	68,150
Utah Copper	Utah	2.00	3,248,980
Yellow Pine, z.l	Nev.	.06	60,000
Yukon Gold, g	U. S.	.02½	87,500

Canadian, Mexican and So. American Companies	Situation	Per Share	Total
Cerro de Pasco, c	So. Am.	1.25	1,009,474
Esperanza, g.s.	Mex.	.24	109,200
Hedley, g	B. C.	.15	36,000
Hollinger, s	Ont.	.05	246,000
Kerr Lake, s	Ont.	.25	150,000
Lucky Tiger-Comb., g	Mex.	.10	71,534
McIntyre Porcupine, g	Ont.	.05	180,514
Mex. Mines of El Oro, g	Mex.	.96	174,960
Min. Corpn. of Can., s	Ont.	.18¾	311,260

Holding Companies	Situation	Per Share	Total
General Dev.	U. S.	1.00	120,000
Yukon Alaska Trust	.....	1.00	203,433

Increase in Asbestos Production

The total quantity of domestic asbestos sold in 1917, according to the U. S. Geological Survey, was 1683 short tons, valued at $506,056, an increase of about 13% in both quantity and value over 1916. Most of the domestic asbestos comes from Arizona, where the proportion of crude spinning fiber to that of lower grades is much larger than in Canada, so that the average price of American fiber in 1917 was $301 a ton, whereas the average price of that in Canada was only about $50.

Some years ago the opinion was expressed that as the Arizona fiber contains less iron than that mined in Canada, it is therefore better adapted to use for electrical insulation than the Canadian fiber. This impression has recently been confirmed by analyses made by R. E. Zimmerman, of Pittsburgh, whose investigations also indicate that the harshness of certain parts of the Arizona asbestos is due to thin films of calcite among the fibers. The demand for imported asbestos for use in filters is being supplied by amphibole asbestos obtained from residual deposits of the crystalline rocks of Maryland.

Editorials

"Profiteering"

THE report on "profiteering" addressed to the President of the United States Senate by the Federal Trade Commission in response to a Senate resolution asking for detailed information on this subject, issued on June 29, was manifestly timed for political purposes, especially in connection with the new tax legislation. It is as extraordinary a document as was to be expected from a public body possessing the unbalanced mental constitution of this one. Unfortunately it is likely to have a misleading and disturbing effect upon the public, which does not know, or has forgotten, how the Federal Trade Commission was discredited in the matter of fixing coal prices about a year ago. In our opinion this body was more responsible than any other one agency for setting in motion the wheels that produced the calamity of last winter.

The present report on the subject of "profiteering" does not read to us like an unprejudiced report. According to it, profiteering exists, and "much of it is due to advantages taken of the necessities of the times, as evidenced in the war pressure for heavy production, but some of it is attributable to inordinate greed and barefaced fraud." In the industries that are enumerated—flour milling, coal mining, petroleum refining, meat packing, steel, copper, nickel, sulphur, lumber, canned milk, and salmon canning—the commission finds in almost each case that too large profits are being realized. Its common method of stating the case may be illustrated by its remarks in connection with copper, as follows:

"The commission's figures show that 21 companies, including a large proportion of high-cost companies, made profits in 1917 which ranged from 1% to 107% on their investments. The average profit was 24.4%. Probably over 70% of the production is marketed at profits over 20% on investment." It will be noted from this that the commission has not reviewed the whole industries, but has taken samples, so to speak, more or less large, which in the case of copper include "a large proportion of high-cost companies"; but it is not given to us to know what proportion, or anything more respecting the details. This is something like what would be the report of a mine sampler who said that the vein was of spotted character, wherefore he had thrown into his sample what he considered to be a proper proportion of gangue material or metallics, according to his disposition. Furthermore, in computing the percentage of profit, the commission figures upon what it considers "investment." It does not permit us to review its figuring as to that all-important and highly complicated factor.

Presumably, the commission bases its figuring upon what was originally put into a business, disregarding capital earned and reinvested. Indeed, it specifically condemns the meat packers for having capitalized their surplus earnings of the past, their earnings when figured on that basis being at a much lower rate than what the commission figures. It is allowed to leak out, moreover, that the companies do not agree with the commission respecting investment. Thus, the commission says that in 1917 the profits of the International Nickel Co. on the commission's basis were 30%, but on the basis claimed by the company they were only 15%. Of course, the general public, and even many Congressmen, will not understand that in the figuring of investment the company may be right and the commission wrong; and if the latter, all of its sensational deductions are exploded. As between the companies and the commission in this fundamental matter, we are disposed to uphold the intelligence and sincerity of the companies, rather than those of the commission.

Dismissing this fundamental matter, the bone of complaint by the commission is that in any industry while one concern may realize a profit of only 1%, other concerns earn 100% or more. In practically all of the major industries it found that condition to exist. However, the mental obliquity of the commission is well illustrated by its remarks regarding zinc, as to which industry "the evidence in the commission's possession indicates no unusual profits . . . with the exception of the operations of the New Jersey Zinc Co." Then it proceeds to extenuate the New Jersey Zinc Co. and explains that its large profits result from its possession of an orebody of unusual richness and purity. That is true enough, but similarly, in the copper industry, the large profits of Anaconda accrue from its development of unusual metallurgical talent and its expenditure of millions of capital in order to put its new and dearly earned knowledge to account; the immense profits of Utah result from the bold imagination of engineers and financiers, who risked fortunes scarcely more than 10 years ago in the exploitation of what was then a mountain of worthless material, the success of the enterprise becoming assured but relatively recently, after many years of travail; the United Verde Extension company was rendered very profitable by the discovery of a mine of "unusual richness" in a district wherein previous prospecting, unusually expensive and hazardous, had been fruitless.

In speaking of the brimstone producers, the commission tells an absolute untruth when it says that these companies—the Freeport and the Union—"may be said to have a natural monopoly of sulphur." They have no such thing. Exploitation of sulphur deposits in Louisiana was begun about 30 years ago, and large sums of money were lost in the attempt to mine them. Success did not come until after many years of trials and tribulations. The Union Sulphur Co. was organized to extract the sulphur by a new, revolutionary method, which at the time of its introduction was pronounced chimerical by many experts. Such monopoly as ever existed in this industry was due to patent rights, but, either

through the expiration of such rights or by the generous release of them by the Union Sulphur Co. during the time of war, the Freeport company in Texas was enabled to become a large producer and large competitor. Nor was the field restricted to those two companies, for even now other companies, one of them a strong one and claiming the possession of a larger deposit of sulphur than Freeport, is prosecuting plans for production as rapidly as priority orders will permit it to do so.

With regard to the matter of price-fixing, the commission tries to ride two horses and falls off completely. On the one hand, it thinks that price-fixing has increased profits and enabled the stronger companies to be "enriched by profits which are without precedent," and therefore finds fault. And on the other hand, it declares that the petroleum companies have made large profits owing to there having been no price-fixing and "as yet no Government interference with the law of supply and demand."

Really, the burden of complaint of the Federal Trade Commission is that in our industries there are any profits that reflect the results of anything better than low-grade or mediocre management, the kind that would mean stagnation in our industries and not unlikely would mean our losing the war. The commission says, naïvely: "The outstanding revelation is the heavy profit made by the low-cost concerns under a Governmental fixed price for the entire country." What else did the commission expect? Does it think the proper thing would be to fix a price for each producer, according to his particular cost of production? Such a program as that would, indeed, halt the wheels of commerce and industry and spell disaster.

What we are really getting at, what Congress will get at if it is able to see through the hallucinations and dishonesties of the commission's report, is that the uneconomic policy of price-fixing should be abandoned and that the unusual profits realized by capital that are directly attributable to the war should be equalized by taxation, by a true system of taxing war profits. This is what conservative economists, as distinguished from the emotional and opportunist, have been arguing from the beginning. Congress may well take note that the Federal Trade Commission last year advised the Administration disastrously with respect to what coal prices ought to be. It will do well to be suspicious of the present advice of this discredited doctor.

The Value of Practical Details

ONE of the best examples of the advantage in mining for a man of wide practical experience to travel from property to property in order to study mining practice of the different camps and describe them in detail for the benefit of mining men as a whole is to be found in "Details of Practical Mining" this week. A tool known as a picaroon, which is of great service in handling timbers underground, especially heavy stulls, is described. Made from worn-out axes, the picaroon has been in use for at least 20 years in the mines of the Cœur d'Alene district. And in spite of the great utility of the device, it has not been used, as far as we know, in other mining camps. One reason, perhaps is that foremen do not change often from district to district, and rarely do mining companies send their foremen to see what mines in other parts of the country are doing. Mine managers and superintendents travel, but such details as these are frequently passed by, as the visiting engineer usually is trying to cover the ground so rapidly that he sees only the larger points in the practice of a district and neglects many of the details, except when some phase of the practice makes an especial appeal to him. Only a man who studies the practice in detail, in the different camps of the country, appreciates these minor points and sees the importance of describing such an apparently trivial device as the picaroon. New ideas are constantly appearing in the mining field; old ideas, which to some are new, may be the means of solving a troublesome problem, and therein lies the value of a practical details department.

The American General Staff

IN THREE important elements the Allies have never since 1914 been inferior to the Central Powers: (1) morale and fighting qualities; (2) numbers of trained soldiers; (3) material resources. The inferiority resulting from separate commands has recently been cured by the Versailles Council and the appointment of a supreme commander-in-chief. But the great superiority of the Central Powers lies in the great German General Staff. All their successes have come from this institution. No attempt has been made by any of the Allies to duplicate it, and there can be no victory until this has been done; nothing but a continued wasting of men and resources.

This organization absorbed through careful selection all the most capable and trained thought in the province of war. Strategy, preparation—every problem that can be solved back of the lines—is its province, and to the field commander is left only the task of translating its plans into acts. Modern warfare is too complex and too vast to be conducted successfully by any other system, but the Allies still preserve the archaic method of selecting an individual as commander-in-chief and leaving it all to him. There can be no victory so long as this fatal policy of trying to win by exalting an individual and opposing him to this kind of an organization continues. The result has been that during four years of warfare the initiative has generally been with the enemy. Trench warfare, trench mortars, long-range artillery and "pill-boxes" have all been theirs. They have taught the Allies, who have, under fire, only bravely imitated them for the purposes of defense. What have the Allies had to show except the tanks?

It is possible, in this country, by reason of the President's position as commander-in-chief of the Army, to duplicate in all important essentials the German General Staff, and so incorporate into it all of the boards recently constituted, together with such features of their organizations as may be adopted.

An illustration of one of the gravest defects in the Allied armies resulting from clinging to ancient methods in constituting military units is the failure to provide for the proper number of engineers and expert construction men in their regiments. In modern warfare at least four-fifths of the work of the army calls for engineering and construction, while not more than one-fifth is strictly military. The result is that the overwhelm-

ing amount of this construction work to be done finds the Allies, trained strictly to fighting, to be both inexperienced and without the necessary training or organization to meet the new construction requirements.

The Germany army is the only one that from the beginning of the war has adapted itself, by reason of the intelligent direction of its general staff, to this revolutionary condition of modern warfare. At no time in pure fighting has it been superior to any of the Allies, but its superior efficiency lies in its superior organization for purely construction work. Every German regiment contains a certain percentage of engineers and trained construction officers, and every soldier is qualified in construction work.

The Price for Copper

THE War Industries Board on July 2 advanced the price for copper to 26c. This is a recognition that we need more copper and that the way to get it is to give a stimulus that will lead to the utilization of antiquated furnace capacity and will afford an incentive to those mines to continue production that heretofore have been doing no more than break even. This is the argument that we have emphasized all along. That favorable attention has been given to it is a hopeful sign. The Government now recognizes that a fixed price is restrictive of production. An arbitrary price that is subject to change, and may in fact experience a change, possesses different qualities from one that is supposed to be finalized.

The Index—Volume 105

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

If you want a copy of the Index, send in your request promptly. A postcard will do.

The gas service of the U. S. Bureau of Mines has been transferred by order of the President to the War Department, it being considered that greater unity of purpose can be accomplished by having this essential branch of modern warfare under the Secretary of War rather than under the Secretary of the Interior. In making the change, both the President and the Secretary of War addressed highly appreciative letters to Mr. Manning, Director of the Bureau of Mines, recognizing the important service that he has rendered to the country in organizing and developing this work. Their testimonials are highly merited, and the well-deserved honor coming to the head of the Government's Bureau of Mines will be warmly acclaimed in our industry.

BY THE WAY

Our friend D. M. Riordan, of San Francisco, has issued to the many who love him the following notice:

TO ALL TO WHOM THESE 'ERE PRESENTS MAY COME
Greetings, Health and Apostolic Benediction:

The purpose hereof is to proclaim, announce, and also give notice, that from about the 20th of June until about the 5th of July, I shall as a rule not be "on deck" at the office in the Underwood Building. My whereabouts will be as difficult to locate as I can make it, except to one or two who may be with me; they, however, will probably know that I am somewhere in their vicinity, every waking minute.

The proximate cause of this announcement is that, between the aforesaid dates, I will try to "get by" the 70th mile-post on the Journey from Whence to Whither—my baptismal record being kept in Watervliet, N. Y., dated July 1st, 1848, and indicating that my discovery of America on the banks of the Hudson took place some days previously.

So "fur" the "going" has been good—that is to say, purty good; some rocky road; some corduroy; some swamp, and some hill-climbing, and some heart-breaking, dead-level sandy wash, and a pitiless sun that just wouldn't set, but seemed to stand still in a brazen sky, at times. But, on the whole, probably better'n I deserved; and, ef I do say it as shouldn't, better, a great deal better, than that of a good many wayfaring men I have met who deserved better than they got. So I have no cause for complaint, and am blessed with abundant reason for rejoicing, for thankfulness to the Giver of all good; for health, for hopeful and helpful companionship, for the blessings of Emancipation from many things once foolishly desired, until granted, then graciously withdrawn, leaving me disciplined, disappointed, and sometimes bewildered; but in the end with sorrow and regret turned to gladness and interior peace.

During this 70-year Journey, I shall have worked, man and boy, 60 years; and, calling the Journey the "Week of Years," of which the Book speaks, and each decade thereof a Day, I shall have worked six full days of the Week. And I think if I keep at my tasks 20 years more, spending in leisurely fashion the afternoon of the Sixth Day, I will be putting in a little overtime, and should thereafter be entitled to a Sabbatical period, to do the things I like and enjoy doing, thus keeping busy, and I trust useful, up to the end.

We used to think that Mr. Riordan belonged with us in New York, whither he had naturally gravitated after a stirring career in the West, but San Francisco lured him away. Many will join us in extending to him felicitations upon his anniversary of July 1, said felicitations to be delivered not before July 5.

Mr. Hoover is going to England, and during his stay in that country will be the guest of the nation, whose hospitality, with singular appropriateness, will be made manifest and effective through the agency of the British Food Ministry. In the first half of the year 1914 Mr. Hoover was comparatively unknown to his fellow countrymen. Since then he has become a national figure, says the *Sun*. He has risen from the obscurity which compelled his identification by the name of Herbert C. Hoover, through the stage in which he was known as Herbert Hoover, to the high place in which he is immediately recognized when Mr. Hoover is mentioned. It is not improbable that he may eventually attain that enviable distinction which confers on a man the supreme privilege of being hailed among his fellows by his unadorned surname, shorn of all prefixes and suffixes. He is unquestionably headed that way. At this moment, rendered auspicious by the extraordinary honor to be conferred on Mr. Hoover by the British Government, the *Sun* salutes him with affection and admiration. He is as well thought of at home as he is abroad. His fellow countrymen testify to their respect and affection for him by obeying his injunctions cheerfully and without repining. He has accomplished a maximum of good with a minimum of friction. In cutting down our rations he has earned our good will, just as he earned the good will of the Belgians by increasing their rations.

The Mining Index

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print) in the original language for the price quoted. Where no price is quoted the cost is unknown. Inasmuch as the papers must be ordered from the publishers, there will be some delay for the foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for $1, 33 for $5, and 100 for $15. When remittances are made in even dollars, we will return the excess over an order in coupons if so requested.

COPPER

9386—ANALYSIS—Determining Copper Minerals in Partly Oxidized Ores. Felix Cremer. (Met. and Chem. Eng., June 15, 1918; 2¼ pp.)

9387—ARIZONA—E'ectric Power for Mining in Yavapai County, Arizona. (Eng. and Min. Journ., June 22, 1918; 3¼ pp., illus.) 20c.

9388—COST of Australian Copper. Robert Slessor. (Eng. and Min. Journ., June 15, 1918; ¾ p.) 20c.

9389—MEXICO—La Negociacion Minera "The Moctezuma Copper Co." Marcelo Pena. (Bol. Minero, Feb., 1918; 7 pp.)

9390—ONTARIO—Statistical Review of the Mineral Industry of Ontario for 1916. Thos. W. Gibson. (Ann. Report, Ont. Bureau of Mines, Vol. XXVI, 1917; 66 pp., illus.)

9391—POWER—The Electrical Power Installation of the Braden Copper Co., Part II. (Teniente Topics, Vol. II, No. 8, Dec., 1917; 9 pp., illus.)

9392—PRICE for Copper and the Supply. Editorial. (Eng. and Min. Journ., June 1, 1918; 1¼ pp.) 20c.

9393—PRODUCTION of Copper in 1916. B. S. Butler. General Report. (Mineral Resources of the U. S., 1916—Part I, Apr. 22, 1918; 55 pp.)

9394—REFINING—Oxygen and Sulphur in the Melting of Copper Cathodes. Stanislaus Skowronski. (Bull., A.I.M.E., Mar., 1918; 5 pp., illus.) 40c.

9395—ROASTING—The Humboldt Roasting Plant. A. A. Watson. (Min. and Sci. Press, Mar. 9, 1918; 3½ pp., illus.) 20c.

9396—SMELTING—Matte Settlement and Slag Disposal at Grand Forks. Walter B. Bishop. (Min. and Sci. Press, June 15, 1918; 5 pp., illus.) 20c.

9397—SMELTING METHODS at El Paso. Courtenay De Kalb. (Min. and Sci. Press, May 18 and 25, 1918; 15 pp., illus.) 40c.

9398—UTAH—Notes on Gold Hill and Vicinity, Tooele County, Western Utah. J. F. Kemp and Paul Billingsley. (Econ. Geol., June, 1918; 27 pp., illus.) 60c.

GOLD AND SILVER—GEOLOGY

9399—ALASKA—The Cosna-Nowitna Region, Alaska. Henry M. Eakin. (Bull. 667, U. S. Geol. Surv., 1918; 54 pp., illus.)

9400—CANADA—The Origin of the Gold Deposits in the Canadian Precambrian. R. C. Wallace. (Bull. 74, Can. Min. Inst., June, 1918; 3 pp.)

9401—DEPOSITION OF GOLD in Nature, Further Studies on the. Victor Lenher. (Econ. Geol., May, 1918; 23½ pp., illus.)

GOLD AND SILVER—CYANIDING

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9554—PULVERIZED FUEL—Methods for More Efficiently Utilizing Our Fuel Resources: Part XVII—The Extent of the Use of Pulverized Fuel in the Industries and Its Possibilities in the War. F. P. Coffin. (Gen. Elec. Rev., May, 1918; 8 pp., illus.) Also gives a list of the American users of pulverized fuel. 40c.

9555—PHILIPPINE ISLANDS—Coal Mining Possibilities in the Philippine Islands. V. E. Lednicky. (Bureau of Sci., Manila, P. I., 1917; 1½ pp.)

9556—STORING COAL—Effects of Moisture on the Spontaneous Heating of Stored Coal. S. H. Katz and H. C. Porter. (U. S. Bureau of Mines 1917; 25 pp., illus.)

MINING AND METALLURGICAL MACHINERY

9557—BLAST-FURNACE HOIST INSTALLATIONS. David L. Lindquist. (Iron Tr. Rev., June 20, 1918; 6½ pp., illus.) 20c.

9558—ELECTRIC FURNACE—High-Temperature Resistance Furnaces with Ductile Molybdenum or Tungsten Resistors. W. E. Ruder. (Bull. 134, A.I.M.E., Feb., 1918; 7 pp., illus.)

9560—ELECTRIC POWER—The Development of an Efficient Earthing System. J. P. Forster. (Iron and Coal Tr. Rev., Mar. 29, 1918; 2⅝ pp., illus.) 40c.

9561—LUBRICATION—Internal-Combustion Engine: Lubrication and Lubricants. P. H. Conradson. (Advance copy, Am. Soc. for Testing Materials, June, 1918; 6 pp.)

9562—MINE-TRACK WORK, Mechanical Tampers in. H. L. Hicks. (Eng. and Min. Journ., June 8, 1918; 1 p., illus.) 20c.

9563—POWER PLANTS—Fuel Economy in the Operation of Hand-Fired Power Plants. (Circular No. 7, Bull. 31, Univ. of Ill., Apr. 1, 1918; 94 pp., illus.)

9564—SAFETY—Mine Safety Devices Developed by the United States Bureau of Mines. Van H. Manning. (Report Smithsonian Inst., 1916, 1917; 12 pp., illus.)

9565—TESTING MACHINE—A Simple Type of Brinell Testing Machine for 500-kg. Load. A. V. de Forest. (Advance copy, Am. Soc. for Testing Materials, June, 1918; 11 pp., illus.)

9566—TESTING MACHINES—Some Continental Testing Machines. H. S. Primrose and J. S. Glen Primrose. (Iron and Coal Tr. Rev., Apr. 19, 1918; 3 pp., illus.)

INDUSTRIAL CHEMISTRY

9567—AMMONIA Program for 1918, The. Chas. W. Merrill. (Journ. Ind. and Eng. Chem., June, 1918; 2 pp.) 60c.

9568—KELP—The California Kelp Operations of the Hercules Power Co. An American Industry Developed as a Result of a Demand for Acetone for Use in Munitions. (Met. and Chem. Eng., June 1, 1918; 5 pp., illus.)

9569—NITER CAKE—A Summary of the Proposals for the Utilization of Niter Cake. John Johnston. (Journ. Ind. and Eng. Chem., June, 1918; 3½ pp.)

9570—POTASH from Wood Ashes; Production in Michigan and Wisconsin. C. T. Edgar. (Met. and Chem. Eng., May 15, 1918; 2 pp., illus.)

9571—SULPHURIC-ACID INDUSTRY, The. C. J. Goodwin. (Chem. Tr. Journ., Apr. 20, 1918; ¾ p.)

9572—SULPHURIC ACID—L'Appareil Gaillard, Pour la Concentration de l'Acid Sulfurique. A. Hutin. (Revue d. Chim. Ind., Mar., 1918; 2½ pp., illus.)

MATERIALS OF CONSTRUCTION

9573—CEMENT—Description of the Works of White's South African Cement Co., Ltd. H. Campbell. (Journ. So. Afr. Inst. of Engrs., Jan., 1918; 7 pp.)

9574—CEMENT—The Rizal Cement Plant, Philippine Islands. J. C. Witt. (Bureau of Sci., Manila, P. I., 1917; 11 pp., illus.)

9575—CONCRETE—Effects of Grading of Sands and Consistency of Mix Upon the Strength of Plain and Reinforced Concrete. L. N. Edwards. (Advance copy, Am. Soc. for Testing Materials, June, 1918; 14 pp., illus.)

9576—LIME—The Valuation of Lime for Various Purposes. Richard K. Meade. (Journ. Ind. and Eng. Chem., Mar., 1918; 4½ pp., illus.)

MISCELLANEOUS

9577—CLAY-WORKING INDUSTRIES and Building Operations in the Larger Cities in 1916. Jefferson Middleton. (Mineral Resources of the U. S., 1916—Part II, Apr. 13, 1918; 73 pp., illus.)

9578—EDUCATION—Report on Mining Education in England with Special Reference to India. G. F. Adams, E. H. Robertson and Glen George. (Trans. Min. and Geol. Inst. of India, Nov., 1917; 108 pp.)

9579—EDUCATION—Texas State School of Mines. Wm. D. Hornaday. (Eng. and Min. Journ., June 1, 1918; ⅔ p., illus.) 20c.

9580—HEALTH—Silicosis in Rats in a Witwatersrand Mine. J. Pratt Johnson. (Journ. Chem., Met. and Min. Soc. of So. Afr., Mar., 1918; 2 pp.) Reply to Discussion.

9581—LABOR—How Erie is Solving the Housing Problem. (Iron Age, May 30, 1918; 4½ pp., illus.)

9582—LABOR—The Cafeteria at the Kerr Lake Mine. H. A. Kee. (Eng. and Min. Journ., May 25, 1918; 2 pp., illus.) 20c.

9583—LABOR—The Crippled Soldier in Industry. Frank Gilbreth. (Bull. 136, A.I.M.E., Apr., 1918; 10 pp.)

9584—LABOR—A Dietary for Miners. J. B. Hastings. (Eng. and Min. Journ., June 15, 1918; 1½ pp.) 20c.

9585—LABOR—Getting the Foreign Workman's Viewpoint. Prince Lazarovich-Hrebelianovich. (Bull. 136, A.I.M.E., Aug., 1918; 7½ pp.)

9586—LABOR—Illness in Industry, Its Cost and Prevention. Thos. Darlington. (Bull. 134, A.I.M.E., Feb., 1918; 15½ pp.)

9587—LABOR—Social and Religious Organizations as Factors in the Labor Problem. E. E. Bach. (Bull. A.I.M.E., Feb., 1918; 10 pp.)

Personals

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

P. C. Schraps, metallurgist for the South American Development Co., has arrived in San Francisco.

C. W. Walters, formerly with Guggenheim Bros., has resigned to enlist in the United States Navy.

Amor Frederick Kuehn, of 120 Broadway, New York, has had his name legally changed to Amor Frederick Keene.

Hennen Jennings received the honorary degree of Master of Arts from Harvard University at the last commencement.

E. H. Clark, of New York, president of the Homestake Mining Co., of Lead, S. D., spent several days in Lead, on his way to California.

Dr. Louis D. Ricketts was elected an additional vice president of the Greene Cananea Copper Co. at the organization meeting of the directors held on June 27.

Knox Taylor, president of the Taylor-Wharton Iron and Steel Co., Easton, Penn., has been elected chairman of the Manganese Track Society, succeeding A. H. Mulliken.

Dyke V. Keedy, mining and metallurgical engineer, of Boston, has been engaged by the Norton Co., of Worcester, Mass., and Niagara Falls, to conduct exploration and milling work for it.

Capt. Chauncey L. Berrien, until recently assistant superintendent of the mining department of the Anaconda Copper Mining Co., has been promoted to be a major in the aviation service.

Major Seeley W. Mudd has been promoted to a colonelcy. Colonel Mudd has recently suffered from a severe illness, but is now well on the road to recovery and is convalescing on the New Hampshire coast.

Carl O. Lindberg, of Los Angeles, has spent the last month in Washington and New York. Mr. Lindberg is taking part in the war minerals investigation now going on under the direction of the U. S. Bureau of Mines, having been appointed mining engineer in charge of sulphur investigation with headquarters at Los Angeles. Mr. Lindberg will maintain his practice as consulting engineer as in the past.

Guilliam H. Clamer, first vice president and secretary of the Ajax Metal Co., of Philadelphia, was elected president of the American Society for Testing Materials at its 21st annual meeting just held at Atlantic City. Mr. Clamer, who is 43 years old, is prominent as a metallurgist in the nonferrous casting industry. He became identified with the Ajax company immediately upon his graduation from the University of Pennsylvania as a special student in chemistry. In 1898 he took up the study of metallography, as a result of which was developed Ajax plastic bronze, an alloy used extensively for railroad bearings. Mr. Clamer was awarded the Eliott-Cresson gold medal by the Franklin Institute for developing a process of eliminating zinc, aluminum and iron and other metals electropositive to copper, tin and lead from alloys containing all of these metals. He was also associated with Dr. Carl Hering and others in developing several types of electric furnaces that have been successfully used in brass melting. Mr. Clamer is a past president of the American Institute of Metals, as well as chairman of the Institute's committee that is coöperating with the U. S. Bureau of Standards. He is also a member of the board of the Franklin Institute and of its committee on science and arts.

Obituary

John W. Bell, superintendent of mines for the Gulf States Steel Co., died at Birmingham, Ala., on June 20, aged 50 years.

R. B. Carnahan, vice president of the American Rolling Mill Co., Middletown, Ohio, accidently shot and killed himself on June 23 at his home. He was well known as a metallurgist.

Harry K. Myers, mining engineer, formerly consulting engineer with the D. J. Kennedy Co., and latterly in a similar position with the Kittanning Iron and Steel Co., Kittanning, Penn., died recently in Cowanshannoc, Penn., where he was operating the Kittanning Iron and Steel Co.'s Cowanshannoc mine. He was a graduate of Lehigh University.

Societies

Association of Iron and Steel Electrical Engineers will hold its twelfth annual convention in the Southern Hotel, Baltimore, Sept. 9 to 14 next.

Revelstoke International Mining Convention will be held at Revelstoke, B. C., July 8 to 10. Among speakers expected are William Sloan, Minister of Mines; John Hart, Minister of Finance, and J. H. Kig, Minister of Public Works.

British Engineering Standards Association was registered in Great Britain on May 28 with an unlimited number of members, to take over the work carried on since 1901 by the Engineering Standards Committee and to prove and mark certain engineering materials.

War Committee, Technical Societies of Chicago was organized on June 4, 1918, as the outcome of a movement started by the military committee of the Western Society of Engineers. The purpose is to coördinate the activities of the societies in the most effectual manner to help win the war. The following member societies are coöperating on the new committee: Western Society of Engineers; Structural Engineers' Association of Illinois; Society of Industrial Engineers; Illinois Society of Engineers; Illinois Society of Architects; American Railway Engineering Association; Swedish Engineers' Society of Chicago; Illinois chapter, American Institute of Architects; Chicago section, American Society of Mechanical Engineers; Chicago section, American Institute of Electrical Engineers; Chicago section, American Chemical Society; Chicago section, American Institute of Mining Engineers; Mid-West section, Society of Automotive Engineers; Illinois Association of American Society of Civil Engineers; Chicago section, American Society of Heating and Ventilating Engineers; Chicago section, American Society of Refrigerating Engineers; Chicago section, Steel Treating Research Society; Chicago section, Illuminating Engineering Society; Chicago chapter, American Association of Engineers. Officers of the War Committee have been elected as follows: Chairman, F. K. Copeland; vice chairman, W. L. Abbott; secretary, Edgar S. Nethercut; and treasurer, William A. Fox. The executive committee consists of F. K. Copeland, W. L. Abbott, William Hoskins, C. A. Keller, Charles E. Lord, C. F. Loweth, Isham Randolph and Richard E. Schmidt. The address of the secretary of the War Committee is 1735 Monadnock Block, Chicago.

Industrial News

Edison Storage Battery Co. has established a new sales office in Kansas City, Mo., appointing Benjamin F. Eyer as resident manager.

William D. Gordon, for the last seven years manager of the Mine and Smelter Supply Co. at El Paso, has been elected president of Camphius, Rives & Gordon, Inc., and has opened American headquarters for the company at 81 New St., New York.

Foote Mineral Co., Inc., 107 North 19th St., Philadelphia, in anticipation of the conservation of labor facing the publishing trade, announces that its publication "Foote Notes" will be published every other month, until the Allies are victorious, instead of monthly as hitherto. Subscribers will receive their full number of copies, but over a longer period.

C. H. vom Baur has been elected vice president of the T. W. Price Engineering Co., Woolworth Bldg., New York, and 114 East Jackson Boulevard, Chicago. This company has designed and installed electric steel furnaces for the Ludlum Steel Co., Watervliet, N. Y.; Hammond Steel Co., Syracuse, N. Y.; Century Steel Co., Poughkeepsie, N. Y.; Ulster Iron Works, Dover, N. J.; Hubbard Steel Foundary Co., East Chicago, Ind., and others. Mr. Price was formerly vice president and general manager of the Ludlum Electric Furnace Corporation.

Trade Catalogs

Meyer Dry Ore Concentrator. National Milling and Refining Co., Canton, Ohio. Pp. 14; 4½ x 7½ in. Illustrated.

Mining and Industrial Cars. Lake Shore Engine Works, Marquette, Mich. Bulletin No. 17. Pp. 43; 6 x 9¼ in. Illustrated.

Marcy Mill. Mine and Smelter Supply Co., Denver, Colo. Catalog No. 42. Pp. 38; 6¾ x 10 in. Illustrated. A complete description of the Marcy mill.

Rolls for Every Purpose. Rodney Hunt Machine Co., Orange, Mass. Card; 10¾ x 6¾ in. Guaranteed wooden rolls of yard-seasoned or air-seasoned stock.

Lower Pumping Costs with E. M. Synchronous Motors. Electric Machinery Co., Minneapolis, Minn. Bulletin 183. Pp. 23; 8½ x 11 in. Illustrated data on electric drives for large pumps.

"John F. Godfrey Junior" Conveyor. John F. Godfrey, Elkhart, Ind. Card; 8¼ x 10¾ in. Illustrated. Description of a mechanical conveyor (wire rope) for stocking coal; can be operated by one man and handles all sizes of coal up to 50 tons per hour.

Industrial Storage Battery Locomotives. Jeffrey Manufacturing Co., 974 North 4th St., Columbus, Ohio. Catalog No. 231. Pp. 24; 6 x 9 in. Illustrated. A description of the various types of storage-battery locomotives for industrial plants, lumber yards and contractors.

Centrifugal Pumps. Wheeler Condenser and Engineering Co., Carteret, N. J. Bulletin 108-B. Pp. 28; 8 x 10½ in. Illustrated. Shows the latest Wheeler turbine-driven geared centrifugal pumps; bi-rotor; tri-rotor; electric driven; small belt-driven; small high speed; side, end and bottom suction, etc. Characteristic test curves are given.

Electrical Welding Manual. Wilson Welder and Metals Co., Inc., New York. Manual No. 1. Pp. 46; 5¾ x 8¾ in. Illustrated. A book of instructions for installation and operation of equipment for electric welding by the Wilson system. Cast steel, cast iron, wrought iron, brass, copper, and in fact any weldable metal can be welded with this system.

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.

Blast-Furnace Operation—Edwin E. Slick, Westmont Borough, Penn. (U. S. No. 1,267,004 and 1,267,005; May 21, 1918)

Electrode—Ferdinand A. Rudolf, New York, N. Y., assignor to Nichols Copper Co., New York, N. Y. (U. S. No. 1,267,120; May 21, 1918)

Electrode Totally Submerged—Harry H. Stout, New York, N. Y., assignor to Nichols Copper Co., New York, N. Y. (U. S. 1,267,141; May 21, 1918)

Hoist, Traveling—Howard V. Snively, Kansas City, Mo. (U. S. No. 1,266,636; May 21, 1918)

Nickel—Method of Separating Nickel from Nickel-Copper Alloys. Joseph Dhavernas, New Brunswick, N. J., assignor to United States Nickel Co., New Brunswick, N. J. (U. S. No. 1,266,775; May 21, 1918)

Phosphate—Process of Concentrating Phosphatic Material. Hyleman Alison Webster, Columbia, Tenn. (U. S. No. 1,266,730; May 21, 1918)

Smelting—Dust-Collector. Utley Wedge, Ardmore, Penn., assignor to the Process Engineering Co., Philadelphia, Penn. (U. S. No. 1,267,023; May 21, 1918)

Smelting—Process and Apparatus for Utilizing Sulphurous Gases with Treatment of Metalliferous Materials. George C. Westby, Ludwig, Nev., assignor to Western Process Co. (U. S. No. 1,266,731; May 21, 1918)

Smelting—Process and Apparatus for Sulphatizing Metalliferous Ores. George C. Westby, Ludwig, Nev., assignor to Western Process Co. (U. S. No. 1,266,732; May 21, 1918)

Smelting—Process of Electrical Reduction. Charles H. Fulton, St. Louis, Mo., assignor to Metallurgical Laboratories, Inc., Chicago, Ill. (U. S. No. 1,267,347; May 21, 1918)

Smelting—Slag-Heated Steam Generator. Utley Wedge, Ardmore, Penn., assignor, by mesne assignments, to Furnace Patent Co., Philadelphia, Penn. (U. S. No. 1,267,022; May 21, 1918)

Steel—Open-Hearth Process. Charles H. Elliott and Elmer T. McCleary, Youngstown, Ohio, assignors to the Youngstown Sheet and Tube Co., Youngstown, Ohio. (U. S No. 1,266,928; May 21, 1918)

Zinc—Method of Converting Zinc Powder into Liquid Zinc. Sven Huldt, Stockholm, Sweden, assignor to Norsk Elektrisk Metalindustri Aktieselskap, Sarpsborg, Norway. (U. S. No. 1,266,808; May 21; 1918)

Editorial Correspondence

SALT LAKE CITY—June 27

Demands for Increases in Wages occasionally arise, although Utah mine and smeltery employees have been in receipt of frequent increases during recent years. At a meeting numbering about 500 and representing about a third of the working force, employees of the Garfield plant of the A. S. & R. Co., voted to demand a flat increase of $1 a day for all classes of labor. The demand comes at a particularly unfortunate time, and would if granted make itself heavily felt. The wage scale at present ranges from $3.15 per day of eight hours for day labor to $6.65 for foremen. At the Cardiff mine, in Big Cottonwood, which is just beginning its shipping season after the comparative inactivity of the winter, the men are asking an increase of 50c. a day, instead of the 25c. a day granted by the company. Board and lodging can be had at this mine for $1 a day, and the men's quarters are new and equipped with electric lights and baths. The company, which now pays $4.75 to $5 a day to underground hoistmen and from $3.50 to $4.25 to laborers, contends that the low charge for board and lodging and the comfortable living conditions make its present wage scale unusually good.

Increases in Smelting Charges, announced by the Salt Lake Valley smelteries, are to be made as the result of the advance in freight rates announced by the Government, to be made effective June 25. The increases are not definitely specified and are to be fixed later upon receipt of information as to the exact amount of the advance in rates on each class of material. In a circular letter to operators, announcement is made by the smelting companies that the freight advance is particularly drastic as applied to coal, coke, limestone, and smeltery products. It is explained by Mr. McAdoo as being made necessary by existing war conditions. Operations are now being carried on under great difficulties, owing to the increased cost of all materials and the shortage of labor, and smelters are unable to bear the additional burden of the proposed advance in freight charges. It will be necessary, therefore, for them to make the increased costs a charge against the shipper and to remodel their contract terms in such a way as to make an adjustment of such increase. As soon as the necessary information as to exact amount of advance in freight rates has been obtained, they will state in detail the changes that are necessary. The letter asks for coöperation on the part of operators. Mine operators in this section are considerably worried as to the proposed advances, taken in connection with the fixed price of copper and with lead and zinc low.

PHOENIX, ARIZ.—June 25

Property of the Arizona Ray Copper Co., at Ray, has been sold to W. B. Smock and R. T. Dorsey. This corporation, organized in Los Angeles, was once the centre of an advertising campaign understood to have enriched its promoters, though practically no work was done on the property. It is understood that little or no ore was ever found, the basis of extravagant claims being the fact that the Arizona Ray claims adjoin the property of the developed Ray Consolidated and Ray Hercules companies.

A Shortage of Mica has been reported by the War Minerals committee at Washington. Arizona has at least one large deposit of the mineral, but it has been left unworked. It lies on the Pima Indian Reservation, near the summit of the Sierra Estrella range, and about 10 miles from the main line of the Southern Pacific R.R. about 20 miles west of Maricopa. In the Pleasant Valley section of northern Tonto Basin, east of Payson, on the Spring Creek mine, John Carolan and associates have developed a silver-gold proposition said to be of unusual merit. The property will be producing soon, as a stamp mill with cyaniding tanks is about complete.

Improvements at the Swansea Mine, in northern Yuma County, are being made, following a series of experiments by the mine management, and include a 200-ton flotation mill. Most of the mine product of sorted ores has been shipped to the United Verde smeltery, in the Verde Valley. The low-grade sulphides left will furnish milling material for months to come. A new 500-ft. working shaft has been completed and has been connected with the main orebody, securing economical stoping and transportation. The property is equipped with a large smeltery that can not be operated economically under present conditions. In the last few years the mine has been getting out of debt, under an advantageous leasing system, and its bankruptcy soon is expected to be a thing of the past. A large part of the stock is held in the war devastated region of Belgium and Northern France, and the whereabouts of hundreds of stockholders, including the president of a year ago, are not now known. It is reported that the famous old Silver King mine, 60 miles east of Phoenix, has cut on the 400 level a new silver and copper orebody, 20 ft. thick. The work is in new ground, as the old workings are full of water or badly caved. A 30-ton mill is being built to handle the concentrating ores. Another pioneer silver producer, the Tip Top, in the southern Bradshaws, about half-way between Pheonix and Prescott, once a regular dividend payer, has been taken over by H. C. Wilmot & Co., of New York. The deep shaft, now full of water, will be cleaned out and a new reduction plant installed especially to secure the tungsten, which now is of more value than the silver.

TUCSON, ARIZ.—June 27

Arizona Corporation Commission has recently ruled that all stock pooled with the commission after July 1, 1918, will not be released until the company has paid a dividend of at least 7 per cent on all issued stock. The dividend must be bona fide and out of the earnings of the company. This is expected to act as a check on promotion schemes of questionable merit.

Arizona Bureau of Mines has undertaken the preparation of a new and amplified edition of a manganese bulletin which will be ready for distribution in a few weeks. The pamphlet will contain a complete description of the various commercially important ores, discussion of the genesis and structural peculiarities of manganese deposits, complete data on the chemical and physical peculiarities of manganese ores used in different industries, information concerning the prices which different grades of ore bring, and a list of all known purchasers of each grade of manganese ore. Requests for a copy of this bulletin may be sent to the Director, Arizona State Bureau of Mines, Tucson, now, and copies will be sent as soon as they are issued.

The Arizona State Bureau of Mines has been reorganized, with Dean G. M. Butler, of the University College of Mines and Engineering, succeeding C. F. Willis as director. The technical staff retained includes S. E. Dickinson, safety engineer; M. A. Allen, mineral technologist; G. R. Fansett, mining engineer, and Mark Ehle, rock and mineral analyst. Plans are being made for a complete reconnaissance geological map of the state and for the issuance of bulletins covering the mineral resources of each of the counties. The Bullion Bar property, in Pima County, owned in Detroit, is to have a small stamp mill, for the working of soft ores from a vein that runs from three to seven feet in width and carries gold. At Tombstone, the Phelps Dodge interests still are prospecting the old Bonanza properties and lately are said to have found new manganese and copper orebodies of value. The main trouble lies in the present inability to separate the two minerals profitably.

SPOKANE, WASH.—June 26

Mine Owners of the Kootenays, in British Columbia, in session at Nelson, recently adopted resolutions calling upon the Dominion government to appoint a permanent royal commission with unlimited power to inquire into all phases of the smelting industry. Such a commission would supersede the commission appointed some time ago by boards of trade, which was without government authority. R. F. Green, Member of Parliament from Kootenay, says such a commission will undoubtedly be appointed, with sufficient funds for all expenses. It was suggested that either F. E. Starkey, of Nelson, or Sidney Norman, of Spokane, be one member of the commission. The meeting also called on the authorities to investigate the assertions that the Canadian Pacific R. R. is unable to supply cars for ore consigned to points in the United States.

Immediate Construction of Motor Roads into the Ten Mile, Elk City and other gold districts of Idaho County, in central Idaho, was urged by resolutions adopted June 20 by the Northwest Mining Association and presented to the U. S. Bureau of Mines and other Government agencies. This action followed recent demands from Secretary McAdoo for a speeding up of gold production. The districts mentioned are largely in or surrounded by forest reserves, and the county and state are not in a position to supply adequate roads. It is estimated that placers of these districts have produced $50,000,000 in gold, largely in the early '60's. It is claimed that quartz mining will add heavy gold production now if transportation can be secured. The resolutions urge the commercial bodies of Idaho, the Idaho Mine Owners' Association and state authorities to join in an appeal to the Government to obtain construction of these roads and to secure data on cost of roads and possible gold production.

Bounties on Lead expire in British Columbia on June 30, according to a report issued by G. O. Buchanan, supervisor of lead bounties. He reports that during the year ended Mar. 31, there was received at the Trail smeltery, from Canadian mines, ore containing 36,762,916 lb. of lead and from mines of the United States ore containing 10,871,192 lb. of lead. During the same period there was received at the smeltery ores classed as zinc ores having lead contents of 23,101,424 lb., but the recovery of this lead remains a metallurgical problem as yet imperfectly solved. The Canadian mines that have made production of more than 100 tons each of lead ore during the year were as follows: Sullivan, Bluebell, Standard, Queen Bess, Emerald, Surprise, Galena Farm, Paradise, Highland, St. Eugene, Florence, Van Roi, Rambler, Cariboo, Coveroupee, Slocan Star, Cork-Province, Retalleck, Utica. The principal shippers from the United States have been the Electric Point (8,478,177 lb. lead), the Hercules and the Snowstorm. A total of 108 properties have shipped ores with more or less of lead contents to the smeltery during the year.

HELENA, MONT.—June 29

The Restraint on Funds of the Butte & Superior Mining Co. in connection with the Minerals Separation Co., Ltd., suits has been removed by Judge Bourquin of the U. S. District Court. Reports state that the order entered in October, 1917, restraining the company from disposing of its assets, had been set aside. Judge Bourquin was said to have set aside also the order requiring the filing of monthly statements and the deposit of earnings with the court.

JOPLIN, MO.—July 1

A Shallow Pyrite Deposit is to be opened up by the Red Granite Copper and Water Power Co., which is sinking a shaft on a lease near Spavinaw, Okla., not far from Strand. Discovery of the deposit was made last fall while prospecting for zinc ore. The pyrites are found at a depth of only 20 ft., and contain no less than 52% sulphur. One of the large sulphuric-acid makers of the country, represented by a local buyer, has evinced an interest in the deposit and may buy part or all of the lease.

Ball Mills for Pulverizing are gaining in popularity in the district. The White mine, at Picher, recently shut down to install three ball mills, all of which are now in place and giving good results. One takes the overflow from the two rougher jigs, one handles the tails from the sand jig, and one takes the middlings from the rougher tables. After pulverization the dirt is once more sent over the tables, and the recovery is further improved by the second largest flotation plant in the district. Assays made since the ball mills were installed show that the loss in the tails has been reduced

from 2.5 to 1.5%. The White mine handles comparatively thin dirt, and the management decided its only chance to continue in successful operation was to increase its recovery, and it has accomplished this in a satisfactory manner.

Delegates from Oklahoma Section of the Joplin district will be sent to the meeting in Oklahoma City on July 8, when a branch of the American Mining Congress is to be formed. Representatives of the coal and oil and gas interests also will attend the meeting, which is expected to be the largest of its kind ever held in the state. The movement has received the endorsement of the zinc and lead operators, and at their latest meeting at Picher they voted to send delegates.

Completion of the Interurban Line of the Southwest Missouri R.R. from Joplin to Picher has been accomplished, and announcement has been made of an arrangement whereby what amounts to through service from Joplin to Miami will be supplied by a connection of the interurban line with the motor car line of the O. K. & M. at Picher. Hourly service will be maintained from Miami to Picher, and twice an hour from Picher to Joplin. The Southwest Missouri, now operating cars to within about half a mile of the main portion of Picher, will complete its track laying and establish connection with O. K. & M. about August 1.

Development of Zinc and Lead bearing sections outside of the older district continues, despite unfavorable price conditions. At Mansfield, Mo., the Pioneer Mining Co. has just completed the building of a modern mill and will work a lease that has been proved up. The ore in this field is found in shallow deposits, and during the last week the Pioneer Co. reports a fine strike in drilling on an adjoining tract at only 35 ft. At Butterfield, Mo., the New Mexico Mining Co. has completed its first hole, which showed about 21 ft. of good-grade ore. Good strikes also have been reported in the last week down on White River, in Taney County, Mo. There has been some development there, particularly on a fissure vein, but little successful mining.

Drilling Operations in the Oklahoma and Kansas sections of this field are easing up decidedly, and many of the drill rigs have left for new oil fields being developed in Oklahoma. Within the last two years approximately 400 companies have been organized for operations in this Oklahoma-Kansas field, and though many of them have developed or are developing good properties, many have been organized and the principals have been persuaded to invest their money without much of a chance of even getting it back. Some of these fake promotions are being brought to light now, and the usual and to be expected reaction from the boom of six months ago is under way. When the readjustment has been completed, however, it will be found that the district as a whole is remarkably solid, and it is expected that the output from the Oklahoma-Kansas region will continue heavy for many years. At present the Commerce camp is entirely idle, but even there the mines have not been worked out, and plans are under way to get them back in operation at an early date.

CALUMET, MICH.—June 26

One of the Pioneer Mines of the Lake Superior copper country comes into Federal litigation as the result of the war, according to the belief of local people who have been asked by the Federal custodian of alien property for a report on the old Clark mine, of Keweenaw County. The mine is situated a short distance south of Eagle Harbor, and was opened in 1858, but has not been operated for many years. It is the property of Leon Estivant, a captain of the French army, who acquired it through inheritance. Estivant was captured by the Germans, and is still a prisoner of war. Just why this should be made the basis of action by the Government in taking over the land under the alien property act is not understood here. The property, which consists of about 2000 acres, has not been considered valuable until recently. It carries considerable manganese ore, it is stated, which has come into great demand because of the war, and it may be the intention of the Government to reopen and work it for this product. The last work on the property was done some years ago by the United States Smelting Co., which conducted diamond-drilling exploration.

A Shortage of Miners, particularly skilled machine men, seems probable, because many of them who have been working on machines here for years are leaving, being attracted by the high pay offered in factories and munitions plants elsewhere. Heretofore it has only been the shortage of trammers and unskilled labor that has bothered the copper-mining companies. Miners, shop men, machinists and others are now going out in increasing numbers. This movement, too, comes in the face of repeated increases in wages, the offering of bonuses and of premiums, with the option of working on contract for work done over the minimum "company account" system. It is the class of smaller properties that is suffering through this condition. Calumet & Hecla, Quincy and Copper Range have few complaints to make. Ahmeek, Osceola and Isle Royale are also holding their men well. These are about the highest-paying properties, in the matter of wages, operating in this district, except the Mohawk and Wolverine mines, which have met the wage increases of the other mines. The properties listed have been increasing their forces of trammers steadily and have been installing improved tramming equipment, making it unnecessary to employ such large numbers of men as in years past. In two or three of the mines such as the Ahmeek, mules and horses are also used for tramming. Men who have been earning $6 to $7 a day on contract work with some of the mining companies here feel the call from outside companies offering as high as $8 per day, and even more, irresistible.

VICTORIA, B. C.—June 27

California Fuel Oil Shortage, because of war exigencies, is occupying the attention of most of the large industrial corporations of British Columbia, which have been dependent on that form of fuel. The Powell River Pulp Co., one of the largest industries of its kind in the Northwest, has arranged to make a rapid change from oil to coal should developments make it necessary. The same is true of the Whalen Pulp and Paper Mills, and Mr. W. P. Hinton, vice president of the Grand Trunk Pacific Ry. Co., who was in the West a few days ago, states that his company has made representations at Washington, D. C., with a view to ascertaining the attitude of the U. S. Fuel Administration toward the reported shortage of California fuel oil. Mr. Hinton explains that his company is particularly interested because of the steamers which it is operating in the Pacific Northwest. It is intended to reconvert the G. T. P. locomotives using fuel oil on the 800 miles of line to Prince Rupert to coal burners, and in this connection the company is interested in the development of the Telkwa and other Northern British Columbia collieries which are tributary to the Grand Trunk Pacific Railway.

An Increase of Wages Has Been Demanded by employees of the Consolidated Mining and Smelting Co., of Canada, in several of its mines. In most instances the miners have accepted the company's offer of substituting the Rossland mine's scale in the lead mines, which means an increase of approximately 15c. a day. Some miners, however, have refused this proposal. At the Sullivan Mine, Kimberly, B. C., an increase of 50c. a day was asked which would give muckers $4.15 a day and miners $4.65. Permission has been secured from the Dominion government for the export from Canada to the United States of 5000 tons of manganese ore. Hon. William Sloan, Minister of Mines, has been advised of this action by Ottawa. The license applies particularly to the Curle property, near Kaslo, B. C., which has been opened recently and already has a considerable quantity of the mineral ready for shipment.

NEW YORK—July 1

To Investigate and Finance Mining, Oil and Industrial Enterprises, the Finance Exploration and Development Corporation of America has been incorporated under the laws of the State of New York. An initial capital of $500,000 has been provided. This corporation will develop and maintain a staff of skilled engineers and investigators to examine the merits and possibilities of companies needing additional capital for development or expansion. The directors are William R. Jones, Jackson B. Sells, Burt Brown Barker, E. L. Kerstetter and Homer L. Carr. Mr. Carr is mining engineer for the corporation, with offices at 50 Broad St., New York City.

Brazilian Manganese Ore is again moving from the mines, and by Aug. 1 it will be arriving in Rio faster than it can be exported, says Robert J. Todd, general manager of the International Navigation Corporation, in the "New York Commercial." The changed situation is due to the lifting of the embargo on the Central Railroad of Brazil. The present shortage of Brazilian manganese is due not so much to the acts of the shipping authorities of this country as to conditions in Brazil. The first effect of the increased movement of the ore will be that the poorest qualities recently put on boats will be eliminated and the previous high standard of 48% to 50% metallic manganese resumed.

WINNIPEG, MAN.—June 28

A Discovery of Gold is reported at the north end of Herb Lake. Paul Gasse has located several claims along a dyke cutting a porphyritic gneiss, which shows free gold and a heavy mineralization of iron, zinc and lead sulphides. The dyke has been traced 4500 ft. with a width of at least 50 ft., occasionally increasing to 100 ft. The region has hitherto been avoided by prospectors, under the impression that the gneiss would be barren. About 30 claims had been staked at last accounts.

TORONTO—June 27

Cobalt Mining Companies are directing their attention to the southeastern section of Bucke Township, about three miles north of the town of Cobalt. It is stated that a contact zone extends from Lake Temiskaming at a point known as the Devil's Rock, about three miles southeast of Haileyburg, running northwest through Bucke Township. Much faulting occurs along this zone, and some promising veins are to be seen.

The Mining News

ARIZONA

Cochise County

SILVER KING (Douglas)—To resume production. Development work has begun, and good-grade silver ore has been cut.

Gila County

MIAMI COPPER (Miami)—Soon to operate 100-ton unit of mill to develop nethod for handling carbonate ores. Work o be in conjunction with Bureau of Mines.

Greenlee County

ARIZONA COPPER (Clifton)—Copper produced in May was 4,130,000 pounds.

Mohave County

ARGO (Kingman) Operating small cyaniding plant.

ARIZONA ORE REDUCTION (Kingman)—Has installed new mill and completed 1800 ft. tunnel and shaft has been sunk to 400 level.

BERKELEY (Kingman)—New hoisting plant has been installed.

CHLORIDE QUEEN (Kingman)—Has installed 60-hp. engine and will develop mine.

GOLD ROAD (Kingman)—To operate cyanide plant soon.

TINTIC (Kingman)—Development work to begin soon.

ALCYONE (Oatman)—Plant now working and shaft being sunk to 400 level.

ARIZONA MOSSBACK (Oatman)—New plant has been completed. Shaft to be sunk to the 500 level.

BLUE BIRD (Oatman)—Plant enlarged and operations to begin soon.

GOLD ORE (Oatman)—Producing about 70 tons daily. New stope opened.

MOSSBACK (Oatman)—Shaft being retimbered.

RECORD LODE (Oatman)—Shaft to be sunk deeper as soon as pumping is completed.

RED LION (Oatman)—To sink 500 ft. of shaft.

TOM REED (Oatman)—Aztec shaft has been sunk 60 ft. Cutting out of ore pockets is almost complete.

Pima County

BULLION BAR (Ajo)—Installing new machinery and plans 10-stamp mill.

Pinal County

GOLDEN BELLE (Kelvin)—Property located near Copper Buttes now being developed by W. E. St. Charles with a force of 20 men. New hoist and compressor recently installed.

RAY-KELVIN (Kelvin)— New shaft down 90 ft. and shows three feet of lead-silver ore.

TROY-ARIZONA (Kelvin)—Closed down until adequate pumping equipment can be provided for Climax shaft.

U. S. VANADIUM (Kelvin)—Mine and mill have been leased for 10 years to Allied Metals Co., of Denver. Additional mining equipment to be installed and the capacity of mill increased. Harry S. Bryan is acting general manager.

GRAND PACIFIC (Superior)—Cut vein carrying good copper ore in shaft.

SILVER KING (Superior)—Silver ore cut on fourth level. Mill to be started middle of July, and new unit to be installed.

SUPERIOR BONANZA (Superior) — To be reopened. Equipment has been ordered and work to start as soon as plant is installed.

Santa Cruz County

DIXIE (Patagonia)—Good-grade lead ore has been cut.

FLUX (Patagonia) A 300-ton mill has been installed.

MOWRY (Patagonia)—A new hoist and engine have been installed.

CONSOLIDATED ARIZONA (Patagonia)—To open El Paso group soon; 500-ft. shaft to be sunk.

WORLD'S FAIR (Patagonia)—Machinery has arrived and operation to begin as soon as installation is complete.

Yavapai County

GREEN MONSTER (Jerome)—Dorothy May shaft has been sunk to the 1000 level. Present formation is quartz-porphyry.

UNITED CHINO (Jerome)—Drilling suspended due to caving ground.

UNITED VERDE (Jerome)—Main shaft to be sunk to the 1700 level.

UNITED VERDE EXTENSION (Jerome)—To develop 1500, 1600 and 1700 levels soon.

VERDE SQUAW (Jerome)—New shaft to be sunk.

CALIFORNIA

Amador County

PLYMOUTH CONSOLIDATED (Plymouth)—Comprehensive work being done on 2600 level. Mill is running at capacity.

CENTRAL EUREKA (Sutter Creek)—Crosscutting on 3500 level to develop orebody recently cut in foot wall. Albion Howe is superintendent.

Butte County

CHROME DEPOSIT near Lumpkin being developed by John Mullings and W. D. Fowler. Product will be hauled to Oroville.

THREE CHROME DEPOSITS near Magalia, beside the Western Ore Co. land, being developed. A. Wakeman working the Lambert and the Eureka properties. J. E. Stevens operating Curtis property.

WESTERN ORE. (Oakland)—Carload of concentrates from new mill on chrome claims at Limestone, eight miles west of Magalia, shipped to Pittsburgh. Equipment includes 1400-ft. tramway from mine to loading station. A. E. Vandercook is superintendent.

Eldorado County

ARGONAUT (Georgetown)—Mine on Greenwood road leased to O. S. Ford and A. Moyer. Development by tunnel.

Glenn County

ADAMS CHROME (Chrome)—First ore delivered at Orland for shipment. R. G. Adams and associates developing this and three other chrome properties. L. J. Joiner is superintendent.

Humboldt County

HORSE MOUNTAIN (Eureka)—Chrome ore at this copper mine ready for shipment to San Francisco. George Harpst is superintendent.

Kern County

JOE FERRIS (Caliente)—Temporarily closed down owing to insufficient mill capacity. Expect to purchase new mill equipment.

ZENDA (Caliente)—Closed down. Has large body of low-grade gold-silver ore.

Mariposa County

OWL COPPER (Los Angeles)—Purchased the Diaz copper mine near Indian Gulch. Louis A. Parsons is president.

Nevada County

ALLISON RANCH (Grass Valley)—New 550-gal. pump being installed as auxiliary to present plant.

San Luis Obispo County

CHROME MINING in Morro district active. Equipment shipped to Atascader Beach, where large deposits are reported. Locations recently made in Paradise Valley.

MANGANESE ORE mined in Los Osos Valley going to Noble Electric Steel Co., at Heroult, amounts to about 200 tons a week.

Santa Barbara County

CHROME MINING near Los Olevos bids fair to become profitable industry. Property is worked by O'Donnell & Burns, of San Francisco. Product shipped to Niagara Falls.

Sierra County

CHROME ORE mined in vicinity of Downieville hauled to Blairsden for shipment. Part of the ore is taken from the White Bear ground.

MONARCH (Sierra City)—Report of finding oreshoot in lower tunnel confirmed. Crosscut disclosed vein eight feet wide.

Siskiyou County

CHROME SAMPLING WORKS at Yreka contemplated by Hugh McKinnie, of Oro Grande Mining Co., and associates.

RANCHERIA (Henley)—Closed because electric power line not equal to requirements.

Stanislaus County

CHROME CONCENTRATING (Patterson) — Equipment recently increased. Chrome and manganese mines situated in western part of county, about 20 miles from Patterson.

Tuolumne County

EAGLE-SHAWMUT (Shawmut)—Milling on large scale. Shaft deepened to 2243 ft. Chlorination plant closed. Sulphurets shipped to Selby.

CONFIDENCE (Sonora)—Ball mill, tube mill, 10-tank cyanide plant and other equipment being installed.

COLORADO

Pitkin County

PARK TUNNEL (Aspen)—Removing compressor at Vinie Mine.

Summit County

ELK MOUNTAIN (Kokomo)—Operating old Iron Mask property. Has rebuilt and remodelled mill. F. R. Tabor is in charge.

SILVER EDGE (Kokomo)—Has cut lead-zinc ore in new tunnel. Shipping to smeltery at Salida.

READY CASH (Kokomo)—Operating custom mill equipped with magnetic separation installation.

GEORGIA

Lumpkin County

CHESTATEE P. & C. CORP. (Chestatee)—The 600-ton sorting and concentration plant and 10-mile standard gage railroad are practically completed, and the production of pyrites will be started early in July. Underground development has shown up large deposits of iron pyrites, and considerable ore is blocked out and broken in stopes.

IDAHO

Boundary County

DEER CREEK (Buckhorn)—To be equipped with Chilean mill.

Shoshone County

COEUR D'ALENE ANTIMONY (Wardner)—To sink main shaft an additional 75 ft. and cut station. New mill and flotation plant nearly completed.

MICHIGAN

Copper District

FEDERAL SYNDICATE (Calumet)—Good showing of copper in felsite conglomerate underlying felsite amygdaloid. Purchased four-drill second-hand compressor and Jackhamer drills.

SENECA (Calumet)—Sunk vertical shaft 96 ft. first half of June. Delayed by broken ground requiring timbering after each blast.

CENTENNIAL (Centennial) — Has greater area than was expected and is developing property, despite statements that reserves are small and rapidly being depleted.

QUINCY (Hancock)—Dwelling houses nearly completed.

HOUGHTON COPPER (Houghton)—Has cut hard trap rock after passing through second new lode.

MAYFLOWER-OLD COLONY (Houghton)—Shaft down 500 feet.

NEW ARCADIAN (Houghton)—Resuming drifting at 1700 and 1850 levels in ground better than average.

NEW BALTIC (Houghton)—Crosscut from shaft to New Arcadian lode cutting good ground. Another crosscut is being driven north of shaft to same lode.

AHMEEK (Kearsarge)—Rock below 22 level to be hoisted through No. 2 shaft. Sinking of No. 1 shaft has been discontinued.

MICHIGAN (Rockland)—Purchased 93 acres from Mason estate.

MINNESOTA

Cuyuna Range

CLARK (Ironton)—To sink shaft. Shipments will be made this year. O. C. Montgomery is superintendent.

SULTANA (Ironton)—New washing plant under construction.

MISSOURI

Joplin District

BANKERS (Joplin)—Preparing to build mill on lease near St. Regis Mine, near Chitwood. Several thousand tons rich dirt on dump. J. M. Bloyd, Joplin, is manager.

FIFTEENTH STREET (Joplin)—Following sinking of winze to sink mill shaft from 164 to 186 ft. for lower run. Also drilling south part of lease, near field shaft.

YELLOWSTONE (Joplin)—Stopped zinc production and making lead from shallow level. Recent cave at mine did no material damage.
MUST

MONTANA

Jefferson County

COMET (Boulder)—Opening up 400 and 500 levels and to increase output.

Silver Bow County

BARNES-KING (Butte)—Has taken lease and option on the Mount Pleasant and to develop property immediately.

DAVIS-DALY (Butte)—Completed raise from 2500 level to 1900 level.

NEVADA

Elko County

BELLEVIEW (Contact)—Gasoline hoist installed, and incline shaft now down 200 ft. Development work on 100 level has opened good-grade carbonate ore.

BOSTON (Contact)—Development work under way.

CAMP BIRD and ZETTA BLANCHARD (Contact)—Optioned to Duluth men. Development work under way.

QUEEN OF THE HILLS (Contact)—Operated by lessees. Carbonate ore from shaft and tunnel workings being stored.

MIDNIGHT (Good Hope)—Development work to begin at once. Property an old silver producer.

BULLSHEAD MINING (Wells)—Recently purchased old Harrold property, in Spruce Mountain district. Shipments of silver ore being made to Utah. Some high-grade manganese ore carrying silver also opened.

Lander County

BLUE DICK (Battle Mountain)—Installing machinery.

GOLD TOP (Battle Mountain)—To sink double compartment shaft.

Lyon County

WESTERN NEVADA (Mason)—Shipping crude ore. Operated by Nevada Douglas Consolidated.

BLUESTONE (Yerington)—New 400-ton flotation plant completed and in operation. Ore treated consists of chalcopyrite scattered through silicified lime. Large tonnage crude ore shipped to Thompson smelting plant.

EMPIRE NEVADA (Yerington)—Several lessees working. Shipments of crude ore made. Work at leaching plant unsuccessful.

MONTANA-YERINGTON (Yerington)—Making regular shipments of good-grade copper ore.

Nye County

MANHATTAN CONSOLIDATED (Manhattan)—Raising from 300 level to cut vein of free milling ore above 200 level. East orebody being prospected from 500 level.

UNION AMALGAMATED (Manhattan)—Drift on 600 level which was driven north into the foot wall has been stopped with face of the drift in low-grade quartz.

WHITE CAPS (Manhattan)—Ore for the mill coming from 302, 404 and 406 stopes and from 510 raise.

ATLANTA (Goldfield)—Crosscut on main vein at 1850 level has cut several ore seams.

GOLDFIELD CONSOLIDATED (Goldfield)—Mill continues to treat tailings by cyanide.

GRANDMA CONSOLIDATED (Goldfield)—Shaft has cut shale at 825 feet.

SILVER PICK (Goldfield)—Shaft cut mineralized quartz at 1200 feet.

TONOPAH DISTRICT ore production for the week ended June 15 totaled 10,389 tons, of an estimated gross milling return of $176,766. Producers were: Tonopah Belmont, 1983 tons; Tonopah Mining, 3750; Tonopah Extension, 2570; Jim Butler, 621; West End, 869; MacNamara, 315; Montana, 161; North Star, 16; Cash Boy, 47; Midway, 47 and miscellaneous 19 tons.

JIM BUTLER (Tonopah)—Crosscut from raise from 600 level in Desert Green section of mine has cut good ore.

MONARCH PITTSBURGH (Tonopah)—Retimbering of shaft in progress.

NORTH STAR (Tonopah)—Drift through Mizpah fault on 900 level still shows quartz containing good return.

TONOPAH BELMONT (Tonopah)—Net earnings for the quarter ended May 31 were $182,539.83.

TONOPAH DIVIDE (Tonopah)—To sink shaft to 360 level, cut station and crosscut south.

TONOPAH EXTENSION (Tonopah)—Receipts from mine and mill operation during May were $119,906.27; current expenses, $80,911.33; leaving an operating profit of $38,994.94.

TONOPAH MINING (Tonopah)—Dump ore hoisted through Silver Top shaft being shipped regularly to mill at Millers.

OKLAHOMA

Joplin District

LOST TRAIL (Commerce)—New shaft being sunk and mill to be restarted about Aug. 1. Mine one of the oldest in Oklahoma field.

MAURICE (Douthat)—Has rebuilt derrick destroyed by fire and plans for mill in near future.

BUNKER HILL (Hockerville)—Plans 400-ton mill as soon as shaft now under way is completed. Tract well drilled. Owned by Tulsa investors.

BLUE BONNET (Miami)—New 400-ton mill completed and running part time. Two other shafts being sunk to ore at 211 ft. W. H. Logan, of Miami, manager.

COMMONWEALTH (Miami)—To build new 500-ton mill to replace one destroyed by fire June 18. To purchase drills, sludge and slime tables, ore cars and other machinery. L. W. Dana, Joplin, Mo., is superintendent.

DULUTH-MIAMI (Miami)—To erect mill as soon as shaft is completed. Now down to 136 ft. To use gas for mill power. George W. Knox, Oklahoma City, is president.

MARY ANN (Miami)—Has bought Jayhawk lease and to finish sinking shaft started some time ago and connect with mill, 300 yd. distant by incline tramway. Both properties near St. Louis, Mo.

MIAMI (Miami)—To build 400-ton mill, construction to start July 1. To purchase sludge and slime tables, crushers, engines, boilers and other machinery for four mills. J. P. McNaughton is superintendent.

ST. LOUIS (Quapaw)—Draining operations of several companies combined enabled this company to continue shaft sinking into orebody, and will start new mill soon.

OREGON

Coos County

COPPER CLAIMS situated in Coos and Curry counties have been acquired by the Coal and Metals Trustees, a company recently organized at Marshfield by M. G. Gibson, of San Francisco, Calif.; E. W. McInturff and J. A. Gates, of Seattle, Wash., and Russell Winslow, of Marshfield. Granite, Rusty Butte, Monumental and Salmon claims are included in the deal. Russell Winslow is mining engineer in charge of operations.

Jackson County

JAMES DOWNEY (Gold Hill)—Uncovered gold-bearing vein.

Josephine County

OREGON CHROME (Galice)—Large tonnage of ore available for shipment upon completion of road. Harry Sordy is superintendent.

J. F. REDDY (Grants Pass)—Purchased and leased chrome deposits between Hamburg and Seid, on the north side of Klamath River, in northern California. Properties producing.

R. A. SPENCER (Grants Pass)—To develop chrome deposits in Briggs Creek district in the south end of Josephine County.

UTAH

Juab County

TINTIC DISTRICT SHIPMENTS during the week ended June 22 were 152 carloads. Shippers were. Dragon Consolidated, 41 cars; Chief Consolidated, 17; Iron Blossom, 16; Tintic Standard, 15; Colorado Consolidated, 11; Centennial-Eureka and Eagle & Blue Bell, 10 each; Grand Central, 8; Gold Chain, 7; Gemini, 5; Scranton and Showers leases, 2 each; and Godiva, Ridge & Valley, Victoria, Bullion Beck, Swansea Consolidated, Empire Mines, Chief Consolidated managanese lease and Minnie Moore lease, one each.

COPPER LEAF (Eureka)—Shaft down 580 ft. and shows iron.

CROWN POINT (Eureka)—Winze being sunk from 800 level 250 ft. from shaft. Winze to be sunk 125 feet.

Piute County

FLORENCE MINING AND MILLING (Marysvale)—Work on new alunite mill being pushed.

Salt Lake County

ALTA CONSOLIDATED (Alta)—Opened orebody from which it will ship regularly during shipping season.

ALTA TUNNEL AND TRANSPORTATION (Alta)—Tunnel being driven for downward extension of Prince of Wales fissure in 3408 ft. and shows stringers of lead and silver in face.

LITTLE COTTONWOOD TRANSPORTATION (Alta)—Narrow gage road now open for traffic as far as Alta.

CARDIFF (Salt Lake)—Hauling 60 tons daily by trucks.

Summit County

PARK CITY SHIPMENTS for week ended June 15 amounted to 4,174,950 lb. Shippers were Ontario Silver, Judge Mining and Smelting, Silver King Coalition, Daly West and Glencoe lease.

SILVER KING CONSOLIDATED (Park City)—California-Comstock to be worked from 450 level to surface until lower levels are unwatered by Spiro tunnel, which is making progress of 450 ft. monthly.

WASHINGTON

Ferry County

KNOB HILL (Republic)—Producing 12 to 14 carloads a month.

WISCONSIN

Zinc-Lead District

CONSOLIDATED LEAD AND ZINC CO. (Benton)—Has drilled orebody and is sinking shaft on Charles Smith land, 1½ mile south of Benton. Charles Lawyer is manager.

LAWRENCE MINES CO. (Benton)—Drilling old Lake Superior tract just north of Indian Mound mine.

ZINC HILL (Cuba City)—Has drilled good orebody and will drift from Little Dick shaft, which is sunk deeper. A 50-ton mill to be provided at once.

CONNECTING LINK (Cuba City)—Operating new three-jig mill on Henry Dall and Will Coulthard land adjacent to the old Dall mine.

MONMOUTH ZINC CO. (Hazel Green)—Drilling has developed new orebody. To be worked from old shaft idle three years. O. E. Newell is manager.

CANADA

Alberta

HUDSON'S HOPE (Peace River District)—Sanders and Galbraith are preparing to dredge for gold and have secured a 75-mile dredging base on the Peace River.

British Columbia

SILVERSMITH (Slocan) Slocan Star, taken over by this company, has been working since May 15.

WHITEWATER (Slocan)—M. S. Davys, lessor of Kaslo concentrator, to remodel plant and treat 100,000 tons tailings of Whitewater at Retallack and 40,000 tailings of Arlington mine near Slocan City.

BELMONT SURF INLET (Surf Inlet)—Net earnings for the quarter ended May 31 were $90,694.43.

Manitoba

REX (Herb Lake)—Initial shipment of bullion has been made.

Ontario

ASSOCIATED GOLDFIELDS (Larder Lake)—Completing installation of electrically driven equipment.

DAVIDSON (Porcupine)—Work has been started on sinking of shaft to 700 level. Levels to be cut at 400, 500, 600 and 700 ft. and the body of high-grade ore known to occur on these levels will be blocked out.

DOME LAKE (Porcupine)—A third lens of ore has been cut on the 500 level. Winze will be sunk to 600 level.

NEWRAY (Porcupine)—Mill again in operation.

PORCUPINE CROWN (Porcupine)—Rich oreshoot opened up at 1100 feet.

VIPOND NORTH-THOMPSON (Porcupine)—Operations are being gradually suspended and mill put in condition for period of idleness.

WEST DOME CONSOLIDATED (Porcupine)—Test run of ore put through Dome Lake mill showed average mill-heads of $9.80 per ton. Ore was representative of the body opened up along the entire length of the drift on 310 level. Showing was considered satisfactory, but as the companies could not come to an agreement as to the customs charge for the permanent treatment of ore at the Dome Lake mill, the West Dome mine was closed down.

BEAVER (Cobalt)—Good ore is being shipped from 600 and 700 ft. levels and exploration carried on at higher levels.

GREEN MEEHAN (Cobalt)—Another vein carrying commercial silver has been cut.

LA ROSE CONSOLIDATED (Cobalt)—New vein of high-grade ore cut on 70 level in old workings.

ALADDIN COBALT (Kirkland Lake)—Purchased the original Tough Oaks stamp mill, for treatment of high-grade ore from Burnside property.

MINAKER — (Kirkland Lake) — Small plant installed and development started on No. 1 vein.

ONTARIO-KIRKLAND (Kirkland Lake)—Arrangements have been completed for installation of electrically-driven plant.

DAVIDSON (Matachewan)—Mining Corporation of Canada, which has a short term option on this claim, has large force sampling property.

OTISSE, (Matachewan)—Cores from diamond drilling have been shipped to New York for assaying.

COOK CLAIMS (Boston Creek)—Visible gold has been found in a large red porphyry dike interspered with small quartz veins.

PATRICIA (Boston Creek)—New 50-ton mill is being tested. Underground workings have reached depth of 200 ft. Stoping is under way and ore reported as high grade.

HATTIE (Coulson Township)—Vein containing visible gold and tellurides has been discovered. Shipping and trenching being done. Shaft to be sunk 300 feet.

MEXICO

Baja California

COMPAGNIE DU BOLEO (Santa Rosalia)—Copper production during May was 1,873,760 lb. Copper ore averaged 3.54% copper.

The Market Report

SILVER AND STERLING EXCHANGE

June	Sterling Exchange	Silver New York, Cents	Silver London, Pence	July	Sterling Exchange	Silver New York, Cents	Silver London, Pence
27	4.7530	99½	48⅞	1	4.7530	99½	...
28	4.7530	99½	48⅞	2	4.7530	99½	48⅞
29	4.7530	99½	48⅞	3	4.7530	99½	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

June July	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
27	*23½	†	7.90	7.75	@8⅛
28	*23½	†	7.90	7.75	@8⅛
29	*23½	†	7.90	7.75	@8⅛
1	*23½	†	7.90	7.75	@8⅛
2	*26	†	7.90	7.75	@8⅛
3	*26	†	7.90	7.75	@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

June July	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
27	110	110	125	332	332	29½	54
28	110	110	125	332	332	29½	54
29	...	...	...	...	...	...	...
1	110	110	125	332	332	29½	54
2	110	110	125	332	332	29½	54
3	110	110	125	337	337	29½	54

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

Metal Markets

NEW YORK—July 3

The outstanding feature of the market this week was the advance in the price of copper. Lead was firm and scarce. Zinc was quotationally higher, but was rather dull.

Copper—Representatives of the copper producers met the Price-Fixing Committee of the War Industries Board in Washington on July 2, and, as the result of their conference, the price of copper was advanced to 26c. That there was going to be an advance was foreshadowed in our report of last week, it being known that important officials in Washington had changed their minds respecting the copper situation. A formal announcement of the advance, as communicated by our Washington correspondent, is as follows: "Subject to the approval of the President, the Price-Fixing Committee of War Industries Board, in conference with representatives of the industry, has fixed the price of copper at 26c. per lb., an advance from 23½c., the price formerly fixed. The new price goes into effect July 2 and will continue until Aug. 15."

As in previous cases, there is a certain vagueness in this announcement, which leaves many matters open for adjustment. The most important of these is the question of existing contracts. In so far as the relations between the Government and the producers are concerned, the position is that whereas there was an agreement previous to June 1, since that time there has been no agreement, the producers having specifically refused to assent to the price that was then named by the Price-Fixing Committee. In the matter of commercial business, however, it is understood that existing contracts are to be filled at the previous price unless different provisions were agreed upon at the time of sale.

Though the advance in price does scarcely more than compensate for increase in freight rates, and some other recent increases in cost, the new attitude of the War Industries Board has created an immensely better feeling in the copper industry. Although all producers have striven patriotically to produce every pound of copper possible during the last nine months, the advance in price will do more than anything else to promote additional production.

Copper Sheets are quoted at 34½c. per lb. for hot rolled, and 1c. higher for cold rolled. The situation in regard to the price of copper wire is indefinite owing to the change in the price of the metal.

Tin—Practically no spot tin is obtainable in this market. As an index to conditions, Banka may be quoted at 93@95c. and the 99% grades at 91@92c., but those quotations are nothing more than nominal. Singapore quoted £348¾, c.i.f., London, on June 27; the same on June 28 and July 1; £343¾ on July 2, and £344 on July 3.

Lead—New transactions were light. Producers reported inquiries as being rather few. This is probably attributable to the appreciation among consumers of the futility of making inquiries. Some important consumers need large tonnages, and would not only make inquiries but also would buy if there were any immediate chance of their getting the lead. The price of all producers remained unchanged at 7.90c. New York, and 7.75c., St. Louis. Some small adjustments are to be expected in order to compensate for the changes in freight rates. The schedules issued for June 25, when the new rates became effective, were so complicated that not even the traffic managers could solve them at once. It has turned out this week that the advance in rate from St. Louis to New York will be 35c. per 100 lb. instead of the 24½c. expected, while the smelting-in-transit differential will be 27c., instead of 17½c., which was expected. The quoted prices for lead up to and inclusive of July 3 do not allow for the new rates. Inasmuch as those rates have been in effect since June 25, sellers will be the losers. The monstrous increases in these rates will be protested in hearings to be held in the near future.

Zinc—There was a small further advance in this market, largely on speculative bidding and buying, but at the close it seemed to be not quite so strong. Transactions were of no great volume, and, on the whole, the market was rather dull.

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

Aluminum—Price fixed at 33c. per lb. for lots of 50 tons or more, ingot, 98-99% grade. Price was established June 1 and will continue to Sept. 1. Little available except for Government orders.

Antimony—Several large orders were placed, and in consequence of this business the situation was much improved. We quote spot at 13½@13¾. We quote futures at 11⅞@12¼c., c.i.f., in bond.

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

Cadmium—This metal is quoted at $1.50 minimum and $1.75 maximum per pound.

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

Quicksilver—We quote $125@$130, sales being reported at the latter figure. San Francisco reports by telegraph, $116, firm.

Silver and Platinum

Silver—Situation remains substantially unchanged, New York official has advanced ¼c. to 99⅝c. per oz., while London has declined to 48⅛d. These slight changes bring the fixed prices to a parity with each other, and represent actual marked conditions. Shipments to London week ending June 29 were 500,000 ounces.

Mexican dollars at New York: June 27, 77; June 28, 77; June 29, 77; July 1, 77; July 2, 77; July 3, 77.

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

Ore Markets

Joplin, Mo., June 29—Blende, per ton, high, $76.60; basis 60% zinc, premium, $75. Class B, $60; prime Western, $52.50@50; calamine, per ton, basis 40% zinc, $35@25. Average selling prices: Blende, $50; calamine, $36; all zinc ores, $8.78 per ton.

Lead, high, $99.80; basis 80% lead, $97.50; average selling price, all grades of lead, $94 per ton.

Shipments the week: Blende, 9310; calamine, 142; lead, 1254 tons. Value, all ores the week, $578,870. Shipments, six months: Blende, 230,624; calamine, 10,488; lead, 38,955 tons. Value, all ores six months, $15,368,910.

The shortage of production is making buyers anxious, and sharp competition resulted in advances on all but premium ore. Lack of cars, diverted to the harvest fields, holds down the shipments, but there is little unsold ore. Sellers realize the situation and are holding for firm prices. The Weir Smelting Co. has been revived, with a lease on the Caney plant of the American Zinc, Lead and Smelting Co., and put a buyer in the field this week for 200 tons of ore, as an initiative step. It is expected to use 400 to 500 tons per week in full operation. W. H. Eardley succeeds George W. Moore as local manager of the ore-purchasing department of the American Metal Co. Mr. Moore goes to the Eagle-Picher Lead Co. Both companies will have head purchasing offices in Joplin.

Platteville, Wis., June 29—Blende, basis 60% zinc, highest price reported paid for premium grade was $72.20 per ton. Second grade and high grade leady blende advanced to $47.50 per ton. Base lead ore, basis 80% lead, $86 per ton.

Shipments reported for the week were 2797 tons blende, 422 tons galena, and 743 tons sulphur ore. First six months 1918: Zinc, 66,434; lead, 3594, sulphur ore 26,601. tons. First six months 1917: Zinc, 70,177; lead, 2949, sulphur ore, 13,934 tons.

Pyrites—Spanish lump is quotable to those who possess a license from the Government at 17c. per unit on the basis of 9s. ocean freight, buyer to pay war risk, less 2% and excess freight. Tonnage is extremely difficult to obtain, and of the allotment that was scheduled to be delivered in April and May, only a small portion has come in. Domestic pyrite is selling at prices ranging from 25 to 30c. per unit, f.o.b. mine. Unchanged.

Tungsten Ore—The market remains steady, with prices ranging from $19 to $24 per unit, according to grade. High-grade ores free from impurities are quoted at from $23 to $24 per unit for 65% and 70% WO_3, respectively; low-grade ores containing impurities are quoted at $19 to $20 on the basis of 60% or over.

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

Manganese Ore—Unchanged at $135. basis 48 per cent.

Molybdenum Ore—A small lot was reported sold at $1.25 per lb. of molybdenum sulphide in concentrates containing over 90 per cent.

Iron Trade Review

PITTSBURGH—July 2

The war activities are being well supplied with steel. It has been possible to accumulate some ship steel at fabricating plants, and there is some accumulating of fabricated parts at shipyards, although complaint is made that at one or two shipyards, notably Hog Isalnd, receipts of steel are still not altogether sufficient. Some of the forge shops have not been able to keep pace with the rate at which steel has been shipped them. There is no relaxation of pressure by the Director of Steel Supplies, who desires to accumulate stocks as a measure of safety against possible interruptions to manufacture or transportation next winter. After these liberal shipments are made for the direct war activities, there are left good supplies for commercial purposes standing highest in the preference list. The industries standing near the bottom of the list are receiving relatively little steel, while the industries not recognized at all with preference are getting practically nothing. Hardship is resulting in few if any cases, however, because the industries not accorded preference are much less active than usual, and have considerable stocks of steel. The shortage of steel that has existed for nearly three years got nearly all buyers, jobbers and manufacturing consumers alike, into the habit of carrying good-sized stocks, and though lines are broken or poorly assorted in many instances, the aggregate tonnage is large. The outlook is that the apparently drastic control of pig-iron and steel deliveries is not in itself likely to disturb trade greatly.

Production of both pig-iron and steel ingots was at a slightly better rate in June than in May, but lessened production is expected in July and August, on account of weather conditions.

Pig Iron—Some of the merchant furnaces are greatly concerned over their costs, which it is claimed are in some cases approaching the Gover. ment price limit. The best-attended meeting in the history of the American Pig Iron Association was held in Pittsburgh last Friday, chiefly to discuss the situation. The greatest complaint does not come, as might be expected, from consumers of Lake Superior ore, who have to pay an advance of 45c. a ton from July 1, through the recent price adjustment of the War Industries Board, but from furnaces in Tennessee and Virginia, whose difficulties arise chiefly from inefficiency of labor. Another meeting is to be held late this week, in Cleveland. Despite reports to the contrary, there is no gen.ral desire on the part of the merchant furnaces to seek higher Government prices. There are few open market sales, but many allocations by the Government. Commercial consumers not accorded preference treatment by the authorities are receiving little iron, but no great inconvenience seems to result. The market remains quotable at the set limits: Bessemer, $35.20; basic, $32; No. 2 foundry, $33; malleable, $33.50; forge, $32, f.o.b. furnaces. Freight from the Valleys to Pittsburgh, formerly 95c. advanced May 22 to $1.10 and June 25 to $1.40. W. P. Snyder & Co. report average prices in June, based on actual sales, at $35.20 for bessemer and $32 for openhearth, at Valley furnaces. Foundry iron was quoted throughout the month at $33, furnace.

Steel—There is no soft steel available in the market, and only an occasional small lot of discard steel. Discard steel and off heats are being rolled into essential products wherever possible or are being melted up as scrap.

Ferromanganese—The market is quiet, with prompt and forward still quoted at $250, delivered, for 70%, with $4 a unit for higher manganese content. Spiegeleisen is regularly quoted at $70, furnace, but only fourth-quarter deliveries are obtainable at this figure, prompt commanding a premium of about $4.

STOCK QUOTATIONS

N. Y. EXCH.†	July 2
Alaska Gold M.	2⅛
Alaska Juneau	1⅛
Am.Sm.& Ref.,com.	79
Am. Sm. & Ref., pf.	105
Am. Sm. Sec., pf., A	89
Am. Zinc	21
Am. Zinc, pf.	52
Anaconda	67⅞
Batopilas Min	1
Bethlehem Steel	82⅜
Bethlehem Steel, pf.	‡88⅛
Butte & Superior	31
Butte Cop. & Zinc	12
Cerro de Pasco	34
Chile Cop.	16⅛
Chino	40⅛
Colo. Fuel & Iron	47
Crucible Steel	67
Crucible Steel, pf.	90
Dome Mines	7
Federal M. & S.	10⅛
Federal M. & S., pf.	32
Great Nor., ore ctf.	32
Greene Cananea	42
Gulf States Steel	85
Homestake	70
Inspiration Con.	54⅛
International Nickel	29
Kennecott	33
Lackawanna Steel	83⅛
Mexican Petrol	98
Miami Copper	29
Nat'l Lead, com.	59⅛
National Lead, pf.	101
Nev. Consol.	19⅛
Ontario Min	11
Ray Con	24⅛
Republic I.&S.,com.	89
Republic I. & S., pf.	99
Sloss-Sheffield	62
Tennessee C. & C.	19
U. S. Steel, com.	105⅛
U. S. Steel, pf.	111
Utah Copper	82½
Va. Iron C. & C.	71

N. Y. CURB†	July 2
Big Ledge	1
Butte & N. Y.	‡.75
Butte Detroit	‡1
Caledonia	.44
Calumet & Jerome	1
Can. Cop. Corpn.	1
Carlisle	‡2
Cashboy	.05
Con. Ariz. Sm.	1
Con. Coppermines	5
Con. Nev.-Utah	‡
Emma Con.	.17
First Nat. Cop.	‡1
Goldfield Con.	‡1
Goldfield Merger	.02
Greenmonster	‡
Hecla Min.	4
Howe Sound	‡4
Jerome Verde	‡
Kerr Lake	5.35
Louisiana	‡.50
Magma	33
Majestic	.23
Marsh	.04
McKinley-Dar-Sa.	.38
Milford	‡.75
Mohican	‡.06
Mother Lode	.36
N. Y. & Hond.	‡12
Nipissing Mines	8
Nixon Nevada	‡.42
Ohio Cop.	
Rawley	‡2
Ray Hercules	4
Richmond	‡.56
Rochester Mines	.38
St. Joseph Lead	14
Standard S. L.	
Stewart	.16
Success	.09
Tonopah	2
Tononah Ex.	1
Tribullion	‡
Troy Arizona	.12
United Cop.	‡
United Verde Ext.	39
United Zinc	‡1
Utica Mines	‡.08

SAN FRAN.*	June 25
Alta	.03
Andes	.07
Best & Belcher	.04
Caledonia	.04
Challenge Con.	.03
Confidence	.04
Con. Virginia	.30
Gould & Curry	.01
Hale & Norcross	.01
Jacket-Cr. Pt.	.06
Mexican	.28
Occidental	.51
Ophir	.11
Overman	.02
Savage	.03
Sierra Nevada	.10
Union Con.	.50
Utah Con.	.01
Belmont	2.95
Jim Butler	.65
MacNamara	.20
Midway	.04
Mont.-Tonopah	.10
North Star	.07
Rescue Eula	.08
West End Con.	.99
Atlanta	.05
Booth	.02
Comb. Frac.	‡.02
Florence	.10
Jumbo Extension	.08
Kewanas	.02
Nevada Hills	.03
Nevada Packard	.27
Round Mountain	.23
Silver Pick	.03
White Caps	.26
Big Jim	‡.75
United Eastern	3.25

BOSTON EXCH.*	July 2
Adventure	.50
Ahmeek	75
Algomah	.30
Allouez	49
Ariz. Com., ctfs.	13⅛
Arnold	.20
Bingham Mines	9⅜
Bonanza	.17
Butte-Balaklava	.27
Calumet & Ariz.	67
Calumet & Hecla	445
Centennial	10⅜
Copper Range	46⅛
Daly West	2
Davis-Daly	5⅛
East Butte	9
Franklin	4
Granby	75
Hancock	5⅛
Hedley	‡12
Helvetia	.20
Indiana	‡.50
Isle Royale	26⅛
Keweenaw	1
Lake	5⅛
La Salle	2
Mason Valley	4
Mass	5⅛
Mayflower	2⅛
Michigan	2⅛
Mohawk	58
New Arcadian	2⅛
New Idria	14
North Butte	14⅛
North Lake	.60
Oilbway	.60
Old Dominion	41
Osceola	49
Quincy	68
St. Mary's M. L.	50
Santa Fe	.70
Seneca	10
Shannon	4⅛
Shattuck-Ariz.	16
So. Lake	1⅛
So. Utah	10
Superior	‡4⅛
Superior & Bost.	2⅛
Trinity	3
Tuolumne	96
U. S. Smelting	43⅛
U. S. Smelt'g, pf.	44
Utah Apex	1⅛
Utah Con.	9⅛
Utah Metal	2⅛
Victoria	2⅛
Winona	1
Wolverine	27
Wyandot	.50

BOSTON CURB*	July 2
Alaska Mines Corp	.12
Boston Ely	.80
Boston & Mont.	.52
Butte & Lon'n Dev.	.17
Calaveras	.50
Calumet-Corbin	‡.01
Chief Con.	2⅛
Cortez	.05
Crown Reserve	.15
Crystal Cop.	.23
Eagle & Blue Bell	2
Gila Copper	‡17
Houghton Copper	.50
Intermountain	‡.05
Iron Cap	.18
Mexican Metals	.35
Mines of America	1⅛
Mojave Tungsten	.07
Nat. Zinc & Lead	.17
Nevada-Douglas	.45
New Baltic	.80
New Cornelia	17⅛
Oneco	.20
Pacific Mines	‡.35
Rex Cons.	.08
Yukon Gold	1

SALT LAKE*	June 29
Bannack	‡.26
Cardiff	‡2.00
Colorado Mining	‡.07
Daly	‡2.00
Empire Copper	‡.92
Gold Chain	‡.05
Grand Central	‡.47
Iron Blossom	.38⅛
Judge	‡5.50
Lower Mammoth	‡.03
May Day	‡.01⅛
Moscow	‡.05
Prince Con.	.54
Rico Wellington	.11
Silver-King Coal'n	1.15
Silver King Con.	1.45
Sioux Con.	‡.02
So. Hecla	‡.68
Tintic Standard	1.91
Uncle Sam	.02
Walker Cop.	1.25
Wilbert	‡.06⅛
Yankee	‡.02⅛

TORONTO*	July 2
Adanac	.07
Bailey	.03⅛
Beaver Con.	.25⅛
Chambers Ferland	.11
Coniagas	2.62⅛
Hargraves	.04
La Rose	.31⅛
Peterson Lake	.09
Temiskaming	.29
Wettlaufer-Lor.	.04
Davidson	.33
Dome Exten.	.09
Dome Lake	.12
Hollinger	4.50
McIntyre	1.12⅛
Newray	.12⅛
Porcu. Crown	.13
Teck-Hughes	.30
Vipond	.12
West Dome	.07

STOCK QUOTATIONS—Continued

COLO. SPRINGS	July 2
Cresson Con.	4.50
Doctor Jack Pot.	.05
Elkton Con.	.04
El Paso	.10
Gold Sovereign	‡.02
Golden Cycle	1.58
Granite	.17
Isabella	.03⅛
Mary McKinney	.04
Portland	.78
United Gold M.	.14
Vindicator	.30⅛

LONDON	Apr. 15
Burma Corp.	£4 0s 0d
Cam & Motor.	0 11 0
Camp Bird	0 7 9
El Oro	0 8 6
Esperanza	0 8 6
Mexican Mines	5 5 0
Min. Corp. Can.	0 16 3
Nechi, pfd	0 10 6
Oroville	0 17 9
St. John del Rey	0 16 0
Santa Gert'dis.	0 12 9
Tomboy	0 17 3

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

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1916	1917	1918	1916	1917	1918
Jan.	56.775	75.630	88.702	26.960	36.682	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	95.34	30.662	36.963	47.215
May	74.269	74.745	99.505	35.477	37.940	48.980
June	65.024	76.971	99.500	31.060	39.065	48.875
July	62.940	79.010		30.000	40.110	
Aug.	66.083	85.407		31.498	43.418	
Sept.	68.515	100.740		32.584	50.920	
Oct.	67.855	87.332		32.361	44.324	
Nov.	71.604	85.891		34.192	43.584	
Dec.	75.765	85.960		36.410	43.052	
Year	65.661	81.417		31.315	40.851	

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

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1917	1918	1917	1918	1917	1918
Jan.	28.673	23.500	131.921	110.000	142.895	125.000
Feb.	31.750	23.500	137.895	110.000	148.100	125.000
Mar.	31.481	23.500	136.750	110.000	151.000	125.000
April	27.935	23.500	133.842	110.000	147.158	125.000
May	28.788	23.500	130.000	110.000	142.000	125.000
June	29.962	23.500	130.000	110.000	142.000	125.000
July	26.620		128.409		140.409	
Aug.	25.380		122.391		137.000	
Sept.	25.073		117.500		135.250	
Oct.	25.500		110.000		125.000	
Nov.	23.500		110.000		125.000	
Dec.	23.500		110.000		125.000	
Year	27.180		124.892		138.401	

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

(a) No average computed.

Lead	New York		St. Louis		London	
	1917	1918	1917	1918	1917	1918
January	7.626	6.782	7.530	6.684	30.500	29.50
February	8.636	6.973	8.595	6.899	30.500	29.50
March	9.199	7.201	9.120	7.091	30.500	29.50
April	9.288	6.72	9.158	6.01	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		10.644		30.500	
August	10.594		10.518		30.500	
September	8.680		8.611		30.500	
October	6.710		6.650		30.500	
November	6.249		6.187		30.500	
December	6.375		6.312		30.500	
Year	8.787		8.721		30.500	

Spelter	New York		St. Louis		London	
	1917	1918	1917	1918	1917	1918
January	9.619	7.836	9.449	7.661	48.329	54.000
February	10.045	7.814	9.875	7.639	47.000	54.000
March	10.300	7.461	10.130	7.286	47.000	54.000
April	9.459	6.810	9.289	6.71	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		8.473		54.000	
August	8.390		8.190		54.000	
September	8.136		7.966		54.000	
October	7.983		7.813		54.000	
November	7.847		7.672		54.000	
December	7.685		7.510		54.000	
Year	8.901		8.813		52.413	

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

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

‡ As reported by W. P. Snyder & Co.