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An Ore-handling Plant in New Caledonia

An Elaborate System of Suspension Tracks and Cables, Comprising Four Main Lines, for Carrying Ore, Coal, Merchandise and Passengers

SPECIAL CORRESPONDENCE

The development of the ore resources of the island of New Caledonia has hitherto suffered severely from the lack of suitable transportation and handling facilities between the sea and shore. Owing to the rocky and treacherous nature of the coast, approach is difficult, the difficulty being accentuated by the heavy surf which prevails. Such conditions militated against

trade, more especially so since vessels of heavier tonnage were precluded from securing consignments of this freight for their return voyage to Europe.

Under these circumstances the mining interests concerned decided to lay down a complete modern plant replete with every facility and convenience for the expeditious handling between ship and shore not

vessels, and to connect this isolated landing stage with the mainland by means of a wire ropeway, over which the whole of the traffic between the ship and shore would travel.

Such an arrangement offered complete independence of the state of the tide, currents, rocky character of the shore; and the contemplated site, being sheltered by



ROPEWAY FROM CENTRAL STATION TO LOADING BRIDGE

vessels, except those of the small, and shallow-draft coastal type, and prevented their coming sufficiently near the mainland to ship the ore from the barges which brought it from a small jetty, through the surf. Such methods, being not only tedious and slow but expensive as well, handicapped the expansion of the export

only of the ore but also miscellaneous freight such as stores, coal, and even passenger traffic. As a solution of the problem Adolf Bleichert & Co., of Leipzig, Germany, suggested the construction of a large landing stage about 1000 yd. from the shore provided with every appliance for the rapid discharging and loading of

a peninsula jutting into the sea, offered complete protection from storms, thereby enabling even the largest vessels that would call at the island to ride in perfect safety and beyond the surf. The construction of such a landing stage, as the engineers pointed out, offered no insuperable difficulties, while the necessary piers

for supporting the ropeway required only a small base width, so that they would offer only the minimum of resistance to currents which might lead to the accumulation of silt, while the carrying ropes could be carried at such a height as to be beyond the reach of the waves during the heaviest storms.

REQUIREMENTS OF THE SYSTEM

Under these circumstances the mining authorities decided upon this system and the contract was placed with the firm named at the end of 1902. In this decision not only were the mining interests impressed by the lower cost and the expedition with which such a project could be consummated with complete satisfaction, so far as their requirements were concerned, but it entailed the readjustment of their existing facilities on the island to the minimum. Such a cableway accommodated itself easily to the conditions prevailing.

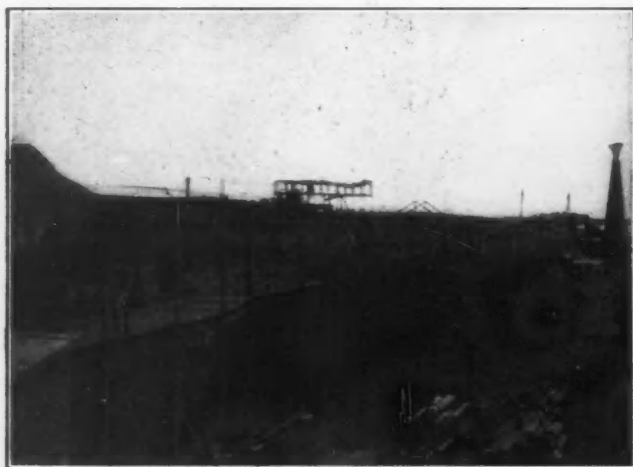
such as was required at the dumps. A bank 65 ft. high was contemplated in order to carry large stocks of ore, and as in any event this phase of operations would have necessitated the construction of an aerial cableway, it was realized that considerable saving in time and expense would attend a complete rope-driven suspension railroad over the whole district to be served, and it offered the further advantage that the varying differences in level could be more easily negotiated by the guide-driven ropeway and would enable the working of the whole to a very great extent to be carried out with an automatic drive.

A comprehensive idea of the varied and heavy nature of the work which this cableway was designed to perform may be gathered from the following:

- (a) Discharge of ballast or coal from arriving vessels.
- (b) Discharge of ore from small steamers arriving from contiguous islands.
- (c) Piling ore brought from vessels at the seaboard dumps.

terminus of the existing railroad coming from Bornet. At this point the road runs with a moderate gradient up a bank to such a height that by opening the bottom traps of the cars the contents can be shot into huge hoppers, underneath which is situated the terminus of the overhead cable railroad, so that the hoppers can be discharged quickly and easily as rapidly as they are filled from the railroad cars.

The cableway system is divided into four sections, each of which performs a distinct function, though all effect a junction at the central station. Line No. 1 is that which handles the ore between the railroad stations and the ore dumps. Immediately upon receiving its charge of ore at the railroad-station hoppers the car is carried over lofty steel supports to a return station where it turns automatically and returns toward its starting point where the ore dumps are placed. In order to negotiate this section the line makes a sharp ascent in order to give the requisite



DRIVING STATION WITH COAL DEPOT



CENTRAL STATION, SHOWING SWITCHES AND CROSSINGS

The mines are situated on the Thio plateau and the ores are transported from Bornet to the seaboard station at Mission bay over a surface railroad. The drop to the shore, however, is somewhat rapid and steep, and to continue the railroad from its existing terminus to a point where it was decided to establish ore stock dumps would have been impossible owing to the heavy nature of the grades while breaking bulk, and transference to other types of transport would have been too expensive. At the same time the supplies of ore thus brought down by the railroad to the stock dumps are supplemented by cargoes from the neighboring islands carried in small coastal vessels. These latter had to discharge into lighters which brought the ore to the shore, whence it was carried to the dumps, a similar process having to be repeated in loading these vessels with coal and stores.

Again the configuration of the country prevented the formation of a high tip

- (d) Removing and storing sand brought as ballast on incoming ships.
- (e) Transfer of coal from incoming vessels to seaboard coal depot.
- (f) Transportation of ore arriving from up-country per railroad from terminus of latter to the dumps.
- (g) Transfer and load ore arriving from inland vessels moored at the landing stage.
- (h) Remove ore from dumps to vessels at landing stage.
- (i) Transport coal from depot to bunkers of incoming vessels.
- (j) Negotiate all passenger and other traffic between vessels and shore.

The heaviest and most important work, however, is that under *g* and *h*, which occurs every day.

PLAN OF THE INSTALLATION

In view of the fact that the whole plant was to be carried out as a rope-driven suspension railroad, it was decided, owing to the advantages offered, to establish a central station at a suitable point, whence all the lines for the various operations could be converged and the driving movements could be controlled and directed. Selection fell upon a small area close to the sea, and in close proximity to the

high for the formation of the dump. As the car passes over this latter it is caught by a movable adjustment appliance which tips the car without arresting its forward progress and the contents are discharged upon the dump beneath without the slightest interruption of the traffic.

Considering the fact that the dumps are intended to attain a size of 50,000 tons, it is necessary to tip to a height of 65 ft., so that the towers or supports carrying the overhead railroad, and having a height of 80 ft. will be buried in the ore up to the level of the protection rollers of the carrying ropes. In order that these supports may not suffer any damage from the falling ore by the pressure from the bank becoming higher on one side than the other, or its integral parts becoming blocked with the mineral, the usual profile in iron design is superseded by a cone-shaped support of sheet steel which affords a higher factor of stability and rigidity.

Consignments of ore, intended to be transported direct from the railroad cars to the ships moored outside the landing stage, are also carried over this line and to line No. 2, the section connecting the landing stage with the mainland, the cars discharging their contents upon arrival at the landing stage into traveling hoppers, from which in turn the buckets of the loading cranes are filled and emptied into the vessel's hold, the cableway cars turning automatically and running back to the central station. Line No. 1 has a carrying capacity of 40 tons per hour. The cars are spaced 390 ft. apart, and have a traveling velocity of $6\frac{1}{2}$ ft. per second.

CABLE LINES OF THE SYSTEM

Line No. 2, which is the most important of the whole system, inasmuch as it connects the landing stage with the mainland, is about 1000 yd. long, and effects a junction at the central station with the other three sections. Its duty is somewhat heavy, and for this reason its hand-

per hour, with a car speed of $6\frac{1}{2}$ ft. per second and with the cars spaced $175\frac{1}{2}$ ft. apart.

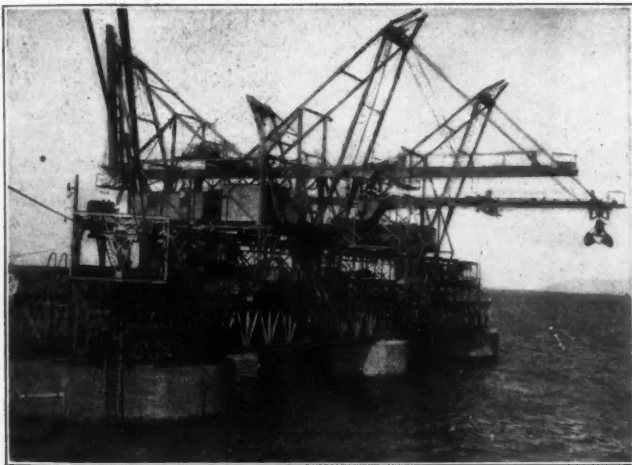
This line serves a variety of purposes. The northern stretch serves on the one hand to form the connection between the "taking-up" line and the sea, and on the other hand the connection between the coal depot and the sea. At the same time at a point, about midway in this northern stretch above the three side tracks of the railroad which the line crosses, there is a large hopper for the accommodation of sand ballast transferred from incoming ships. This sand is loaded from the vessel by grabs, dumped into cableway cars which convey it over line No. 2 to the central station, where it is taken up and dumped.

The sand is in turn discharged from these hoppers into railroad cars and used for building up railroad embankments, or for filling depressions in the ground. This arrangement has the advantage that on one side of the line supplies of ore can be

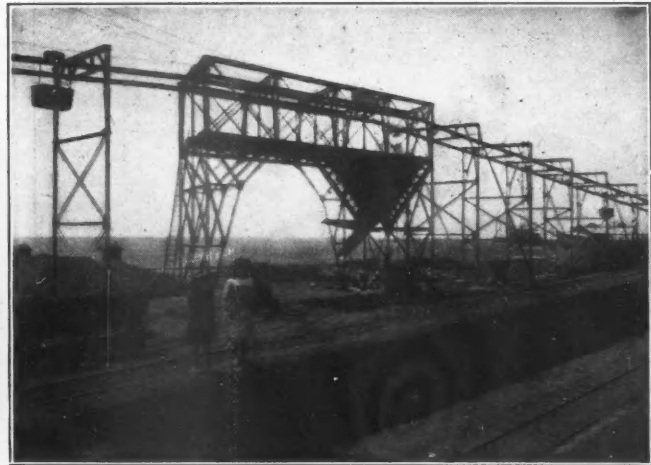
it into the crane hoppers. The coal-laden cars travel back to the coal depot, deliver their contents, are pushed over from line No. 3 to line No. 4, which extends along the ore dump, recharged, pushed back again off line No. 4 to line No. 3 and sent back to the ship.

Line No. 4 is a low-level section, and its function is to convey ore from the dumps to line No. 3 for transportation to the landing stage, thereby supplementing the through direct line between the railroad and the sea stations. It is a double-rope-driven line and extends along the ore dump at the low height of $6\frac{1}{2}$ ft., connecting with a traveling cross-bridge spanning the whole dump and also carried at a height similar to that of the cableway in conjunction with which it works.

On this traveling bridge are two hoppers from which the cars of the cableway are filled, and these hoppers in turn are charged by two cup elevators running along the dumping site on a track. In the area of the dump, however, are the



LOADING CRANES IN THE HARBOR



SAND HOPPER AT CROSSING OVER SURFACE LINE

ling capacity is considerably increased in comparison with the other stretches; it can deal with 100 tons per hour in either direction. The car speed is the same, $6\frac{1}{2}$ ft. per sec., but the cars are spaced only $175\frac{1}{2}$ ft. apart. Over this line all traffic between ship and shore, irrespective of character, is maintained.

Line No. 3 conveys ore from the dumps over line No. 4 to the central station or landing stage, coal and sand from the central station to the coal depot and sand hopper, respectively. This line is laid at a great height, for not only has it to cross line No. 4, but also three surface-railroad tracks extending between the central station and the ore dumps. As it approaches the central station it descends sufficiently to come level with line No. 1. Indeed, the whole system is designed so that at this point the four sections are at a uniform level, to facilitate handling and switching, approximately 8 ft. above the ground. Its handling capacity is 100 tons

obtained for conveyance to waiting vessels, while ballast can be brought back on the return trip. Consequently, the cars need not return empty, and both sides of the cable way are thus turned to profitable account. Again, the whole of the coal traffic is maintained over this section. The coal unloaded from the incoming vessel is despatched over the sea section, or line No. 2 to the central station, switched on at that point to line No. 3, whence it is carried to an angle station, pushed upon the southern stretch of this section and sent to the coal depot into which it is discharged automatically without stopping the car, the latter then returning to the ship.

METHOD OF OPERATION

In handling coal two operations can be carried out at the same time. A steamer discharges this freight into the cars which have brought their consignments of ore out to the landing stage and discharged

two conical steel towers supporting line No. 1, and in order that the cross-bridge may not be obstructed in its operation, it is constructed in two separate parts connected in the center by swing rails. In passing one of the towers the cross-bridge is divided by swinging these connecting rails outward and the parts thus pass the obstruction separately, being reconnected upon the other side. If necessary the bridge can be used at half-length in order to pick up the ore near the supports, at least on one side, there being a return rail in the center of the cross-bridge for this purpose.

The cars are pushed over the bridge by hand; at the extremity is a coupling joint where the cars are attached to the traction rope of the cableway. The cars, charged with ore by the cup elevator, run along the dump on the inner side of the framework carrying the cableway to a return station and then toward the center of the cableway framework. From the pre-

vailing low level the line now has a sharp upward grade continuing until a height of about 33 ft. is gained at the junction and angle station, which branches off on one side to the central station and thence to line No. 2 through switches and cross-overs; on the other side it goes to the coal depot which is of 1500 tons capacity. The cars have now reached the level of line No. 3 upon which they are pushed by hand, run over this section to its junction with line No. 2 and thence direct out to the sea station. This fourth line has also a handling capacity of 100 tons per hour, but the car speed is increased to 26 ft. per second while the spaces between the cars is reduced to $71\frac{1}{2}$ feet.

For the sea section of the line and that extending over the ore dumps the track is of locked carrying-ropes of long span. Over the ore dumps the spans are consecutively 195 ft., $227\frac{1}{2}$ ft., 179 ft. and $162\frac{1}{2}$ ft.; on the sea section the spans are 390 feet.

come by the utilization of the Bleichert automatic gripping apparatus with underhung rope which admits gradients up to 45 deg. and at the same time is absolutely unaffected by any variations in the diameter of the rope arising from the causes named.

The work of erection offered no serious difficulties. The only precautions necessary were in connection with the construction of the more elevated portions of the ironwork against the severe storms and typhoons common in the locality. In regard to the sea section, however, constructional work was of a more difficult character. The sea bed is of a varying nature being rocky and level close inshore giving way to silt farther out and offering no stable foundation. For the former sites suitable rocky ridges were selected and upon these cement piers were built to high-water level with the usual type of iron profile towers constituting the superstructure for carrying the cableway.

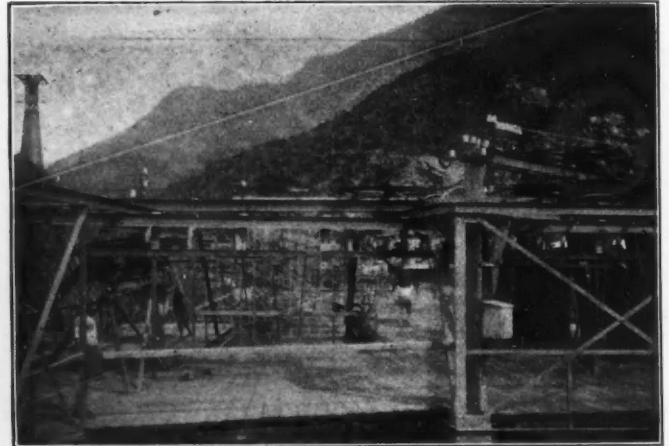
air-lock could not be undertaken, since a single storm would have sufficed for the complete destruction of this preliminary work. Moreover, the nature of the sea bed was but indifferently known. Consequently it was decided to build huge caissons or tuns on land for inclosing the masonry work, and then to take them out to sea and sink them in the desired position.

At first, however, the sites were extensively dredged to remove the upper layer of mud and silt, and to gain access to the underlying gravel for a firm foundation. These areas were then covered with large stones to a depth of about 17 ft. to protect the sites from becoming covered with silt and partly to afford a suitable foundation for the caissons.

The design of caisson adopted comprised two timber cylinders, one inserted within the other. The inner was of $32\frac{1}{2}$ ft. and the outer of $45\frac{1}{2}$ ft. diameter, leaving an annular space $6\frac{1}{2}$ ft. wide to be provided with a substantial flooring. These



RETURN AND TENSION STATION, LINE NO. I



ANGLE AND JUNCTION STATION

DIFFICULTIES OF CONSTRUCTION

In laying out the cableway the number of curve returns that had to be dealt with constituted an important feature. It was imperative that they should be negotiated automatically without detaching the cars from the traction rope, as this would have caused interruptions in traffic owing to the comparatively rapid sequence of the cars. Further, although there are four different traction ropes for various purposes it was essential that they should work together in such a manner as to enable the cars to be switched over from one line to the other without any difficulty.

With four different traction ropes subject to varying tensions the difficulties of the problem may be realized, especially as the disadvantage of different rope diameters due to differences in strain have to be neutralized. All the traction ropes are of the same diameter, but this does not remain constant; the shrinkage in diameter aggregates as much as 27 per cent. after prolonged use, according to the strain imposed. This difficulty was over-

Where sand was encountered piles were driven and strengthened by concrete, this work being carried out by divers, and the whole finally covered with heavy stones. Upon this mass an iron frame was built supporting a platform above water upon which was placed the iron supporting towers about 49 ft. high. This part of the work completed, the cables were soon placed in position.

LANDING STAGE

The construction of the landing stage comprised the most difficult part of the whole undertaking. It was imperative that it should be placed sufficiently far out to sea to provide a minimum depth of 33 ft. of water, so that vessels could come, moor and go at any state of the tide. The most serious part of the work was in connection with the piers for carrying the superstructure. The strong currents, the rough character of the sea, and the muddy water prevented submarine building by divers, while similarly piling by means of an

cylinders were built on shore. The floor was first laid and to this the iron frame around which the planks were to be secured was placed in position. The planking was erected in the same way as the staves of a barrel with iron rings of U-shape pointing upward. Finally the cylinders were rendered water-tight with roof-felting and tarred sail-cloth. Upon completion they were launched, towed out to the site, and sunk into position by the simple admission of water. Despite the numerous difficulties that had to be overcome in connection with this part of the work, it was rapidly and successfully accomplished, and the masonry was soon filled in and completed ready for the superstructure.

The landing stage is built in two sections, the outer extremities resting on the outer piers and meeting on the central pier. Each section is 114 ft. long giving a total length from end to end of 228 ft. The clear span length of each section is 96 ft. Again each section consists of two main carriers with parallel bracing of an

simple construction with a height of 9 ft. 9 in. The main carriers are spaced 36 ft. from one another. The lower chord of these main carriers is of angle iron with intermediate riveted vertical steel sheets, and the upper chord is composed of two U-irons with the webs turned to each other; the upper flanges with the help of cross-irons serve to take up the rails for the traveling cranes.

On the middle pier the landing-stage sections have their extremities on a fixed bearing, the two outer piers carrying suitable roller bearings to allow necessary play. The cross bracings of the landing stage also consist of parallel girder carriers above which are the bracings for the working platform and the cableway. These are also longitudinally strutted with U-irons, the longitudinal U-iron binding together the top cross U-irons also forming the main girder for taking up the cableway shoes.

The working platform is 6½ ft. above the upper chord of the main carriers along which a second platform 3¼ ft. wide extends, but which is intended only for attendance on the traveling drive of the cranes. On the side facing the shore the landing stage has an extension somewhat resembling a balcony joining the main structure at an obtuse angle and which carries the saddles for the carrying ropes of the cableway as also the tension-weight rollers, the weights hanging in a recess in the pier. The saddles of the carrying rope are faced on the sides with cast-steel plates at the point where they transfer the traffic to the fixed overhead rails of the landing stage in order to protect the carrying ropes from damage as they are particularly subject to wear and tear at the deflection points owing to the passage of the cars. The carrying ropes from the shore to the landing stage are firmly anchored in the central station and stretched by weights on the landing stage with the aid of flat strand tension ropes running over large cast-iron tension rollers.

THE CRANES

The two cranes are of the double-jib type with raising jibs and with two rope trolleys which permit hoisting and lowering as well as stopping at any point of the track. Both cranes span the superstructure of the bracing of the landing stage on which the cableway is carried. Just over the superstructure is the engine house providing the power for the cranes complete with steam engine and boiler. It was decided to be more satisfactory to select an independent steam drive on the landing stage for its own requirements since, although electric operation would have been possible, the expense of laying a cable for the purpose from the shore was considered too heavy, while at the same time any breakdown at the electric generating station would paralyze loading and unloading on the landing stage.

Owing to the exposed position of the cranes (they travel on a track 162½ ft. in length, while the jibs when raised are nearly 100 ft. above the water level) it was necessary to secure a high factor of stability, especially when the heavy wind pressure incidental to the heavy storms and typhoons is borne in mind. The wheel base of each crane is 32½ ft., while the width of the engine houses is 16 ft. For further protection against storms the cranes can be brought up side by side and anchored together forming one complete structure with an extensive ground area. The outer parts of the jibs can be raised for a length of 40 ft. to enable ships to moor alongside without recourse to cross-towing.

The cranes can be worked with both grabs and buckets. A so-called drum-grab has been selected, the closing chain winding on the drum axle while the hoisting chain unrolls from the drum in tightening. The gearing lies in the difference between the diameters of the drum-axle and the drum. These grabs have the advantage that they can be quickly changed for buckets without taking out the hoisting ropes, a point of no little importance as frequent changes from grabs to bucket and *vice versa* are necessary.

The trolley, which carries the grabs and buckets and which can traverse the whole track, is driven by the triple-drum winch coupled direct to the steam engine. The trolley traveling rope coming from one of the two traveling drums, which are free on the main winch axle, is fastened at its end on one side of the trolley. On the other side of the trolley the end of the rope going to the second traveling drum is fastened. This rope coming from the trolley first winds around a roller on the extreme end of the jib and thence passes to the opposite jib point. It here lies on a return roller from which it goes to the second traveling drum. The hoisting rope for hoisting and lowering the grabs or buckets is made double to procure a smaller diameter. At the extremity of the jib it is fastened with a spring buffer, runs downward over a return roller in the trolley, winds round the double-rilled steel block, which carries the bucket or grab, and then passes over the second return roller of the trolley to the extremity of the opposite jib. Here it is again wound around a return sheave whence it passes to the hoisting drum provided with symmetrical grooves running in opposite directions. The two traveling and the hoisting drums are mounted on the main winch shaft with which they are connected by friction couplings, the latter being provided with band brakes.

DETAILS OF OPERATION

For raising the jib two winches are built in above the engine house driven by the steam engine of the main winch by Ewart driving chains. From the winches

by means of special guide rollers the wire ropes pass over the end of the fixed jib frame to the extremity of the movable jib which is held in its level position by joint rods.

The steam engine is of the non-reversible twin type, hoisting, lowering, and reversal of the trolley traveling movement being effected by suitable motions of the drums assisted by band friction couplings. Steam is raised by a fire-tube boiler, and the water is brought from the shore in special cableway cars.

Each crane is fitted with four hoppers and charging funnels, one of the latter being built in on each side of the crane at the height of the working bridge. The cableway cars arriving from the shore with ore, dump their contents into these funnels, while beneath the latter are chutes through which the ore gravitates and fills the buckets of the crane, there being flaps in the chutes operated from the engine house controlling the delivery into the buckets.

For discharging vessels there is a further hopper built on each side of the crane on the level of the engine-house platform into which the buckets or grabs discharge their contents. At the bottom of these hoppers is a funnel which conveys the material into the cableway cars below and in such a manner that the cars can be filled without difficulty from the inner side. On the landing stage there are several short sidetracks and switches radiating from the main cableway system, so that it is not necessary for the cars to traverse the whole length of the landing stage. The suspension rails in the upper parts of frame are hung directly by means of cast-iron shoes on the cross braces of the bridge-carrier, the chords being made to project for this purpose.

Owing to the design of the plant it is always possible to carry out several operations simultaneously. Two ships can be loaded or unloaded at the same time, one on each side, while one can be loaded as the other is being discharged. As the cableway on the sea section has a capacity of 100 tons per hour each way this gives a total capacity, when used to its fullest extent, in either direction of 200 tons per hour. The cranes have a capacity of 100 tons of ore loading, and 60 tons of sand and 40 tons of coal unloading, giving a total capacity for both cranes of 200 tons per hour. A ship of 3000 tons which formerly required about 30 days to take in her freight now accomplishes the operation in two or three days, while at the same time the system has dispensed with the extensive fleet of barges and some hundreds of workmen occupied in transporting the ore from the shore to the ship at anchor in the roadstead. As work is often maintained day and night continuously, the whole of the plant is electrically lighted including the supporting standards of the sea section of the cableway.

Mining at Grass Valley and Nevada City

The Veins Dip about 30 Degrees from the Horizontal and the Ore Is Lowered in Cars down the Stopes. Inclined Shafts Are Used

BY G. E. WOLCOTT*

Grass Valley is an old camp. It was discovered even before the days of the famous Comstock in Nevada, the rush to which at one time almost depopulated this California camp. The Empire mine, the second largest producer today, was first opened up in 1853. Grass Valley is as good a camp today as ever in its history, and will doubtless be a gold producer 100 years from now. The distinctive feature of the deposits which makes a discovery in the district of especial importance is the fact that deposits can usually be depended upon to continue to a great depth. There are, of course, exceptions to this rule, or, at least, apparent exceptions, yet the camp as a whole is remarkable for the continuity of the veins. The Empire vein has been worked to a depth of 3500 ft., and the North Star vein,

cal. The North Star vein has an average dip of only 26 deg. from the horizontal, while 30 deg. may be taken as a close approximation to the general dip. There is, however, no general direction of dip. The North Star vein dips east, the Empire to the west, the Maryland to the south, and the Golden Gate to the north. Many of the veins are at times almost horizontal and have even been known to dip in two opposite directions.

The chief producers in the vicinity of Grass Valley in the order of their production are: The North Star, the Empire, the Pennsylvania Consolidated, the Prescott Hill, the Idaho-Maryland, and the Golden Gate mines. The North Star has two 40-stamp mills in operation, the Empire one of 40 stamps, the Pennsylvania Consolidated one of 20, the Prescott Hill

In the neighborhood of Nevada City the principal producers are: The Champion with a 40-stamp mill; Murchie, 20 stamps; Ousteamah, 10 stamps; and Mountaineer, 10 stamps. Most of these mills are run only intermittently, or at part capacity. As a gold producer, Nevada City is behind its neighbor. The Champion has been a great producer, and has been worked to a depth of 2400 ft. in the vein. It is known that there are bodies of ore below this depth, but with present pumping and hoisting facilities greater depths cannot be attained. The ground is now being partly worked by tributors. The company furnishes everything necessary for mining, and the tributors get one-half the gold obtained from the amalgamation plates. All the concentrates go to the company.



EMPIRE MINE



CENRTAL SHAFT, NORTH STAR COMPANY

which has been worked for nearly half a century, has this year been opened up to a depth of 5400 ft., and appears as strong at this depth as nearer the surface.

THE CAMP AND ITS MINES

Nevada City and Grass Valley may be roughly considered as forming one mining camp. While lying four miles apart they are closely connected by an electric-car line, and from a mining point of view the distinctive features of the one are the same as those of the other. The veins are largely of the same form, the ore of the same general character, and mining and milling conditions are largely the same. The distinctive mining features arise from the fact that nearly all of the veins, as far as worked, have been found lying nearer the horizontal than the verti-

*Mining engineer, Reno, Nevada.

one of 20, and the Idaho-Maryland one of 40 stamps, which have not been operating for some time. At present (Nov. 10, 1908), the mining and milling plants of the Idaho-Maryland are being overhauled, and the mine promises to be rejuvenated by the discovery of a new vein parallel to one which has before produced millions of dollars. The new vein has been opened up at 600 ft., and carries very high-grade material in places. The Golden Gate mine has only a 4-stamp mill, but it is of considerable prospective importance because of the fact that considerable ore has been opened up in recent development work. The Grass Valley Dana Company, which has just started operations under a bond and lease on the Christopher Columbus and Dana claims, has excellent prospects and has already opened up a 7-ft. lode carrying pay ore.

METHODS OF MINING

On account of the flatness of the veins it has been found necessary to adopt stopping methods differing from those usually employed in Western metal mining where the veins are more nearly vertical. The conditions approximate those found in the Rand, the stopes being too flat for the broken rock to run down the stope by gravity. Owing to this fact a system of mining has been evolved, particularly adapted to meet the conditions, and has been brought to a gratifying state of perfection. Shafts are in nearly all cases sunk on an incline to follow the vein, and hoisting is usually done in skips which automatically dump into receiving bins at the surface. Skips are loaded from bins built at the levels just below the level tracks and discharging by bottom gates into the skips below. The station bins are

usually made in two compartments to accommodate waste and ore.

In earlier days levels were usually run rather close together so as to prevent excessive shoveling of material down the stopes. With present methods levels are usually from 300 to 400 ft. apart, and the rock is taken down the stopes by gravity tramways running up into the stopes. The system followed at the Empire mine is shown in an accompanying illustration.

placed nearer the lower level. As the stope progresses the drums are carried farther up the stope, or may remain stationary, the cables being carried over pulleys just above the turn sheet. In this case the lowering drums must either be to one side of the track or high enough for the cars to pass under them.

THE NORTH STAR SYSTEM

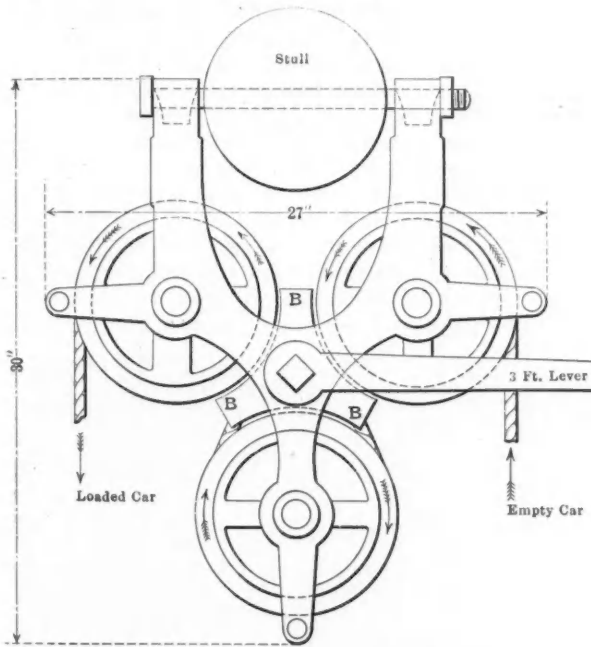
The method used at the North Star

track extending up into the stope; chutes are placed at the bottom and arranged so that the stope cars in descending dump into them automatically. At a convenient distance above the level, depending upon the slope, a turntable is placed and tracks are laid to the chute. Tracks also extend in each direction from the turn sheet, the rails being so placed as to maintain the proper inclination for tramping in the stope. End-dump cars holding 1000 to 1500 lb. are used on these tracks, the ore being shoveled into the cars and the waste stowed below the tramway. The full cars are trammed to the turn sheet and then lowered by means of the go-devil, which is attached to a single stull directly above the turn sheet.

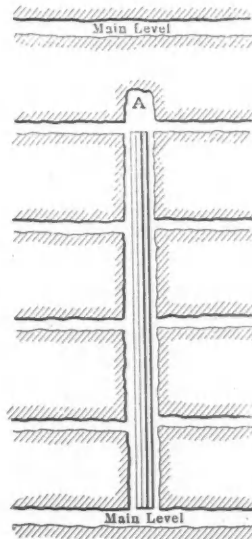
After the stope has advanced 30 or 40 ft. the auxiliary track and turn sheet are taken up and moved up the stope to make another auxiliary level, and stoping proceeds as before.

THE NORTH STAR GO-DEVIL

The go-devil, here spoken of, is the invention of Manager Foote, of the North Star mine. It is a patented article and is manufactured by the Taylor Foundry and Engineering Company, of Grass Valley. An accompanying sketch shows its construction and method of operation. The lowering cable passes around all these pulleys in the direction of the arrows. A central brake block is arranged to apply friction to all three of the wheels on which the rope winds. In lowering a car one man applies the brake by means of



"GO-DEVIL," FOR LOWERING BY GRAVITY

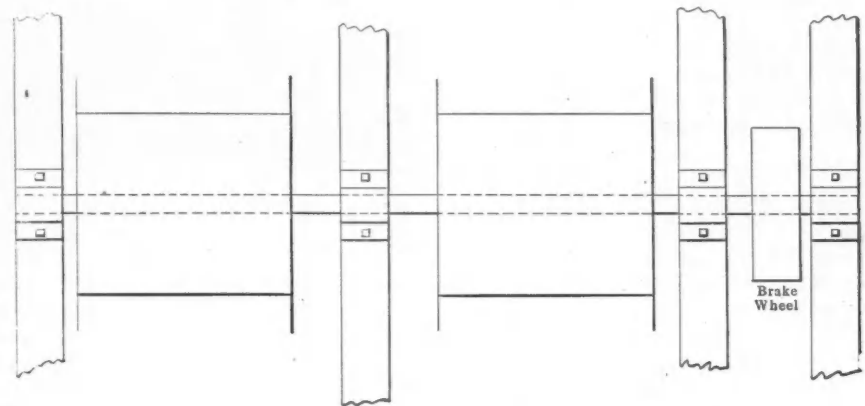


METHOD OF WORKING

The main level having been run, a raise is made near the center of the orebody and put through to the next level, or to within from 75 to 100 ft. of it. Auxiliary drifts are also started along the vein at intervals of from 75 to 100 ft. At a point just above the last intermediate drift is placed the mechanism which serves to raise and lower the cars in the stope. This consists essentially of two drums upon which the cables are wound and a brake wheel, the friction being regulated by means of a post brake. One drum is so arranged that it may be revolved in the shaft, or keyed to it as desired. This allows the length of rope to be regulated to suit the auxiliary levels.

A double track is laid down the raise and turn sheets placed at the intersection of the drifts and raises. Stoping is carried on simultaneously at the different drifts, and the ore is loaded into cars and trammed to the turn sheets, where it is lowered by the gravity tram. Short lengths of rails are placed over the turn sheets when lowering from drifts higher up in the stope. The cars on the tramway dump automatically into chutes at the main level.

By another method the driving of intermediate drifts is dispensed with, and stoping is carried on only at one face. The lowering drum may in this case be



DRUMS FOR LOWERING BY GRAVITY

differs from that employed at the Empire. Raises are not run, except for ventilation, and work proceeds at one breast only. The cars are lowered in the stope by a device called a "go-devil." The accompanying sketches show, without much explanation, the system used. Above the level for from 30 to 50 ft., according to the pitch, the rock is shoveled directly into cars or into chutes from which the level cars are filled. The ore is rough-sorted in the stopes, and the waste is used for filling in behind as the stope advances.

At intervals, as desired, space is left in the filling for the placing of a double

the lever arm which draws it against the wheels at *BBB*.

This contrivance has certain advantages over the drums previously described. It is less cumbersome, it occupies little space in the stope and requires only one stull for a support. The machine is so light that in changing from one auxiliary level to the next, one man can carry the whole thing. It has the disadvantage that in changing levels the rope must either be spliced or exchanged for a longer rope. If a long rope is used to start with it must be coiled up near the ends attached to the cars and is apt to be in the way.

BREAKING GROUND

Stoping is usually done with 2¼-in. piston machines. The veins are too flat to allow the general use of air-hammer drills without hollow steel.

At the North Star mine shooting is done only once each day, this work being performed by blasts after the regular shifts have quit work. The first shift starts at 7 a.m., and works until 3:30 p.m. The second works from 4 p.m. to 12:30 a.m. After this the blasters come in and shoot the holes. Two shifts are taken to a drift round, a one-man 2¼-in. machine being used. By this method the smoke nuisance is largely overcome, for men do not have to go to work directly after firing, and time is allowed for clearing the atmosphere.

The mines, as a rule, have to contend with considerable quantities of water, especially during the rainy season when much surface water finds its way under ground. Cornish pumps are generally

An Important Amalgamation of Transvaal Mines

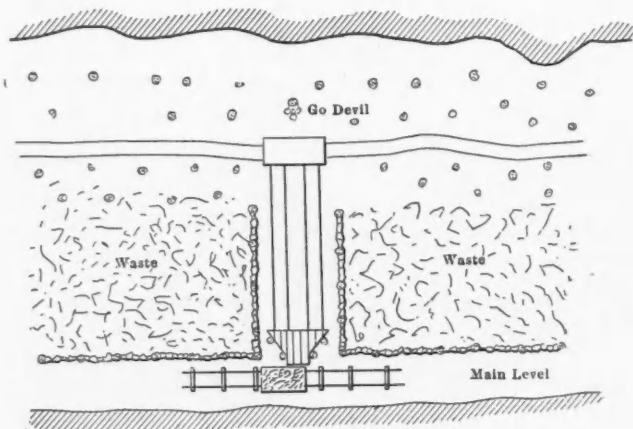
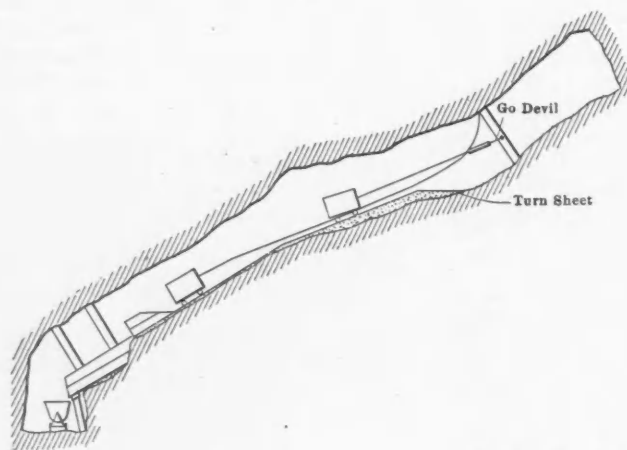
SPECIAL CORRESPONDENCE

The terms of a large amalgamation scheme, involving some of the more important and best known mines of the Central Rand, were announced on the eve of Christmas. A new company, to be called the Crown Mines, Ltd., is to be formed on July 1, 1909, to embrace the present Crown Deep, Crown Reef, Langlaagte Deep, and Robinson Central Deep, all producing mines, together with a large area of adjoining and deep-level claims. The new company will have a nominal capital of £1,000,000, divided into 2,000,000 shares of 10s. each, the market quotation for which is now nearly £7 per share. The nominal capital, therefore, will be curiously out of proportion to the real capital, which, according to the present

ground owners and to sundry other interests.

An amalgamation of companies in this section of the Rand has been talked of for some time. The Crown Reef and the South Rand companies own detached claims lying on the dip of the Crown Deep and Langlaagte Deep, and it was obvious that to enable this ground to be worked economically some combination of forces was necessary. But it was not generally known that the amalgamation scheme would include such deep-level ground as that owned by the new Vierfontein mines and the South Deep, Ltd.; ground which, lying wholly outside the broken up area, was on a different footing. The necessity for the inclusion in the scheme of these very deep claims is not so apparent as in the case of the ground above. A compact block with a long life ahead could have been formed without them.

That criticism would be specially directed



METHOD OF LOWERING ORE IN STOPES

employed, usually driven by water power. Aside from the original cost of installation and the amount of room occupied, they have given better satisfaction than the more modern types of pumps.

The bill for the organization of a State Geological Survey in Massachusetts, introduced in the legislature of 1908, was referred to the legislature of 1909. Inasmuch as Prof. T. A. Jaggard, Jr., is about to start on a voyage, which will take him away from Boston for about eight months, the chances are that nothing will be done about the matter this year.

The precipitation of copper from its solutions by means of aluminum or zinc is not recommended in assaying low-grade ores by A. C. Claudet (*Bull. No. 50 I. M. and M.*) owing to the great difficulty of precipitating the last traces of copper. In rich ores this does not matter much, but in low-grade ores the obtaining of the last 0.01 per cent. becomes important.

market valuation, is in round figures £14,000,000. It is estimated that the company will own some 2000 intact mining claims together with the freehold of 2587 morgen of land. The present milling plant of the combined properties is equal to 137,700 tons a month, and an additional plant is to be erected, so as to increase the production to 150,000 tons a month. The prospectus of the scheme anticipates that profits to the extent of 130 per cent. or 13s. per share will be distributed annually, equal to 9 per cent. on the present market value.

The Crown Reef, Crown Deep, Langlaagte Deep and Robinson Central Deep will, of course, receive the bulk of the new capital, about 70 per cent. being allotted to the shareholders in these mines. The South Rand, a company owning ground to the south of the Crown Deep, and which is being developed through the shafts of that company, is to take 14 per cent. The Paarl Central and Langlaagte Royal take about 5 per cent., while the balance of 11 per cent. will go to the deep-

to this feature of the scheme seems to have been anticipated as the announcement of the terms of the amalgamation calls attention to the fact that for this very deep ground only 8.1 per cent. of the proposed stock issue is to be paid. As a percentage the figure seems small, but has a more important appearance when computed as cash. Inquiry will doubtless be made, if the information is not given officially, as it should be, as to what interest the promoters of the scheme and their friends hold in this deep ground, and on what grounds this speculative property is being offered to the shareholders in the producing mines. It ought not to be lost sight of that the proposed scheme will extricate the owners of the deep claims from an embarrassing position. They obtain securities, which will be readily marketable and worth about a million of money, for property which costs a considerable sum in licenses to hold, and which will require a large expenditure and a long wait before any profit can be earned. A strong case must be made out

for the necessity of throwing these claims in with the better known ground above. It is not suggested that the claims are being put in at a figure beyond their value. No doubt the valuation put upon the ground is supported by professional opinion. The point is, are these claims necessary and would their inclusion be advocated if the promoting house or its friends were not interested?

This is not the first case where deep-level ground of speculative value, which carried heavy financial responsibility, has been tacked on to producing claims. It was only a short time ago that the East Rand producing mines were made to absorb a large area of ground of speculative value—ground upon which the development work done had been anything but encouraging. Another amalgamation of the same character is that now proposed for the South Nourse and Nourse mines. Shareholders in dividend paying mines

take in a partner owning claims which, on account of the depth of the reef and the absence of development, are necessarily of uncertain value. Owing, however, to the conditions that prevail on the Rand the shareholders have in practice very little say in the matter. Amalgamation schemes are arranged for them by one or other of the financial groups, who, although occupying the position of trustees of the shareholders in the producing mines, are at the same time sellers, at a price which they themselves decide, of property in which they may be the sole or main proprietors.

The policy of amalgamation, now so much in vogue and in favor of which there is much to be said has created an unhealthy, if not dangerous situation, as it opens the door to an unfair disposal of unmarketable property. Amalgamation schemes, therefore, require the most careful scrutiny from the shareholders'

of enhanced profits due to economy gained by working on a larger scale. As pointed out above, the calculation of the profits over the long period is not based on data of the same reliability as in the case of the mine with a short life, and consequently the reconstruction of the investment carries with it the element of speculation. In making this criticism on amalgamations, it must not be understood that the writer wishes to attack the Crown mines' scheme. With the exception of the inclusion of the very deep claims—the necessity for which seems doubtful—the scheme appears to have been fairly prepared. When the reports of the engineers are published—they are due to arrive in February—further criticism may be necessary. But from the information available a good case for amalgamation appears to have been made out and a fair valuation put upon the various interests involved. A scheme of this magnitude must have been difficult to arrange, and the promoters are to be congratulated on their success. It may be assumed that they have obtained the approval of the principal shareholders and there is little reason to doubt that the scheme will be carried out, although, of course, it has still to be formally confirmed by the shareholders of the different companies concerned.



MINERS IN TRUCK READY TO DESCEND, NORTH STAR MINE

may be pardoned for being suspicious that the reasons which the promoters urge so vigorously in behalf of their amalgamations, namely, long life and reduced costs, are not the sole reasons that inspire these proposals. It does not seem harsh criticism to suggest that the amalgamations are not always promoted entirely in the interests of the producing mines, but that they find favor because they release a financial house from a difficult position; and make marketable property which would otherwise be a white elephant. It is difficult to imagine, for example, the Nourse mines shareholders being particularly anxious to purchase the South Nourse property, the development of which has so far been disappointing. Neither would one expect a shareholder in the Robinson Central Deep or Crown Deep to be keen to acquire Vierfontein or South Deeps claims. Such shareholders would probably prefer to keep what they have to themselves rather than to

in the producing mines, especially in cases where deep-level claims, which have no chance of being productive for a long period ahead, are proposed for absorption.

The main arguments used in favor of amalgamations are those of long life and reduced costs—all sound arguments, but arguments that can be overdone. The great plan in the argument of long life is the assumption that values will continue much as they have done in the past. There are few mines with ore reserves developed more than three years ahead of the mill. Beyond that the values are to some extent problematical, yet the continuance of payable ore is assumed with composure, and estimates of production made for 20 or 30 years ahead.

The principle underlying all these amalgamations is that the shareholders in the mines with short lives and with profits that can be closely estimated, will receive an equivalent dividend or annuity spread over a longer period with the advantage

Refunds of Payments for Surveys

SPECIAL CORRESPONDENCE

On Jan. 28 the House of Representatives passed with some minor amendments the Englebright bill for the relief of applicants for mineral surveys. The bill reads as follows:

"Be it enacted, etc., That the Secretary of the Treasury be, and is hereby, authorized and directed to pay, out of the moneys covered into the Treasury from deposits made by individuals to cover cost of work performed and to be performed in the offices of the United States surveyors-general in connection with the survey of mineral lands, any excess in the amount deposited over and above the actual cost of the work performed, including all expenses incident thereto for which the deposits were severally made. Such repayments shall be made to the person or persons who made the several deposits, or to his or their legal representatives, after the completion or abandonment of the work for which the deposits were made, and upon an account certified by the surveyor-general of the district in which the mineral land surveyed, or sought to be surveyed, is situated and approved by the Commissioner of the General Land Office."

It is estimated by the Land Office that the total amount payable under this measure will be about \$60,000. This sum will

go in small amounts to a considerable number of persons who have heretofore been unable to collect owing to lack of power in the administrative authorities to make payment.

The Gold Deposits of French Guinea

For some years the goldfields of French West Africa have attracted considerable attention in France; this was especially so in 1908. The administrative division of French Guinea consists of the following colonies: Ivory Coast, Dahomey, Guinea, Sénégal, Upper Sénégal and Niger, and Mauritania; viz., the colonies of the west coast, Congo alone excepted.

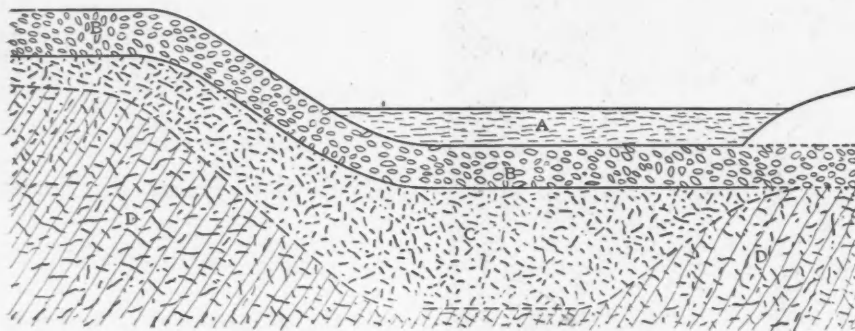
The deposits of Upper Guinea, which are practically all located in the district of Siguiri, have been examined by many mining companies. This mining camp may be easily reached from Bordeaux, via Dakar. From Dakar the traveler goes by

high angle. The strike of the rocks which is about northeast-southwest is quite uniform throughout the goldfields. The deposits are closely related to the eruptive rocks, such as granulites and diabases, which have the same direction as the schists and slates and which can be followed for more than 1000 km. Probably the eruptive rocks are the source of this gold and the deposits were formed by circulating waters that collected the gold. In fact the closer the deposit is to the eruptions, the richer it is.

All the rocks, especially the crystalline rocks and slates, down to permanent water level are decomposed into an earthy and brittle material called laterite. These shales are protected against complete destruction by a ferruginous conglomerate which covers immense areas characterized by extremely poor vegetation.

The country is very flat but presents some depressions which owing to the concentration of gold in them are of special interest from the mining view-point.

The accompanying ideal cross-section, as



IDEAL CROSS-SECTION OF AURIFEROUS DEPRESSION IN FRENCH GUINEA

A is barren clay; B, ferruginous conglomerate; C, auriferous elaterite; D, barren elaterite.

rail to St. Louis in Sénégal (264 km.); thence by steamboat up the Sénégal river to Kayes (900 km.), a journey of 5 to 6 days; again by rail to Bamako (496 km.) and then by boat on the Niger river to Siguiri (300 km.). The total distance between Bordeaux and Siguiri, which is 6200 km.—4300 on sea, 760 on rail and 1200 on river—may be covered in 20 to 25 days at the time of high water; August, September and October.

The gold deposits of that part of the world were lately described in a lecture given in the hall of the Société de Géographie, of Paris by Commandant Villiaume, who examined much of this area during the years 1905 to 1908. According to him, the gold deposits of eastern Guinea have, generally speaking, many features in common with the gold veins of Rhodesia and some other African goldfields, the conglomerates of the Rand, of course, being excepted.

Most of the region is underlaid by oil clayey sediments changed by an intense general metamorphism into banded crystalline schists and slates that dip at a

presented by Commandant Villiaume, gives a fair idea of these auriferous depressions. Stratum A consists of barren clay; excellent bricks are made from this and used for building houses for the European staff. B is the ferruginous conglomerate which is always water-laden. The section shows how it connects with the part exposed at surface by erosion. The conglomerate varies in thickness from 1 to 10 m. It is very hard at surface where it has been dried by the tropical sun, but below surface it is much softer. It was lately found to be auriferous in the depressions or close to them. The soft portion proved to be the richest part, containing in places as much as 12 grams per cubic meter (about \$6 per cubic yard). C is the auriferous laterite, saturated with water. Its thickness varies from 1 to 16 m. The gold is distributed fairly regularly through it. D is barren laterite.

The width of these depressions generally varies from 30 to 150 m. The main valleys or depressions are 25 to 60 km. long, while the secondary ones are only 2 to 10 km. long.

Among the many others who sent prospectors to Guinea, two companies—the Compagnie Minière de Guinée and the Compagnie des Mines de Siguiri—have begun to work their properties and are installing machinery to ascertain the best way of treating this auriferous clay. They have done considerable work in drilling or sinking small pits to test their property, in preparing roads for transporting the heavy machinery and in getting wood for burning under the boilers. They have also had to provide the necessary supply of water for washing the auriferous laterite.

In Kobako valley the Compagnie Minière de Guinée will dig the laterite with two excavators of the ladder type each having an estimated capacity of 500 cu.m. per day of 10 hours. One excavator will dig out the ferruginous conglomerate while the other will work on the laterite proper. Ore will be delivered to a movable washing plant consisting of a big revolving screen of special design for completely disintegrating the material. a 10-in. centrifugal pump delivering water inside the screen, a 12-in. centrifugal slime pump, a 100-h.p. vertical engine and a water-tube boiler of the portable type. This plant is placed on a platform mounted on eight wheels, and will follow the excavators as the work progresses. The oversize from the screen, which consists mainly of gold quartz, is loaded into cars and trammed to the milling plant, equipped with a Dodge crusher, a Huntington mill, 3 ft. 6 in. diameter, and silvered copper plates. The undersize is elevated by the 12-in. pump to a sluice box. At the head of the sluice, for experimental purposes, are placed two gold-saving tables of the Turner type fitted with coconut matting and expanded metal.

The Compagnie des Mines de Siguiri is to work its Fatoya hill property. Small canals fed by a centrifugal pump will transport the ore to a system of sluices with undercurrents. The quartz separated by means of grizzlies will be crushed and amalgamated in two milling plants, both similar to the one erected by the Compagnie Minière de Guinée. These plants are expected to be ready to run early in 1909.

The H. W. Johns-Manville Company, of New York, is introducing a chemical compound, called Leak-No, which resembles powdered iron, and when mixed with water and applied like putty to cracks, or other defects, in iron or steel articles, metallizes and becomes a permanent part of the article to which it is applied. When hard it much resembles iron in color. The manufacturers offer to refund the purchase price in case it fails to stop any ordinary leak in anything made of iron or steel against any pressure of oil, steam, gas, air, ammonia or water; and to stand any heat or chemicals that iron will stand, when applied according to directions.

The East Tennessee Zinc Mining District

The Dolomite in Which the Mineral Is Found Is Abundant and Easily Worked, but It Is Too Low-grade for Small Operations

BY SAMUEL W. OSGOOD*

The zinc district of east Tennessee was mapped in the years 1896 to 1901 and is described in folios issued by the U. S. Geological Survey at the time. The maps gave the district in general three nearly parallel zinc belts extending through Tennessee for 40 to 50 miles and about 20 miles apart. These belts

rise to cross-fissure zones of fracture. In these zones are the richest orebodies. The ores are sulphides and they occur in the filling of the fracture zone or breccia continuous with calcite and dolomite and not in the rock. No barytes is present in these ores in the rocks. Where the clay and sand of the surface is 20 to 30 ft.

The Straight Creek mine and "Lead Mine Bend" mine are two properties on the northern belt, only one of which, the Straight Creek mine, is now operating. It is with the central belt that this article is principally concerned, for on this belt are the most extensive operations owing to accessibility to the railway, and



BLLENDE QUARRY, VALLEY ZINC MINE



JOLLY FARM MINE



CONCENTRATING MILL, HOLSTON ZINC COMPANY



HOLSTON ZINC COMPANY GRAVITY TRAMWAY

are each only a few hundred feet wide and extend in a northeast-southwest direction, following the general strike of the Appalachian system of folds and faults.

The ores are contained in the Knox dolomite, a soft, easily broken rock, lying between Silurian and Cambrian strata. In places local disturbances have given

thick, carbonates and silicates are found to overlie the sulphide ores.

The central belt occupies the valley of the Holston river, and is called the Holston Valley zinc belt. This belt has ores containing zinc with no lead and less than 0.5 per cent. iron. The more northerly orebodies near the Powell river and the southerly belt near the French Broad river carry both iron and lead.

to the simple nature of the ores which are more easily treated.

The Holston Valley zinc belt is about 40 miles long in a northeast-southwest direction and from 50 to 700 ft. wide. Knoxville is about in the center of the belt. The Southern Railway's double-track line between Washington and Chattanooga traverses almost the entire length of the belt, hauling large amounts

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of Tennessee coal from near Knoxville to the coast.

CHARACTER OF ORE

Carbonate ores have been shipped from the district for many years. They occur in a bed of red and yellow clay overlying the dolomite containing the yellowish blende. The shipments of carbonates have been spasmodic and the future of the district will no doubt depend largely on the success of treating the sulphide ores.

The east Tennessee zinc ores, while remarkable for their chemical purity and freedom from the undesirable iron and lead minerals usually found in zinc ores, have never until recently been of much commercial importance owing to the low

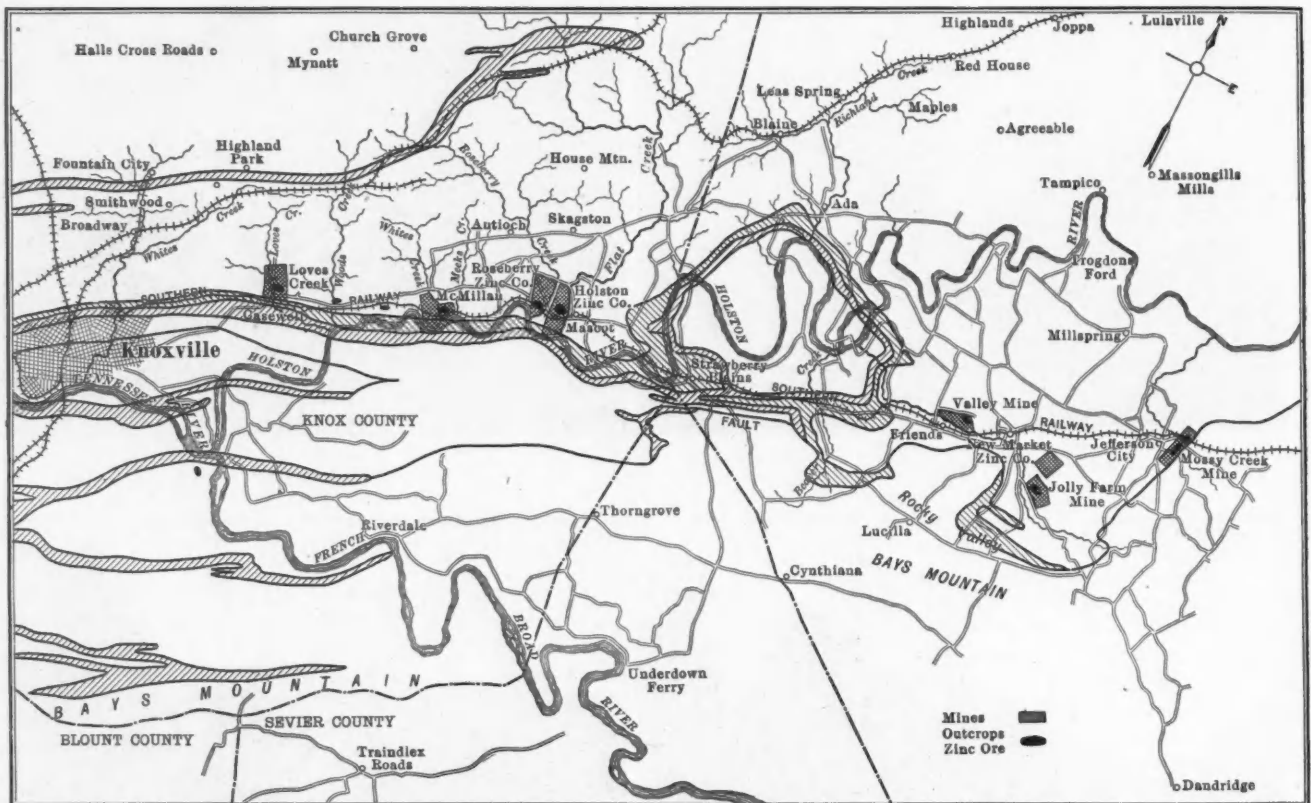
operations that the entire brecciated mass can be mined and milled on a large scale in a modern concentrating mill, maintaining a fair grade of product.

METHODS OF WORKING.

The first mining and milling of the zinc blende ores on any considerable scale was undertaken by the Edes, Mixter & Heald Zinc Company, in 1883 at Mossy creek Jefferson City. This first mill was erected to wash the dumps of blende cobbled from the carbonate ores, and was so successful that in 1885 an 80-ton mill, including crusher, rolls and jigs was erected. This mill treated hand-sorted ore from a large quarry for several years. It was closed

high per ton of ore mined, the cause being simply the inconvenient methods for handling too small a daily tonnage.

The third of these small mills was built by the Roseberry Zinc Company, about 1½ miles west of Mascot in 1900. This mill was an advance on former plants, but the ore was still hand-sorted in the quarry, one car of waste being secured for each car of ore. It was one of the inefficient, old-style Joplin mills of small capacity; but it shipped many carloads of high-grade zinc concentrates. The capacity was low, the mill inefficient and poorly built for continuous operation; consequently the costs per ton were again too high for commercially economic results. The ore was mined in a quarry at



MAP OF KNOXVILLE ZINC BELT

grade of the ore and the methods of milling. Actual results show that the cause for the lack of success was the small daily capacity of the plants, the hand-sorting of the ores bringing the cost per ton of ore treated to an abnormally high figure. The crude method of building the mills also made steady, daily operation over long periods impossible because of frequent and costly repairs.

The blende, while in large bodies of a brecciated rock, occurs in bunches or small seams as a filling in the breccia, of the fissure zone. The ore has in the past always been hand-sorted to give a mill feed assaying from 8 to 12 per cent. zinc. Recently, however, it is thought to have been demonstrated by large commercial

operations in the panic of 1893, but was re-opened by the John Weir Lead and Zinc Company in 1900 and operated for a few months. The small daily capacity and the crude equipment brought the costs per ton so high that the mill was closed after a few months.

The second of these small, unsuitable mills was erected by the Ingalls Zinc Company, about 1½ miles southeast of New Market in 1898. The ore was quarried from near the surface. Here again the ore was hand-sorted, the capacity of the mill being small like that on Mossy creek. The ore was hand-sorted to about a 12-per cent. zinc before milling, and a high-grade concentrate was shipped, but the operating costs were very

first and later a shaft nearly 200 ft. deep was sunk and mining in stopes was begun.

The fourth of the small mills was built by the Holston Zinc Company about ¾ mile west of Mascot in 1903, and this was another advance, especially in the development of a more elaborate jigging system. This mill was, however, of small capacity, and the ore was still hand-sorted in the quarry. In 1905 the shaft was sunk to 180 ft. and underground stope mining was started and milling done with no hand-sorting, which showed another advance. At this time a few slime tables were also added to the mill equipment. The daily capacity of the mill was small, the operation not in experienced hands and the costs per ton relatively high.

The Holston Zinc Company's mill was partially re-equipped in 1907 along lines suggested by A. M. Hewlett, the president of the company, and operated under my management. Mr. Hewlett's untimely death in 1907 had much to do with the Holston Zinc Company's failure to complete the re-equipment of this mill. However, the plant was operated in its incomplete state for several months, and shipments of concentrates were made on a scale not possible before that time in the east Tennessee zinc districts. This showed at once the correctness of Mr. Hewlett's judgment in demonstrating on a commercial scale that all it required to make a success of the Tennessee zinc ores was large capacity to reduce the "per ton" cost, a mill elaborate enough to save the zinc in the ore and of a sufficiently stable construction for continuous daily operation.

The last year's operations on the Holston zinc belt include, besides those of the Holston Zinc Company, the shipments of carbonate ores and prospecting of its blende ore deposits by the New Market Zinc Company and prospecting on the Ingalls or Jolly Farm mine southeast of New Market.

OPERATIONS IN THE DISTRICT.

At the Holston property the ore is mined at a depth of 160 ft. in large stopes 50 or 75 ft. wide and carried to a height of 40 ft. Another level has been started above, and drifts have been started to allow of stoping at a considerable distance from the shaft. This will allow the use of a caving system making it unnecessary to strip the 70 ft. of clay and soil on the surface to get at the ore where it comes to the top of the rock below the soil. Mining is done by machine drills.

In this mine all rock is taken from the stopes for the entire width, no hand-sorting being done. All ore is dumped into the crushing plant and sent from there to the mill. The mill has three departments, a rougher department from which a large amount of the waste rock formerly picked out by hand is sent to the tailings dump, and both a coarse and fine finishing department.

The New Market Zinc Company operates on a large tract of land southeast of New Market on Lost creek where it has developed what appears to be one of the largest bodies of zinc-carbonate ores in the district. The company started operations about two years ago and after extensive development work began shipments last fall.

The Roseberry Zinc Company started operations in 1900. Ore was quarried, hand-picked or sorted and sent to the crude Joplin mill. In 1904 the company made the first successful attempt to develop the Tennessee orebodies by drilling as had been done in Joplin. The drill

disclosed a large orebody which was opened by sinking a shaft 200 ft. deep. The ore was mined in large stopes with machine drills. The ore was only roughly sorted as fed to the mill.

During the last year on the Ingalls or Jolly Farm property a new orebody has been prospected about one-half mile northeast of the old works.

A quarry or open pit has been made 165 ft. long and 40 to 50 ft. wide. The orebody was found at the surface, and over the area it has been opened 10 to 15 ft. deep. The orebody has a slight dip, being nearly horizontal, and is said to be 600 ft. wide. The ore is in a brecciated zone and several seams of blende of a foot to several feet in width will average high in zinc, although no doubt the entire orebody will average much lower, probably about the same as the rest of these ores when mined on a large scale.

The old works of this property consist of an open pit or quarry where the blende was mined for treatment in a small concentrator. The ore was mined and sorted in the quarry and hauled up an inclined track by a small hoisting engine. It was dumped upon a platform to be again hand-picked and then fed to the crusher. There were two quarries, 80 ft. wide by 100 ft. long and about 50 ft. deep. An old mill run shows that 500 tons of hand-sorted ore yielded 52 tons of concentrates assaying 53 per cent. zinc, which is very fair considering the crude equipment of the mill.

The Valley mine is the best looking of the partially opened but inoperative mines of the belt. This mine is at Friends on the Southern Railway, 14 miles from Knoxville. The orebody is opened by an open quarry, about 50 ft. long, 15 ft. wide and 10 ft. deep. The quarry is near Lost creek and the blende appears at the surface of the ground where the creek has washed away the soil. The ore occurs in a brecciated fissure zone and is in appearance identical with the Mascot and New Market ores. Carbonate ores have been shipped from the clays of the subsoil on adjoining properties, which seems to indicate a large orebody on this property.

THE LOVES CREEK MINE

The Loves Creek mine at Loves creek five miles from Knoxville was partially explored several years ago and good ore was found. A 50-ft. drill hole showed ore all the way to the bottom. There is a good mill site with ample water for milling and good surface indications. This is at present among the inoperative properties, but the owners expect to develop it into a mine.

IMPROVED METHODS NECESSARY

Throughout the entire length of the zinc

range from Knoxville to Jefferson City, wherever a creek has washed its way through the soil in crossing the ore zone good blende may be seen in the bed of the creek. The commercial possibilities of the district have been proved by the many carloads of high-grade blende concentrates carrying from 50 to 56 per cent. zinc and the carloads of high-grade carbonate ores which have been shipped. That the milling of these ores has been successfully accomplished has been shown in the case of the Holston mill; it remains but to provide sufficient capacity in the mill as designed to eliminate overcrowding of the individual machines. Overcrowding causes loss because the ore as it flows automatically through the mill by gravity after being ground and mixed with water must remain on each machine long enough for that machine to get the concentrates out of it. If the machine is crowded the ore stream flows across too quickly for this to be accomplished and losses occur which reduce the total efficiency of the mill as well as the grade of the concentrates.

From 100 tons of ore assaying 3.7 per cent. zinc, 3.7 tons of concentrates assaying 52 per cent. zinc were produced, representing a 52-per cent. mill efficiency. The efficiency of the coarse departments was 65 per cent. and with added capacity in the fine department it should be easily possible to increase the efficiency to above 65 per cent. which is a high efficiency for a zinc-concentrating mill on these ores. The efficiency on all sizes up to 60 mesh was above 65 per cent. and frequently as high as 81 per cent., but on the sizes below 60 mesh the losses were great.

THE REMODELED HOLSTON MILL.

During seven months after the mill was overhauled in 1905, 239.5 tons of concentrates were shipped assaying from 49 to 59 per cent., and averaging 56 per cent. zinc. Since Holston zinc ores contain no lead or iron they are very desirable for use in making high grades of spelter.

While the grade of concentrates produced during the seven months' run of the mill was highly gratifying, the daily capacity was not satisfactory. The tonnage treated during this period averaged 38 tons per day, at the rate of 6 tons per hour for 6½ hours per day. The faulty construction of the mill required frequent stoppages, giving an average of only 6 1-3 hours operation per day out of a possible 12 hours. The efficiency of the mill was low because of the lack of the proper facilities for treating the large proportion of fines made in the rolls. There were four Card tables, but owing to the lack of other accessory apparatus and the lack of experience in the use of them, a low percentage of savings was made on the fine sizes. A large proportion of the

concentrates consisted of very coarse sizes.

The machines required for each 100-ton capacity were from a study of this mill found to be as follows: one bull jig, six finishing jigs, three coarse concentrating tables of Wilfley type, and one slime table. This is allowing 10 tons per day per jig capacity for the coarse sizes, 10 tons for the moderate sizes and 8 to 10 tons for the finer jig sizes; also allowing 12 tons per day capacity for two Wilfley tables and one table extra to retreat the middlings; also allowing one slime table of a capacity of 10 tons.

In short, a detailed study of the practical operation of milling Tennessee zinc ores based on the actual performance of this mill when treating ore at the rate of 175 tons per day shows that it can be made commercially successful. On the same basis of machine capacity, jigs are to be added to bring the total capacity of the mill up to 300 tons per day. Such a mill will make at least 11.1 tons per day of concentrates from a 3.7-per cent. ore, and of a grade at least 56 per cent. and more probably 58 to 60 per cent. Based on the actual cost of operating a 125-ton plant, it is estimated that the operating costs will be \$312 per day for a 300-ton mill and mine.

Motor Driven Centrifugal Pump for Mine Use

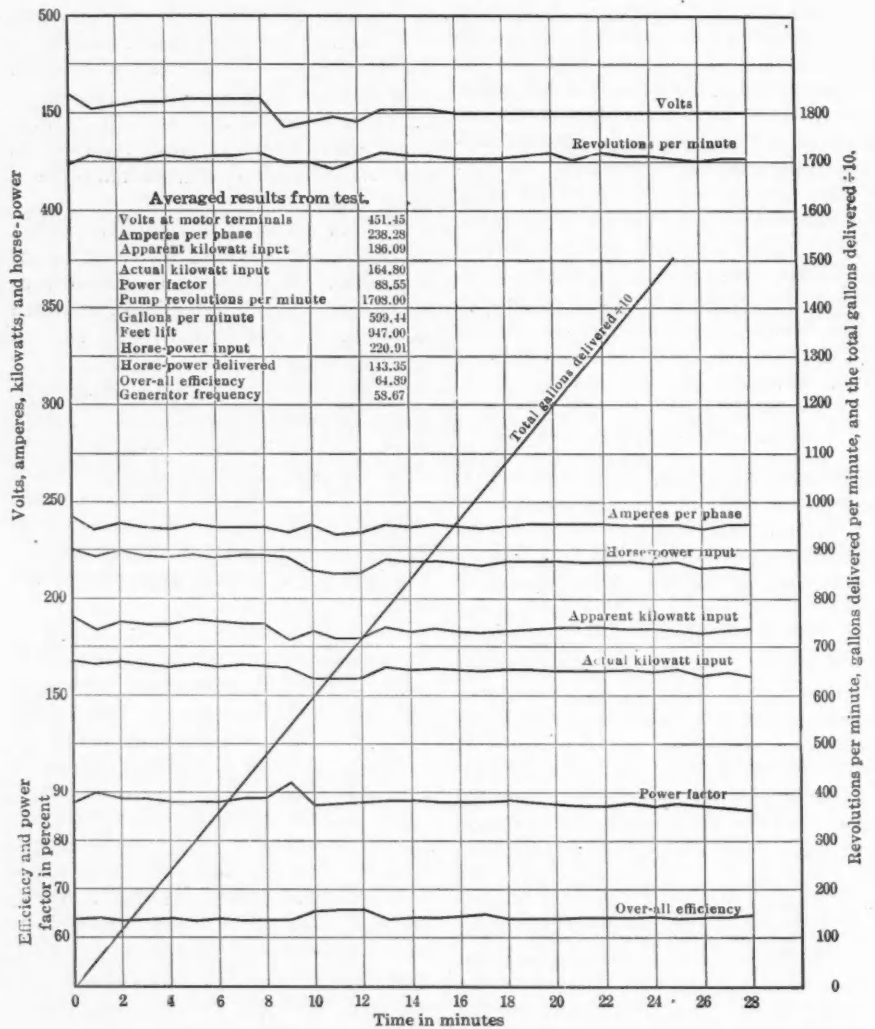
BY CYRUS ROBINSON*

Many mine superintendents have a strong prejudice against centrifugal pumps for underground work. The troubles that have arisen with centrifugal pumps have been very frequently the selection of low-volume, high-head turbine pumps, and of motors not specially designed to work under the varying voltage usual at mines. A turbine pump is quite sensitive to changes of speed, and unless properly designed, a great deal of trouble is experienced in losing the water column whenever there is a sudden drop in speed due to a change in voltage. On account of this prevailing prejudice against centrifugal pumps for mine use I am giving in this article the results of some tests made upon a Sulzer pump at the Ojuela mine of the Compañia Minera de Penoles at Mapimi, Mexico.

In placing the order for this centrifugal pump in July, 1907, I made provision for the conditions to be met with for I specially emphasized the varying voltage, the height of lift, volume of water to be delivered and the efficiency to be guaranteed under these conditions in the following specifications: The pump shall be a six-stage Sulzer pump directly connected to

the motor. The permissible variation in speed shall be between 1750 and 1770 r.p.m. on account of fluctuating voltage which may vary between 400 and 460 volts. The total lift including suction, pressure and pipe losses, against which the pump must work, is 1020 ft. The amount of water to be raised shall be from 600 to 760 gal. per minute, according to the speed. The motor shall have an output of from 223 to 290 h.p., according to the amount of water delivered. The pump shall be built for direct connection to the

meine Electricitäts Gesellschaft, and directly connected to the pump. It shall be so designed that the speed shall not fluctuate more than from 1750 to 1770 r.p.m. when the voltage varies between 400 and 460 volts. It shall use a three-phase, 60-cycle current and shall deliver 300 h.p. under the voltage stated. This motor shall be delivered complete with foundation plates and bolts, slide rails and ratchets to facilitate mounting and dismounting, as well as elastic coupling for connecting it with the pump. A rheostat



TEST NO. 6 OF SULZER PUMP, OJUELA MINE, MAPIMI, MEXICO

motor, and shall be made of special cast iron, while the impeller and the guide wheels shall be of bronze, and the shaft of special nickel steel. This pump shall be delivered complete with foundation plate and bolts, pressure gage, priming funnel, elastic coupling, air and drain cocks, complete set of wrenches, one water gate, 7 in. in diameter equipped with a bypass, one check valve 7 in. in diameter, and one strainer with foot valve 7 in. in diameter.

The motor shall be of the slip-ring induction type, manufactured by the Allge-

shall also be furnished, as well as a switchboard panel (a marble slab with iron frame), on which shall be mounted a bracket with a lamp and shade, one ammeter, and one three-pole switch, with fuse holders and three fuses. The pump shall be guaranteed to work at an efficiency of 70.5 per cent. when the total lift is 1020 ft. and the pump is delivering 600 gal. per minute; and an efficiency of 68.5 per cent. when delivering 760 gal. per minute, against a lift of 1020 ft.; or in other words, with a voltage fluctuating between 400 and 460 volts, and delivering

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volumes of water between these limits, the pump shall work with an average efficiency between 69.5 and 70 per cent.

THE PUMP TESTS

After this pump had been in operation for some time, C. C. Hoke, mechanical engineer at Mapimi, made several tests on it. The water was measured by noting the fall in tanks having a regular cross section and whose capacity was 508.7 gal. per inch of depth; the suction of the pump was connected to these sumps. The delivery head was calculated from the pump pressure gage, and to insure accuracy the gage was calibrated between tests

The Anthracite Miners' Demands

The demands of the anthracite miners, as formulated at their district convention, and now amended and approved by the general convention of the United Mine Workers at Indianapolis, are as follows:

"First—That an agreement shall be negotiated between the representatives of the miners and the operators of the anthracite region, and all disputes arising under the contracts shall be adjusted as provided for in the said agreement.

"Second—We demand the complete recognition of the United Mine Workers

employees paid more than \$1.50 and less than \$2 per day shall receive a 5 per cent. advance.

"Sixth—That the system whereby a contract miner has more than one job, or employs more than two laborers, be abolished.

"Seventh—That the employers be required to issue uniform pay statements, designating the name of the company, the name of the employee, the colliery where employed, the amount of wages, and the class of work performed.

"Eighth—That the contract shall be made for a period of one year."

The convention authorized the levying of such assessments as may become neces-

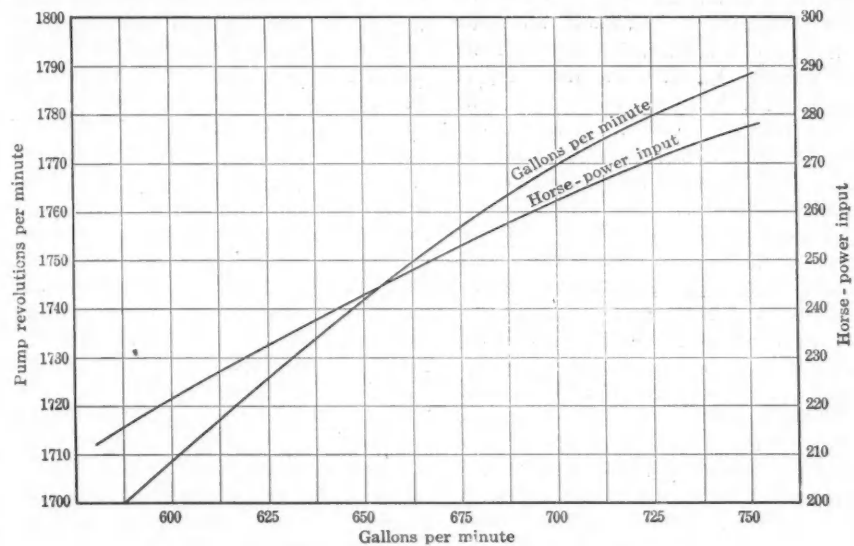
TESTS OF SIX-STAGE ELECTRIC-DRIVEN SULZER PUMP, OJUELA MINE, MAPIMI, MEXICO.

Number of Test.	Date, 1908.	DURATION OF TEST.		Pump Revolution per Minute.	Water Delivered in Gallons.	Water Delivered per Minute in Gallons.	Head in Feet.	Theoretic Delivery in H.P.	Current in Each Phase in Amperes.	Voltage at Motor.	Generator Frequency.	Apparent Input in Kw.	Actual Input in Kw.	Power Factor.	Input in H.P.	Efficiency of Pump and Motor Combined in Per Cent.
		Min.	Sec.													
1	Sept. 14	24	43	1784	18,189.8	735.98	948.5	176.27	283.13	467.27	60.06	228.88	203.92	89.08	273.26	64.47
2	Sept. 14	25	53	1770	18,183.2	702.50	948.0	168.17	286.70	452.90	60.33	224.65	198.23	88.24	266.67	63.05
3	Sept. 15	15	0	1766			957.0		289.40	417.87	60.00	209.21	184.91	88.39	247.87	
4	Sept. 15	26	30	1765	18,181.6	690.44	948.0	165.28	288.48	429.77	60.00	214.91	192.62	89.80	258.12	64.04
5	Sept. 15	26	2	1769	18,183.2	698.45	948.0	167.20	307.38	411.18	60.00	218.64	196.12	89.71	262.80	63.62
6	Sept. 28	25	15	1708	15,176.0	599.45	947.0	143.35	238.28	451.45	58.67	186.09	164.80	88.55	220.91	64.89

No. 5 and No. 6 and further checked against the actual head plus calculated friction of delivery. The results of these tests are given in an accompanying table, and a curve of test No. 6 is given as that test is representative of the general conditions. In another curve the variation of pump delivery at different speeds is shown. The accompanying illustration shows the pump that was tested, but as finally installed a more flexible coupling than the one shown was used so as to give a certain elasticity between the motor and the pump.

The temperatures of the motor and bearings were as follows: Stator laminations, 60.2 deg. C.; stator windings, 61.4 deg.; rotor winding, 54.5 deg.; bearings (oil temperatures), 65.5 deg.; temperatures of air, 29.1 deg. Centigrade.

The efficiency obtained compares favorably with the best type of triplex, geared pumps, including motor, and if the volume of water handled were increased with the same head, using, of course, a larger pump, the efficiency would be still better, but conversely if the volume of water is smaller, the efficiency would decrease. As illustrating this point, tests on a similar pump delivering 200 gal. per minute against a head of 600 ft. showed an efficiency of less than 45 per cent. Consequently, in deciding upon the type of pump to install it is evident that careful consideration must be given to the volume and the head. Failure to do this and to include in the specifications a provision that the pump must be designed to work under a varying voltage has been a source of a great deal of the difficulty met with in using centrifugal pumps for mine work.



TESTS OF SULZER PUMP, OJUELA MINE, MAPIMI, MEXICO

Curves showing relation between revolutions per minute and gallons per minute, and horsepower required to motor terminals at various deliveries against head of 948 feet.

of America as a party to negotiate a wage contract, and that the United Mine Workers of America shall be recognized in our right to provide any method we may adopt for the collection of revenues for the organization.

"Third—That we demand an eight-hour day with no reduction in wages.

"Fourth—That all coal shall be mined and paid for by the ton of 2000 pounds.

"Fifth—That we demand a definite and more uniform scale of wages and prices for all classes of labor at all collieries in the anthracite region; and that all employees paid \$1.50 or less per day shall receive a 10 per cent. advance, and all em-

ployees paid more than \$1.50 and less than \$2 per day shall receive a 5 per cent. advance.

It is understood that they will be presented to the anthracite companies shortly by a delegation headed, or accompanied, by President Lewis of the United Mine Workers. This will bring up at once the question of a full recognition of the union. It is not at all probable that these demands will be accepted by the companies, and a prolonged discussion will certainly follow. Whether terms can be made by April 1, when the present agreement will expire, is not by any means certain.

Disposal of Phosphate Lands

SPECIAL CORRESPONDENCE

How to dispose of the phosphate land question is proving exceptionally troublesome to Congress. Two distinct plans for settling the issue have been proposed. One is that of retaining the lands in Government ownership, leasing the phosphate mining rights to individuals, while the other is that of restoring them to private ownership subject to distinct provisions as to the law under which they may be patented. At a hearing before the House Committee on Public Lands, the latter idea has been urged by Judge S. E. Payson in behalf of owners of 36 or 37 locations under the lode land law upon the phosphate territory in Utah and Wyoming. When the rock was discovered, geologists were sent out by capitalists to determine its condition and extent, and at the outset a serious question presented itself to the legal advisers of locators. This related to the form of the location, whether it should be under the lode law or under the placer law since all mineral lands come within the scope of one or the other classification. Attorneys for some of the locators advocated a resort to the lode location system while those representing other locators came to the conclusion that the placer location was the proper form and thereupon proceeded to locate, some as placer and some as lodes. The first case which came before the Interior Department for decision was one known as the Waterloo placer and it was decided that a placer location was the proper form. The Waterloo claim, therefore, went to patent as a placer claim for some of the phosphate land. Later a formal opinion was rendered by the land office that a lode location was the proper method. Then a number of claims went to patent. Everything has been suspended by reason of the action of the President under his order withdrawing these lands last December. Local land offices are refusing to issue patents for land until further orders from the Department of the Interior. The argument of the original locators is that existing law ought to be continued with reference to all these deposits and that the patenting of each deposit should depend upon the character of it as that is made to appear where an application for patent is made. It is their contention that nobody is harmed by a continuation of existing law. As to the locations heretofore made, they have recommended a curative statute designed to protect the original discoverer no matter what the form of his location may be.

It is argued that there is no difficulty in determining whether a given prospect must be treated as a placer or as a lode location. When a lead of underlying rock is found which carries a mineral worth

mining and reducing and under that a rock of the country the location must be taken as a lode. In mining the phosphate rock, the process is not carried on for the rock itself but for the mineral which is contained in it. Hence, it is argued, under the old statute passed 40 years ago, which provided that wherever any rock in place carries with it a mineral of value it must be taken under the lode location, while a distinction must be drawn between phosphate rock and marble and limestone or any kind of building stone. The latter may be taken as placer because there is no mineral included.

The real question for discussion is recognized as being whether a change is now advisable, taking into account the facts that the law of extralateral rights has been in force for over 40 years and also for many years previous as a part of the miners' rules and customs, that all metal mining except iron in the western States is carried on under it, and that no extralateral rights acquired during that period could be abrogated by any changes but must continue to exist according to the law at the time of their initiation.

Senator Flint, of California has introduced a bill (Senate 8804) for the same purpose as that suggested some days ago by Senator Smoot but containing a number of new provisions. The bill directs that the Secretary of the Interior shall, after examination and classification of any public lands heretofore withdrawn because of deposits of phosphates supposed to exist thereon, restore to entry, selection, and location any such lands as may be found not to be valuable for the deposits of phosphate. In cases where the lands are actually valuable for their phosphate deposits the Secretary of the Interior is directed to clear the title of all invalid mineral entries, claims, and locations. He is then to issue to citizens of the United States or those who have declared their intention to become such, leases or licenses to work the phosphate deposits belonging to the United States, on such terms and conditions as he may deem proper, or as may from time to time be directed by Congress, provided that the leases or licenses shall be on such terms as will insure the proper development of the deposits, prevent monopoly, and secure disposition of the output at reasonable prices, and that none of such leased deposits, or of their products either in their original or manufactured form, shall be exported from the United States. Any violation of this provision by the lessees or licensees, their assignees or grantees, shall work an immediate revocation and forfeiture of the leases or licenses, and the person or persons so violating the proviso may, upon conviction be fined not over \$1000 for each offense.

In all patents for lands henceforward to be issued there is required to be a reservation of all deposits of phosphates, to-

gether with the right on the part of the Government to enter upon or mine under the land in accord with such rules and regulations as will insure surface owners from loss or damage, or will reasonably compensate them. An important provision relating to the application of the placer and mineral lode law is set forth in section 6 which requires that "where lands containing deposits of phosphates have heretofore been located under the placer laws, or laws providing for the entry of mineral lode claims, said locations may be perfected under the provisions of said laws, but no title acquired to lands containing such deposits under the mineral lode laws shall give the locator or entryman any right beyond the perpendicular limits of his claim: Provided, that in case of any conflict between locators under the placer laws and the mineral lode laws no locations heretofore made of lands containing valuable deposits of phosphate or phosphate rock the respective claims of the locators shall be determined as though location of said lands under either of the was valid when made.

Coal Land Locations

SPECIAL CORRESPONDENCE

The House Committee on Mines and Mining on Jan. 29 reported favorably the Mondell bill relating to the patenting of coal lands. The bill as now before the House reads as follows, amendments being in italics:

"That any person who has in good faith heretofore located, selected or entered under the nonmineral-land laws of the United States, any lands which subsequently are classified, claimed or reported as being valuable for coal, may, if he shall so elect, and upon making satisfactory proof of compliance with the laws under which such lands are claimed, receive a patent therefor, which shall contain a reservation to the United States of all coal in said lands, and the right to prospect for, mine and remove the same. (*The coal deposits in such lands shall be subject to disposal by the United States in accordance with the provisions of the coal-land laws in force at the time of such disposal.*) But no person shall enter upon said lands to prospect for, or mine and remove coal therefrom without previous consent of the owner under such patent, except upon such conditions as to security for, and payment of, all damages to such owner caused thereby as may be determined by a court of competent jurisdiction. Provided, that the owner under such patent shall have the right to mine coal for use for domestic purposes on the land, prior to the disposal by the United States of the coal deposit. Provided further, that nothing herein contained shall

be held to affect or abridge the right of any locator, selector or entryman to a hearing for the purpose of determining the character of the land located or entered by him, and to a patent without reservation if the land shall be determined not to be chiefly valuable for coal, or to abridge or deny the right of any entrymen who has earned a title to the land covered by his entry to a patent without reservation."

HOMESTEAD PATENTS ON COAL LANDS

Representative Marshall has introduced a bill to provide for the issue of homestead patents in certain instances. The main provision is that wherever an entry has been made in good faith on lands subject to homestead entry in the State of North Dakota which were afterward classified as containing coal, such entry shall be deemed valid, and upon proof of full compliance with the homestead laws as to residence and improvements a full patent shall be issued to such entryman.

The Copper Mines of Katanga

At the annual meeting of Tanganyika Concessions, Ltd., in December last, Robert Williams, the managing director, made the following statements to the stockholders:

I have the assurance of George Pauling, the well-known railway contractor, whose surveyor has been over the entire route, that he will have the rails through to the Star of the Congo mine in 18 months from the date of signing the contract for construction; and Mr. Gibb, my mining engineer, has also guaranteed to have plant ready at the Star mine in 18 months to produce from 1000 to 3000 tons of copper per month; and I am personally confident that within three years from date the Katanga mines will be producing 5000 tons of copper per month from the eastern section of the copper belt owned by the Union Minière Company, in which we own 45 per cent. of the shares. The cost of the copper from the Star in Katanga will not exceed £15 per ton on the spot, although we believe a considerably lower figure will be nearer the mark, when the Kambove and other mines are producing, but even at £15 per ton the cost would not exceed £25 per ton delivered in Europe via Beira.

THE KANSANSHI MINE

The Kansanshi mine has been producing from 80 to 90 tons of copper per month at a cost of £15 per ton, at the works, and we are sending up a larger furnace, which will produce from 200 to 250 tons per month at a cost of about £12 10s. per ton. We have about £30,000 worth of bar copper in stock at Kansanshi and have entered into a con-

tract to bring the copper to rail-head, and the first shipment of 40 tons has arrived there by this time. Within a year I expect we shall have the railway so close to Kansanshi that we will bring down the whole of the present stock by traction engines to the rail-head, as well as the regular monthly output, and land it in England at £30 per ton. Certainly we should have landed in England within two years from this date 3000 tons of copper from Kansanshi at a cost of £30 per ton. These conditions will steadily improve; costs will go down as the railway goes north.

RAILWAY AGREEMENTS

Last July, I carried through the railway agreements, which I will now explain: A.—The Benguella railway will continue the construction of its line from Lobito bay to the frontier separating Angola from the Congo state between the 11 deg. and 12 deg. parallels south. B.—The Lower Congo railway will construct the section from Ruwe mine to meet the Benguella railway as soon as the lines of approach enable it to do so. C.—The Katanga Railway Company will construct a line from the frontier of Rhodesia to the Star of Congo mine as soon as the Southern railway reaches that frontier. The Katanga Railway Company will extend its line from the Star of Congo mine to Ruwe, and eventually to a navigable point on the Lualaba, as and when circumstances justify that extension. These agreements provided for a "pooling" of gross earnings between the Benguella railway, the Lower Congo railway and the Katanga Railway Company, revisable every 10 years. D.—The Chartered Company agrees to form a company with sufficient funds to construct a line from the present terminus of its railway at Broken Hill to the Congo state frontier. The Chartered Company gives rates for all mineral and other traffic to and from Beira and the frontier of the Congo state and also for all the material for the construction of the Katanga railway from the Rhodesian frontier to Ruwe, and the construction of the railway connecting Ruwe with the Benguella railway on the Portuguese frontier. It is also provided that the agreement between the Chartered Company and the Belgian companies shall continue in force until 10 years after the line to the Star of Congo is completed and open for traffic. This agreement may, however, be terminated when the Benguella railway and the extension thereof to Ruwe shall have been completed, or when more economic rates can be offered by the two northern railways and water routes of the Congo state. These agreements were signed on July 14 last.

ADVANTAGES OF THE BENGUELLA ROUTE

It is evident that when our own Ben-

guella railway is completed it will take the traffic which it ought to get by reason of its being 500 miles shorter to the sea than any other line; in fact it would take most of the traffic even if the length to the sea were the same as other routes. Only by having our own route can we ever control our copper costs. The Chartered Company advised me on Sept. 8 that it was unable to finance its section, and I wrote Dr. Jameson, with whom I had conducted all the negotiations, that I would endeavor to raise the money myself for this section, provided the Chartered Company gave this company the concession to build and own this section, reduce its interest on Kansanshi, and grant me large mineral concession for coal and other minerals, and also provided that Pauling & Co. guaranteed £250,000 of the money required, on condition I got that firm the contract to construct the whole job to the Star at a fixed rate per mile. In reply to this letter Dr. Jameson wrote me that Lord Winchester and Mr. Birch-enough were appointed a committee to deal with my suggestions. We soon came to terms, and an agreement was signed between this company and the Chartered Company on Nov. 4, giving this company full power to form a company before Jan. 31, 1909, and provide the necessary funds for construction of the line from Broken Hill to the frontier in terms of the agreements of July 14 last. This was a great point gained, because it gave this company, for the first time, an opportunity to finance the line itself, for which this company got all it wanted in mineral and other concessions, provided we find the money for the line before Jan. 31 next.

FINANCIAL ARRANGEMENTS

Out of the total amount required to construct the line from Broken Hill to the Star mine, about £1,200,000 has been guaranteed by this company and the Belgian companies we are affiliated with, and the balance is guaranteed by the railway contractors and others connected with them. The Belgian section is to be financed by Belgian capital, and the British section by British capital. All arrangements have been made to form a new company to build the British section, to be called the "Rhodesia Katanga Junction Railway and Mineral Company," and to sell to that company the railway concession to construct and work a line from Broken Hill to the frontier of the Congo state; also the Kansanshi mine and the whole of our coal concessions and rights in Rhodesia. These coal areas are of enormous importance, as they are about 350 to 400 miles nearer the reduction works than any other coal deposit, and a ton of coal will cost 30s. less on railway rates alone, taking 360 miles at 1d. per ton per mile; and Mr. Gibb informs me we can use about 600 tons per day of

this coal for our treatment of the Katanga copper ores. Your company will own shares and debentures in the new company nominally worth about £700,000.

THE INTEREST GUARANTEE

Your company guarantees the interest on the debentures of the new company for 20 years, but the Kansanshi mine itself is producing far more than will cover this interest, and will start with a stock in copper bars amounting to £30,000, which is equal to the first year's interest on all the debentures when the railway can take it away. You are thus in an excellent position—the first line to the great mines of Katanga is assured, and that railway passes close to Kansanshi. We will go on with Benguella railway construction to the plateau, another 80 miles, when that line, according to the report of our resident manager, will commence to have a profit, over all expenses, of £30,000 a year. When the 80 miles are completed the line will be the property of the Benguella Railway Company for 99 years and we should be in position to finance it with ease.

If we have raised, as we have done, upward of £4,000,000 for railways south and west to get at these great copper mines, the Benguella Railway Company will not fail to raise another £1,500,000 to complete the line to the Congo frontier, after we have got at the mines and get profits from our copper. How many companies are there in the world today that have raised £4,000,000, without any returns at all, against every conceivable difficulty, for railways through three different countries and constructed under different governments? We have done this by convincing the different governments, banks and financiers of the value of our assets. Until our own line is completed we shall be paying about £7 more per ton for our copper delivered in Europe than it would cost us by our own line, and we shall be greatly assisting the British South Africa Company; but when our line is completed from the mines to Lobito we shall get the full benefit, and we shall control rates and cost of copper as we please.

We have brought about a powerful combination of finance on clear and well-defined agreements to the accomplishment of a gigantic enterprise. Your capital will be £768,000 issued, with £2,000,000 of 5-per cent. debentures and about £1,000,000 issued with £600,000 worth of debentures if £1,400,000 worth of debentures are converted. If the debentures are not converted we do not pay interest in cash on them for another three years, and even then it will require only £100,000 per annum to pay 5 per cent. on them, whereas if they are converted they would rank as shareholders entitled to a proportion of your profits at any time. With an issued capital of £768,000 and £2,000,000 debentures,

you own 90 per cent. of the Benguella railway, represented by about 2,500,000 fully paid shares, 45 per cent. of the Union Minière Company, and you will also own 700,000 shares and debentures in the Rhodesia-Katanga Junction Railway and Mineral Company.

Black Eagle Falls, Montana

The accompanying illustration of Black Eagle Falls appeared in the program of the 22d annual meeting of the Montana Society of Engineers. These falls are about three miles below the city of Great Falls, where the meeting was held. The power development at this place includes a dam 746 ft. long, placed a short distance above the crest of the falls and giving an effective head of from 42 to 44 ft. There are power houses on both banks, those on



BLACK EAGLE FALLS, MONTANA, 54 FOOT FACE

the south bank belonging to the Great Falls Water Power and Townsite Company, and to the Great Falls Electric Properties. The water is led from the dam to these power houses through sheet-iron penstocks, and the water wheels are of the turbine type, and of various sizes.

The power houses on the north bank of the river belong to the Boston & Montana Consolidated Copper and Silver Mining Company. The water is here carried from the dam to the power houses by an open canal or head race, the walls of which are of concrete. This head race is 100 ft. wide at the widest point. The available head was originally less than 40 ft., but this was increased by means of a tail-race wall separating the tail race from the main river and delivering the tail water to the river at a distance below the power houses, thus taking advantage of the fall in the river below the shear fall at Black Eagle.

About 12,000 h.p. is developed, the Great Falls Water Power and Townsite Company and the Great Falls Electric Properties taking about 2000 h.p., and the Boston & Montana company the balance.

The Transvaal Stope Drill Competition

SPECIAL CORRESPONDENCE

The final list of entries for the £5000 prize stope-drill competition in the Transvaal shows that fewer applications have been received from non-British makers than previous correspondence and inquiries led us to anticipate. Twenty-three drills have been entered, and it is significant to note that the Gordon hammer drill, which won the competition of last

year so easily, is not among them. Nevertheless, hammer drills figure largely on the list. America is represented by only two competitors, in the companies running the "Murphy" and "Waugh" drills; while Germany enters five machines and England 11. The other five are of local production.

British Guiana Mines

Exports of gold from British Guiana for the year ended Dec. 31 were 70,676 oz. bullion in 1907, and 73,089 oz. in 1908; an increase of 2413 oz. The bullion reported in 1908 was equal to \$1,289,948, or 62,407 oz. fine gold.

Exports of diamonds from the colony for the year 1908 were 4968 carats, valued at \$40,872; an increase of \$23,322 in value over the preceding year.

Historical Resumé of the Copper Queen Mine

Bonded at One Time for Twenty Thousand Dollars; Now Valued at Many Millions. The Story of Its Early Struggles and Difficulties

SPECIAL CORRESPONDENCE

Following is a synopsis of an address recently delivered at Bisbee by Dr. James Douglas, president of the Copper Queen Consolidated Mining Company.

In 1876 I was introduced to a gentleman named Riley who had sold a mine in Nevada and was very anxious to come down into Arizona, attracted by the stories he had heard of the famous Ajo mines. I succeeded in helping him to get rid of his Nevada mine, and for some time we kept up a considerable correspondence. Finally, visiting Arizona, the Ajo disappointed him and he went through four years of arduous work looking for something else. At last I heard from him that he had struck a wonderful mine in the Mule mountains. By that time my friend, who was a lawyer of some note, was worn down to where there were hardly any soles to his feet, and he had to borrow money from our friend Zeckendorf in order to go to San Francisco to float this mine in the Mule mountains, on which he had obtained a bond. Zeckendorf had the courage to lend him the money; he went to San Francisco and came in contact with the firm of Bisbee, Williams & Co., who knew a firm of engineers by the name of Martin & Barrett. I believe that Martin & Barrett had had some rather ill-luck in railroad contracts and Mr. Martin had been a sworn enemy to all mining speculation; but driven by necessity, determined that they would put what money they had left into the Copper Queen mines. At that time, you know, mines were not valued by millions and the Copper Queen mine was really bonded at \$20,000, on which Martin & Barrett made first payment, taking my friend Mr. Riley as partner.

The mine was opened by a surface cut in August, 1880. The men who started the open cut acted the fool, as most prospectors do; they ran through rich ore at the end of the open cut, and thought it wiser to stop and get what they could rather than spoil the prospect altogether and get nothing, and therefore, the Copper Queen mine was sold for \$20,000.

Mr. Martin came here and employed Lewis Williams, as superintendent, who recommended that he buy the mine. He was subsequently, as you know, succeeded as superintendent by his brother, Ben Williams, whom most of you undoubtedly knew intimately.

At that time, where Main street is now, there was a little spring on what was known as the Malvina claim. I presume

the spring dried up many years ago, though for a time it supplied the only drinking water the town had. The Malvina spring did not yield water enough to supply the 36-inch furnace, and occasionally the furnace had to be shut down. Mr. Martin went east with the view of buying pipe to get a supply of water from the San Pedro river. However, before they got down three hundred feet they struck more or less water in the mine, and that solved and yet solves, the water question.

I came out to Arizona at the end of that year to look at what has since proved to be the Verde mine. At that time the claims were one hundred and eighty miles from the nearest railroad station, and we therefore could not do profitable work; and being disappointed in my visit to the Verde mine, I came down to see my friend Riley at the Copper Queen. That was in 1881, and the Copper Queen was the only mine actually open in the district. It continued from August until January to yield between 20 and 25 per cent. ore and there were no signs of its abating. I could not have thought well of it at that time, because we professional men thought that the limestone was invariably a fake and was simply placed there by Providence in order to delude us. Somehow or other, I have a certain faith in Providence and feel that he does not play jokes, and whenever you find anything that pays as that open cut did it means something very substantial. I took quite a liking to the Copper Queen and told my friend Martin I thought that such an ore-body was not going to be isolated in that fashion, and he said, "We can get it for \$10,000," and I said, "If I were you I wouldn't hesitate to pay the price."

Mr. Martin had made such an admirable strike in the Copper Queen that his whole ambition was to sell the mine for a million dollars—if he could only get a million dollars that was all he wanted, but to buy \$10,000 worth of limestone was simply throwing that much away, and therefore he didn't buy the claim.

BUYS THE QUEEN

The following year I came out on business, and some one said to me, "You know the Copper Queen," and I said "Yes." Then he said, "Yes, they want to sell it for \$25,000," I replied, "I don't think I can sell it, but if I find a purchaser I will let you know." The following summer Phelps, Dodge & Co., for whom I

had done some work, asked me to come out and examine the property. This I did and I gave them the opinion that if they were poor men and it would likely impoverish them to buy it, they had better leave it alone; but if they were in a position to throw their money away, to take it. They took my advice and bought it. The Queen went on working and they got down to the second level, and the third level, and at last got down to the fourth level from the open cut.

When they got there they cut out absolutely clean; there wasn't a trace of ore left on the 400 level. That occurred towards the end of 1884, after they had been working four years. Mr. Martin called in an expert and measured the ore that remained. There was only about three months' supply. The men in the Queen mine, in the meantime, had gone through a most trying time; there were little bits of ore here and there; a few bushels of it on the surface, and that was all, but that didn't mean anything in particular. We tried the west end, went down and found little streaks of ore; then we came to the east end and we followed a streak there which was barren; then we drove a tunnel. The engineers thought they laid that tunnel out correctly, and after we had driven the tunnel we found that it was in clean ground.

By that time the Queen had got us into deep water. There was no more ore, no more money and my friends in New York insisted on going ahead, and asked me if there was anything to go further for; and while I say there was nothing, there was one little, what we called a "joker," leading across the side line of the Copper Queen, and Mr. Williams did not think we had any right to follow it, and I concurred with him. We did not follow it. We were then mining the Atlantic claim, and my friends wanted to know if there was absolutely nothing in it, and I told them that there was one streak of ore that crossed the line, and that it wasn't worth anything itself, but heaven knows what it may lead to. They trusted several thousand dollars more to reach the "joker" and in the meantime after sinking two hundred feet (I expected to go down about four hundred) we struck another glorious body of ore, and just at the same time the Queen ran into the same body.

FORMED PRESENT COMPANY

Then the question arose as to who

owned the ore, and after some discussion of the matter among us, we came to the conclusion it was best to unite our forces, so instead of the Copper Queen Mining company, we formed the Copper Queen Consolidated Mining company in August, 1885, which was a very wise thing, as it has since turned out. There remained to all intents and purposes nothing more in the Queen claim; everything rested in the ground lying south of it. But that was only the beginning of further discouragement.

After the amalgamation, prices dropped, dropped, dropped steadily. We went on working in the same old rattletrap way underneath the open cut. We had two furnaces, each 36 in. in diameter, and as the price of copper dropped profit absolutely disappeared. The value of the ore in the open cut had fallen to about 12 per cent. before they got to the bottom of the first orebody; the average of the other orebody was lower still; somewhere about 10 per cent. but when bar copper dropped to under eight cents it was perfectly clear that there wasn't very much money to be made in working two old 36-inch furnaces. The Queen at the time was very heavily in debt, and I went to my friends in New York and suggested that if we did more economical work we certainly would be able to make a little with copper at eight cents per lb. They were brave enough in the face of all these difficulties to advance the Copper Queen \$150,000 to put up a larger and more economical plant. This was begun in the fall of 1886, and completed in May, 1887. I left New York shortly after we had the meeting to finance the Queen. We were making a trifle, although copper was selling at about eight cents, and I thought that within three or four years we could pay the Queen's debts. Of course, the new works were making considerable more copper and we had to find an outlet for our product.

Just then a Mr. Secretan came to us to make contracts for the whole of our output for three years, we undertaking to give him a certain minimum per month. Mr. Secretan was very generous and offered us about 13½c. per lb. for our copper. We had been getting 8c., and, therefore, we proceeded to make a bargain with him. With copper at 13½c., the Copper Queen debts began to vanish at a very rapid rate and by the following year we were able to pay about \$100,000 dividends; that was a large dividend because we had not received anything for about three of four years. Under Mr. Secretan's regime that dividend increased to \$300,000 a year. But it was later considerably decreased when our production was diminished. However, the Secretan syndicate, as we called it, was a great impetus, and from that time on we began producing ten to twelve million pounds per year. For three years

after the amalgamation virtually the whole of the copper came from the Atlantic orebody as we called it. That body dipped in the opposite direction from the original orebody, but there did not prove to be anything like as much ore as in the original Queen. In 1886 following that same famous "little joker," which I was aiming at in 1884, we came upon what has proved undoubtedly to be the largest continuous orebody that we have ever found in the Arizona country. The stopes of this orebody fed the furnaces for about three years. (Possibly ten or fifteen per cent. of the ore was mined from the Queen.) Meanwhile, we had found an orebody in the west end, so that by the time the southwest stope was exhausted we were finding considerable ore at a greater depth further to the southwest, when an unfortunate change took place in the character of the ore. Sulphide came in and our copper began to seriously deteriorate. It became extremely difficult to sell the 96 per cent. bar copper which we were taking out. Again Providence came to our assistance in the person of a Frenchman, who applied the same treatment to copper which had previously been applied in the making of steel, and that solved the question.

When we commenced mining copper in Arizona, if we had had sulphide ore it would not have paid at all and we would have been forced to abandon it. Since the advent of the new treatment we are re-smelting the old slag dumps that were thrown away in those days.

In 1899 we began handling mixed sulphide and oxidized ores in the first converter, which some of you may recollect. This of course opened up large areas of our ore-bearing ground which we had been prohibited from touching previously by our inability to handle sulphide. From that time the production of the Copper Queen mine rose rapidly to two and three million pounds per month. There was also a little silver in the ore; some of our ores were found to be richer in silver than others and therefore when the Bessemer treatment was inaugurated we devoted one furnace and one converter to the smelting of silver-bearing ore.

All these things, in the process of development from small days to days of large events and larger quantities compelled us to move our smelters out of Bisbee. It became impossible to extend the plant in proportion to the expansion of the mines and the mines had expanded by the absorption of other property.

I was telling you about the hard times in the Queen's history. During that period they were offered two claims called the Holbrook and the Cave. They were owned by a Mr. Garnett, who at one time intended to work, but decided to sell them for what he thought the property was worth. Mr. James and Mr. Dodge bought them. We worked the Holbrook

and the Cave for quite a number of years as independent operations, in fact, until the year 1892. They used to produce about sixteen to seventeen million pounds.

COL. HERRING'S CLAIMS

There was a member of the bar, Colonel Herring, who had the mining fever, and located a group of claims on the other side of the mountains. He had the Dividend, the Neptune and several others. When I came out early in 1881 I found a certain man who was a mineralogist and geologist, who was superintendent of those claims. He was more than half-hearted about them. He was absolutely pessimistic. He said the ore was in limestone and simply worthless. Anyhow, the Dividend company put up their furnace at Helfa and hauled their ore down there to smelt. The company, however, came into existence through our friend Colonel Herring. Colonel Herring's brother, who located the claims, died and the colonel started in to wind up his estate; he gave up the profession of law in New York, went back again, organized a company, and came out here as the manager of it. When I came out here in 1881 I found Colonel Herring living in what was called the "Castle," a great big *adobe* house down the cañon.

They spent the whole of their capital stock and about \$80,000 of bonded indebtedness; the people who owned it got sick of it, and put it up at sheriff's sale. We bought it. However, the Holbrook, Cave and Dividend were turned over in 1892 for a slight increase in the capital stock of the company. Originally, the capital stock of the Copper Queen was two million dollars; and when the consolidation was effected, instead of adding a few million more, Mr. Dodge, who was very peculiar about those matters, thought that the capital ought to be cut down to one million four hundred thousand. When this other property was bought, including the Holbrook, Cave and Dividend, the whole group was turned in for \$600,000, so the capital of the company was again up to two million dollars. However, after the amalgamation and after the introduction of Bessemer treatment, we moved the works down to Douglas, because there wasn't room to expand up here in the narrow quarters which were assigned to the works.

It became at once evident that it would be difficult for us to carry on a large enterprise without transportation facilities. We therefore built a railroad from Benson to Bisbee, and later this was extended to Douglas. Our railroad would probably have ended there, if it hadn't been that we bought a mine from the Guggenheims at Nacozari. Afterward it was decided, on account of some difficulties which we were compelled to surmount, and in order to afford us a better outlet for our products, to build our line in to El Paso.

Mine Explosions as Related to Earthquakes

A Discussion Favoring the Theory That the Danger from Explosions in Deep Mines Is Augmented During Periods of Seismic Unrest

BY W. A. SPALDING*

In the JOURNAL of June 1, 1907, Prof. James T. Beard discussed the subject of mine explosions, and their connection with seismic disturbances. Every observer must have noted that disastrous explosions in mines seem to come in series, and when one occurs in any field several others in various parts of the world are apt to follow in close succession. Then may come a cessation of such disasters for a considerable time, to be followed by another series. Have these intermittent seasons of mine explosion a sort of periodicity? That is, are the antecedent conditions of gas accumulation which invite disaster, periodically recurrent, and if so, has this condition any connection with seasons of seismic and volcanic activity?

Professor Beard believes that internal pressure is the cause of larger, spasmodic emissions of gas. He states that even in districts producing large quantities of gas and which, therefore, appear to furnish a constant emission, there is a very perceptible ebb and flow, causing periods of fluctuations in the gaseous condition of the mine. He says:

"In other districts and mines, there are corresponding periods in which much gas is given off, followed by intervals when there is almost an entire absence of gas in quantities to cause alarm. Often these periods of the ebb and flow of gas from the strata are quite local; that is, restricted to a limited area or district, and at times appearing in a single mine or portion of a mine only. Several instances have recently occurred where the flow of gas increased in a portion of the mine so rapidly that the men were withdrawn from that district and not permitted to return for nearly a month, when the flow ceased almost entirely."

INTERNAL AGENCIES

Such observations as the above induced Professor Beard to turn his attention to internal agencies, and seismic and volcanic action naturally came in for consideration. Again quoting from his article:

"We possess very little exact knowledge of the condition of the interior of the earth, but the evidence of volcanoes in action and our knowledge of the agency of heat and pressure makes it certain that tremendous activities are in constant operation within the earth's sphere. It is both natural and reasonable to suppose that the pressures in subterranean channels

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that will discharge molten material under a great head, can make themselves felt in other quarters, and incidentally augment the outflow of gas from strata already pregnant. No one familiar with underground conditions and who has listened with awe to the mysterious 'poundings' in the overburden of a mine, caused, as is well known, by the working of gas in the foliations of the strata, can study the phenomena of earthquake waves and shocks without being convinced of the close relationship of the different phenomena. The conclusion is fairly certain that gas generated by the chemical and physical activities within the earth plays an important part in all these phenomena.

"The theory of spasmodic or irregular earth breathings, as just explained, if true, would give rise to periods of frequency of mine explosions, more or less closely associated with volcanic activity. That such is the actual fact is shown to be highly probable by the remarkable coincidence in their occurrence. That there are isolated or errant mine explosions occurring in a period of rest and entirely disassociated from seismic disturbances, does not argue against the theory, since it is not claimed that all mine explosions are the result of such disturbance. The causes producing explosive conditions in mines are too numerous to invite such an expectation. But when periods of marked seismic troubles are almost invariably accompanied by the appearance of gas in increased quantities in mine workings, and the occurrence of one or more mine explosions, the fact is significant of something more than mere chance."

THE VALUE OF A STATISTICAL STUDY

Professor Beard then gives a list of concurrences between seismic and volcanic action on the one hand and mine explosions on the other. At first glance such a statistical comparison would seem to be somewhat unscientific and far from convincing. To institute a satisfactory comparison, we must have a basis of similarity in the things compared. Earthquakes and volcanic eruptions are purely natural phenomena. Mine explosions are only natural insofar as they depend on the antecedent collection of gas in subterranean cavities; the ignition of the gas is accidental, and depends on human agency. Every reasonable precaution to prevent such accidents has been adopted by mine operators; chief of which are the frequent inspection of deep workings, to

detect the presence of gas in dangerous quantities; the ventilation of such workings by proper openings and forced draft, and the use of safety lamps. But these precautions, while theoretically correct, are not perfectly executed; hence an occasional explosion occurs involving loss of life and destruction of property.

If we could have for the purpose of our comparison full statistics of the ebb and flow of gas in mines, it would be far more satisfactory than to deal with those exceptional and largely accidental cases involving disaster. But such full statistics are not generally kept, and the compilation of a sufficient record would require years of constant observation in a large number of mines. Hence, for the present, we must be content with such values as may lie in the natural conditions antecedent to explosions which make the events matters of record.

Under the exigencies of the case, it would be folly to trace the line from cause to effect, starting with natural phenomena which would produce the specified antecedent conditions, and then expect each series to find its logical conclusion in a mine explosion. Our method should rather be inductive—from effect to cause. Given, a mine explosion; the condition of gas accumulation must have been present; now can we trace this condition back to a natural phenomenon, such as an earthquake or volcanic eruption, occurring about the same time? Hence, we should not attempt to find a mine explosion for every seismic or volcanic disturbance, nor yet an earthquake or an eruption for every mine explosion, but such concurrences as we do find should be carefully studied. With the foregoing thought in mind, I have rearranged Prof. Beard's list to present it in a more graphic form and have augmented it somewhat by inserting data gathered from other sources:

TABLE SHOWING CONCURRENCE OF MINE EXPLOSIONS AND SEISMIC DISTURBANCES.

Mine Explosions.	No. Killed.	Seismic and Volcanic Disturbances.
	1896.	
Jan. 23, Newburg, W. Va.	39	Jan. 10, earthquake Persia—2 villages destroyed.
Mar. 23, Berwinstale, Penn.	15	Mar. 29, violent earthquake Chile.
Oct. 29, S. Wilkes-Barre, Penn.	6	Oct. 18, tidal wave coast of Mexico. Result of submarine earthquake.

1897.	Jan. 4, Alderson, Ind. Ter.	5	Jan. 2, earthquake Ottawa, Ontario.	Aug. 1, Wallangang, N. S. W.	127	July 31, earthquake Cal. Santa Barbara.	Oct. 13, Fredericks-town, Penn.	6	Oct. 3, earthquake Ecuador, heavy.
			Jan. 9, earthquake Christianstadt, Sweden.			Aug. 4, earthquake Los Alamos, N. M.			Oct. 7, Vesuvius active.
			Jan. 11, earthquake Kishma Island.			Aug. 4, earthquake Montana.			Oct. 9, earthquake Calabria, Italy.
1898.	Sept. 23, Browns-ville, Penn.	8	Sept. 16, earthquake S. Dak. and Neb.	Sept. 16, Algona, W. Va.	17	Aug. 5, earthquake Genoa and Pisa, Italy.	Nov. 4, Vivian, W. Va.	7	Oct. 12, Vesuvius active.
			Sept. 17, earthquake Deering, Me.	Sept. 22, Stafford, W. Va.	6	Sept. 5, Kilauea, Ha-waii; active.	Nov. 15, Bentleys-ville, Penn.	8	Oct. 15, earthquake Cuba, Jamaica.
			Sept. 19, new craters open Vesuvius.			Sept. 6, Vesuvius; active.	Dec. 1, Diamond-ville, Wyo.	18	
			Sept. 24, Vesuvius active.			Sept. 7, Izalco, Sal-vador; active.		1906.	
1899.	July 24, Grindstone, Penn.	5	July 22, earthquake So. Cal.—slight.			Sept. 9, Alaskan vol-canoes.	Jan. 4, Coaldale, W. Va.	22	Jan. 5-6, earthquake Nicaragua.
			July 28, earthquake Hawaii—violent.			Sept. 20, severe earthquake Adelaide, Australia.	Jan. 18, Detroit, W. Va.	18	Jan. 7, earthquake Nebraska and Kansas.
			July 28, Mauna Loa active.			Sept. 20, Sunfrière; active.	Jan. 24, Witteville, Ind. Ter.	14	
						Sept. 22, earthquake Guam.	Feb. 8, Parrol, W. Va.	27	Feb. 1, Vesuvius active.
	Dec. 23, Sumner, Penn.	20	Dec. 13, earthquake Ceram Island, vio-lent.			Sept. 22-23, earth-quake Russian Turkestan; severe.	Feb. 19, Maitland, Colo.	16	Feb. 12, earthquake Calabria.
			Dec. 26, earthquake So. Cal.			Sept. 28, earthquake Hilo, Hawaii.	Feb. 27, Piper, Ala.	9	Feb. 16, earthquake Ecuador.
1900.	Mar. 6, Red Ash, W. Va.	46	Mar. 1, earthquake Nevada.	Apr. 13, Carbon, Ind. Ter.	6	1903.			Feb. 19, earthquake, Formosa. 8000 killed.
			Mar. 3, earthquake Petaluma, Cal.			Apr. 1, earthquake Montana.			Feb. 21, earthquake Colombia, S. A.
	May 1, Scofield, Utah.	200	May 9, Vesuvius ac-tive; violent eruptions.	Nov. 21, Ferguson, Penn.	17	Apr. 21, earthquake Tuxpam, Mexico.	Mar. 10, Courrieres, France.	1200	Feb. 21, Pelee active.
			Nov. 1, earthquake Jacksonville, Fla. 8 distinct shocks.			Nov. 5, Malaspine, P. I.; active.	Mar. 22, Century, W. Va.	21	Mar. 17-19, earth-quake, Formosa, Japan.
	Nov. 2, Berryburg, W. Va.	15	Nov. 5, earthquake Cahto, Cal.	Jan. 25, Cheswick, Penn. Harwick mine.	178	Nov. 29, tidal wave, Hawaii. (Submarine earth-quake?).	Mar. 28, Takashima, Japan.	307	
1901.	Apr. 29, Alderson, Ind. Ter.	6	Apr. 2, earthquake Hungary.			1904.	Apr. 21, Trinidad, Colo.	22	Apr. 7, earthquake Formosa, Japan.
	May 15, Chatham, W. Va.	10				Jan. 16, volcanic eruption, Central America.			Apr. 18, earthquake San Francisco.
	May 27, Richland, Tenn.	20				Jan. 18, earthquake Shemokka, Rus-sia.			Apr. 20, earthquake Calumet, Mich.
	June 10, Port Royal, Penn.	19		Mar. 6, Catsburg, Penn.	5	Jan. 29, volcanic eruption, Colima.			Apr. 20, earthquake Honolulu.
	Oct. 26, Diamond-ville, Wyo.	32	Oct. 7, earthquake and tidal wave, Ecuador.	Oct. 28, Tercio, Colo.	19	Feb. 24, earthquake Saltillo, Mex.			Apr. 26, Mount Hec-la, Iceland; active.
			Oct. 30, earthquake Italy.	Nov. 29, Luke Fid-ler, Penn.	7				Apr. 26, Mount Col-ima, Mexico; ac-tive.
	Nov. 14, Pocahon-tas, W. Va.	9	Nov. 8, earthquake Erzeroum, Tur-keky.			Nov. 6, earthquake Formosa.	June 6, Red Lodge, Mont.	8	Volcano Las Palmas, Discovery Islands, 9000 ft. high.
			Nov. 13, earthquake Salt Lake, Utah.	Feb. 20, Virginia City, Ala.	116	Dec. 6, earthquake Formosa.			June 1, earthquake Seattle.
			Nov. 15, earthquake Salt Lake and Russia.	Feb. 26, Bluefield, W. Va.	23				June 25, earthquake Kansas.
	Nov. 22, Pocahon-tas, W. Va.	8				1905.	July 19, Huger, W. Va.	5	June 27, earthquake S. Wales.
						Feb. 2, eruption Nic-aragua; severe.			July 2, earthquake Socorro, N. M.
	Jan. 24, Lost Creek, Ia.	20	Jan. 16, earthquake state of Guerrero, Mex.	Mar. 18, Rush Run, W. Va.	24	Feb. 2, earthquake Andizan, Central Asia.			July 8, tidal wave Sandy Hook.
			Jan. 24, earthquake Mexico, Missouri, Illinois.	Mar. 22, Princeton, Ind.	9	Feb. 4, earthquake Lordsburg, Cal.	Oct. 3, Pocahontas, W. Va.	37	July 12, tidal wave Cal., N. M., Texas.
	May 19, Frayter-ville, Tenn.	184	May 18, eruption St. Vincent.	Apr. 3, Zeigler, Ill.	53	Feb. 23, eruption Mauna Loa.	Oct. 5, Blossburg, N. M.	15	July 16, tidal wave Texas and N. M.
	May 23, Fernie, B.C.	127	May 20, eruption Mt. Pelee.				Oct. 14, Wingate, Eng.	24	July 24, Stromboli, Sicily; active.
			May 20, earthquake St. Augustine.	Apr. 20, Cabin Creek, W. Va.	6	Mar. 12, earthquake Menominee, Mich.	Oct. 24, Johnstown, Penn.	7	Oct. 1, earthquake Sydney, N.S.W.
			May 21, earthquake Cal.	Apr. 28, Du Bois, Penn.	13	Mar. 24, earthquake Saltillo, Mex.			Oct. 1, earthquake bed of Indian Ocean.
	July 10, Johnstown, Penn.	112	May 25, volcanic eruption Portugal.	Apr. 30, Willerton, Ind.	13	Apr. 4, earthquake San Jose, Cal.			Oct. 6-11, Pelee ac-tive.
			July 7, earthquake Salonica.			Apr. 4, earthquake northern India, severe.			Oct. 12, earthquake Socorro, N. M.
			July 8, earthquake St. Vincent.			Apr. 7, earthquake Redding, Cal.			Oct. 15, Vesuvius ac-tive.
			July 9, eruption Mt. Pelee.			Apr. 19, earthquake Santa Cruz, Cal.			Oct. 18, tidal wave Miami, Fla.
			July 9, earthquake Persia.			Apr. 23, earthquake Los Angeles, Cal.			Oct. 21, Chulo ac-tive.
			July 11, Mt. Pelee violent.			Apr. 23, earthquake North of England.	Jan. 23, Primero, Colo.	20	Jan. 14, earthquake Kingston.
			July 27, earthquake Cal., Sta. Barbara.			Apr. 25, earthquake Albas, Persia.	Jan. 28, Reden mine, near Essen, Ger-many.	158	Jan. 28, earthquake Kingston.
			July 28, earthquake and tidal wave, St. Vincent.			Apr. 27, earthquake San Francisco and San Rafael, Cal.	Jan. 28, Lievin col-liery, Lille, France	3	
			July 30, volcanic eruption, Costa Rica.			Apr. 29, earthquake Italy, Switzerland, France.	Jan. 29, Stuart mine, near Fayetteville, W. Va.	85	
				July 5, Vivian, W. Va.	10	May 3, earthquake Island of Hilo.	Feb. 4, Elkins, W. Va.	25	Feb. 4, earthquake recorded Leibach Observatory.
						May 9, earthquake City of Mexico.	Feb. 18, Las Espar-anzas, Coahuila, Mexico.	50	Feb. 17, earthquake State of Washing-ton.
						July 15, earthquake Manie.			

Mar. 2, Holden colliery, Taylor, Penn.	7	Mar. 1, earthquake Costa Rica.
Mar. 2, Woodward mine, Kingston, Penn.	2	Mar. 13, Akutau, Alaska; active.
Apr. 24, Plymouth, Penn.	4	Mar. 29, Bitlis, Turkish Armenia; worst earthquake in 40 years.
May 1, Whipple mine, W. Va.	21	Apr. 3, Azore Islands.
May 14, Plymouth, Penn.	2	Apr. 14-17, Colima volcano in eruption.
June 19, Priceburg, Penn.	7	Apr. 14-17, earthquakes in Spain.
Sept. 7, Las Esparanzas, Mexico.	27	Apr. 15, earthquakes City of Mexico and other Mexican cities.
Oct. (?), Wilkes-Barre, Penn.	4	Apr. 17, earthquakes at Valparaiso, Chili.
Dec. 1, Naomi, Penn.	34	Apr. 17, earthquakes at Constantinople.
Dec. 6, Monongah, W. Va.	353	Apr. 17, all seismographs active.
Dec. 16, Golan, Ala.	56	Apr. (?), earthquake reported in China.
Dec. 19, Darr mine, Jacob's Creek, Penn.	233	Apr. 19, earthquake at Charleston, S. C.
Dec. 22, Schoonberg mine, near Pittsburgh, Penn.	0	Apr. 29, Stromboli in eruption.
Dec. 31, Crow's Nest mine, near Massillon, Ohio.	5	May 26, fissure opened on Vesuvius.
Dec. 31, Bernal mine, Carthage, N. Mex.	12	June 5, earthquake at San Francisco.
1908.		June 20-July 5, columns of fire 250 ft. high at sea, off Tonga and Friendly Islands.
Jan. 7, Port Blanchard, Penn.	0	Aug. 30, Vesuvius restless.
Feb. 7, Port Hood, N. S.	10	Sept. 2, earthquake recorded as 6000 miles from Washington, D. C., probably in north Pacific off Japan.
Feb. 10, South Carrollton, Ky.	10	Oct. 24, earthquake shocks in Calabria, So. Italy.
Feb. 14, Glencoe, Natal, So. Africa.	42	Nov. 20-30, ash-storm at Nome, Alaska, from supposed eruption in Aleutian Islands.
Feb. 21, Globe mine, Washington, Eng.	14	Jan. 7, cave of Vesuvius broke and sank.
Feb. 27, Rosita, Coahuila, Mex.	200 (?)	Jan. 15, earthquake at Gonaives, Hayti, W. I.
		Jan. 25-28, whole earth reported as trembling as indicated by seismographs everywhere.
		Feb. 1, earthquake 3800 miles from Washington, D. C.
		Feb. 5, quakes in Connecticut.
		Feb. 8-10, earthquakes 8000 miles from Washington, D. C.
		Feb. 14, earthquake, two shocks recorded at Cheltenham observatory, Md.
		Feb. 19, earthquakes in the Azores.

Mar. 24, Pittston, Penn.	1	Mar. 26, Mexican cities destroyed by earthquakes.
Mar. 28, Hanna, Wyo.	55	

While this article was in preparation there came two striking confirmations of Professor's Beard's theory: March 26, 1908, occurred a severe earthquake in Central Mexico, damaging buildings in that city, destroying the town of Chilapa and causing great destruction of life and property. March 28—two days later—we note a disastrous explosion in the No. 1 mine of the Union Pacific Coal Company at Hanna, Wyoming, in which 70 men lost their lives. As an interesting side light on the question under discussion, the following associated press despatches are worthy of notice:

"Beloit (Wis.), March 19, 1908. The roaring well on the Charles Lathers farm northeast of Beloit, sounds from which preceded the San Francisco disaster, is again emitting rumbling noises and a strong wind from its cavernous depths. It is asserted that this well began roaring a few weeks before the San Francisco earthquake, and ceased at exactly the hour of the quake."

"Beloit (Wis.), March 27, 1908. The famous "roaring well" has again made good. March 19 it was found that the phenomenon, on the farm of Charles Lathers, northeast of this city, was active. The well roared for several weeks before the great earthquake at San Francisco, and the curious sound of rumbling, together with wind from the mouth of the well, ceased at the precise hour when the shock struck the California city. When the well resumed its clamor last week residents of Rocky county predicted a calamity. Yesterday it came—in Chilapa, Mex.

Beloit, Wis., is far removed from San Francisco, yet it appears that there was some sympathetic connection between the roaring well and the earthquake in the latter place April 18, 1906. Again, a still greater distance intervenes between the roaring well and the City of Mexico, yet the phenomenon is repeated March 26, 1908. Such sympathetic action can only be accounted for on the theory of a general stress upon the earth's crust preceding and concurrent with seismic action. I may also add that through personal correspondence with the owner of the well above mentioned, and with reliable citizens of Beloit, Wis., I have confirmed the truth of the press despatches just cited.

AN ANALYSIS OF THE FOREGOING TABLE

The concurrence or close approximation between earth disturbances and mine explosions noted in the foregoing table certainly gives color to the theory that the danger in deep mines is augmented during periods of seismic unrest. When such a theory is abundantly supported by reason,

it challenges consideration. The following fundamental conclusions are obvious:

1. That a seismic convulsion is due to great stresses or strains acting upon the crust of the earth.

2. That the fracture and displacement of strata open up fissures through which gases may escape as the result of internal pressure.

3. That a subterranean explosion producing a volcanic eruption must be accompanied by a lateral and backward pressure equal to that which projects the material from the crater.

4. That with seams in the surrounding strata opened by earthquake shocks, and a great lateral pressure from a subterranean explosion or other cause, gases may be driven to great distances.

5. That such gases may be discharged through fissures into deep mines, and accumulate in the chambers to such an extent as to invite disaster.

As Professor Beard observes: "Because two occurrences or phenomena are of record almost invariably contemporaneous, proves no more than the fact of their association. It remains to be shown whether the association is one of cause and effect, or whether they are both alike the effort of a hidden cause as yet unknown, perhaps unsuspected."

However, in the case under consideration, the cause and effect seem to be closely united on theoretical grounds at least, and the close association empirically shown, while not conclusive, is nevertheless entitled to due weight.

SEISMIC DISTURBANCES ARE NOT LOCAL

It may be objected that volcanic eruptions and seismic shocks are, in a sense, local phenomena; that the principal effects are restricted to a definable area, including the volcano or the epicentrum of the earthquake. Yet it is true that by aid of the seismograph, a tremor from a heavy tectonic earthquake may be traced around the world, showing that at least a secondary effect—a vibration of the earth's crust—is general.

There has been a movement among the more advanced seismologists, of whom the late Professor Heilprin was a representative, to attribute a much closer connection between volcanic eruptions and earthquakes than was formerly conceded, even when the two classes of phenomena are widely separated. An inquiry as to whether there could be any association between a violent outbreak of Vesuvius and an earthquake in San Francisco, both occurring at nearly the same time, would not be flouted by an uptodate investigator. We are still too far from a satisfactory demonstration of the prime causes of seismic and volcanic disturbances to allow, in such case, much weight to a dogmatic disclaimer.

Miners Convention Adjourned

The convention of the United Mine Workers of America, after three weeks of turbulent deliberations in Indianapolis, Indiana, adjourned late Saturday night, Feb. 6. The sessions of the last week dragged along in a manner characteristic of the entire convention and were marked by the customary wrangling. There was scarcely a report made during the convention that did not create some factional disturbance. A resolution was passed providing for the amendment to the by-laws which it is hoped will enable the organization to elect officers without the taint of fraud, and also for the expulsion of any official, candidate or member guilty of making or circulating false statements against one another.

Before the convention adjourned a more friendly feeling was manifested between the factions and the vote of thanks to President Lewis was not opposed.

The scale committee which had under consideration the situation in the anthracite district of Pennsylvania made its report recommending the adoption of the wage scale agreed upon by the anthracite districts at a conference held at Scranton, Penn. last fall, as follows:

"1. That an agreement shall be negotiated between the representatives of the miners and operators of the anthracite region, and all disputes arising under the contract shall be adjusted as provided for in said agreement.

"2. We demand the complete recognition of the United Mine Workers of America as a party to negotiate a wage contract, and that the United Mine Workers of America shall be recognized in our right to provide any method we may adopt for the collection of revenue for the organization.

"3. That we demand an eight-hour day with no reduction in wages.

"4. That all coal shall be mined and paid for by the ton of 2,000 pounds.

"5. That we demand a definite and more uniform scale of wages and prices for all classes of labor at all collieries in the anthracite region; and that all employees paid \$1.50 or less per day shall receive a 10 per cent. advance and all employees paid more than \$1.50 and less than \$2 per day shall receive a 5 per cent. advance.

"6. That the system whereby a contract miner has more than one job or employs more than two laborers be abolished.

"7. That the employers be required to issue uniform pay statements, designating the name of the company, the name of the employee, the colliery where employed, the amount of wages and the class of work performed.

"8. That the contract shall be made for a period of one year."

The committee recommended that the officers of the Mineworkers' organization use their best efforts to bring about a conference with the operators and left the details with the executive committee.

The convention concurred in the report.

On account of the cost it was decided not to send a representative to the International Mining Congress in Europe next year. A number of facetious speeches were made by President Lewis, J. P. White, W. D. Ryan, E. S. McCullough and others previous to adjournment.

The newly elected officers are: President T. L. Lewis, Vice-President, E. S. McCullough; Secretary-Treasurer Edwin Perry.

Indianapolis was again selected as the place of holding the convention next year.

Pocahontas Consolidated Collieries Company Merger Sustained

An important decision in favor of the Pocahontas Consolidated Collieries Company, Incorporated, was rendered by the U. S. Circuit Court of Appeals at Richmond, Va., on Jan. 16, in the case styled *Campbell vs. Jones*, affirming the decision of the lower Federal court.

It will be recalled, as reported in the JOURNAL last January, that this suit was brought by the dissenting minority holders of the \$300,000 of the preferred stock of the Pocahontas Collieries Company, which was merged with and under the name of the Pocahontas Consolidated Collieries Company, Inc., on July 1, 1907, under the Virginia Corporation Act.

The new or merged company issued \$6,000,000 of 50-year 5-per cent. bonds, \$2,800,000 of preferred stock, and \$4,520,000 of common stock, upon the combined properties of the company located in the Pocahontas coalfield in Virginia and West Virginia.

Under the plan of merger the preferred stockholders of the Pocahontas Collieries Company were to receive in exchange for this stock \$1,500,000 of the new bonds. All the securities of the several companies merged were exchanged in accordance with the plan of merger except the \$300,000 of this preferred stock of the Pocahontas Collieries Company, and the holders of these shares of stock attacked the merger on the ground that they did not wish to exchange their stock for a 5-per cent. bond, and asked the courts to set aside the merger.

The case was heard in Lynchburg, Va., in June, 1908, in the United States Circuit Court of the Western District of Virginia, and a decision rendered in favor of the company, dismissing the suit, from which an appeal was taken, the result of which was the decision as above men-

tioned, affirming the decision of the lower court. The effect is, to remove any question as to the validity of the securities issued under the plan of merger, and the decision is important, in that it is the first large merger that was made under the Virginia Corporation Act, which act is also sustained by this decision.

Rescue Apparatus in Austrian Mines

Among the amended regulations issued by the Austrian Mining Board is an interesting provision relative to the use of rescue apparatus. This regulation states that some approved form of rescue apparatus shall be kept in working order, and in a readily accessible place at all mines. In order to keep the valves and fittings from being attacked by rust, the oxygen bottles must be perfectly dry inside, and recharged with dry oxygen by a dry pump. A bypass valve must be provided for use if the reducing valve gets out of order. In the most dangerous class of mines, the prescribed number of sets of rescue apparatus is as follows: Five when not more than 200 men are at work per shift, 10 for shifts working from 200 to 400 men, and 15 for shifts of over 400 men. Each apparatus must be able to supply oxygen for 1½ hours at the minimum. Where the mines are less dangerous and belong to the nonfiery class, the number of apparatus is fixed at five, irrespective of the number of men per shift, except that where these are below 200, a smaller apparatus—supplying enough oxygen to last for an hour—is permitted.

Where a number of dangerous mines, employing over 200 men per shift, are situated close together, all the apparatus in excess of the five sets necessary for the equipment of one corps of rescuers may be kept at a central depot of easy access from all mines. Rescue stations must be furnished with a duplicate source of oxygen bottles, and a number of safety lamps of some permitted type; one oil lamp for testing the presence of firedamp is necessary when the other lamps are electric. A trained deputy must be placed in charge of the station and made responsible for the good order and maintenance of the equipment. The men trained for rescue parties must be medically examined, and each corps must use the apparatus at least every six months, the results of practices being entered on official forms, together with those of the examinations of the apparatus, etc., at regular intervals.

The cost of mining at Mount Lyell mine, Australia, for the six months ending Sept. 30, 1908, including cost of removing overburden, was 6s. 9d., or \$1.62 per ton.

Colliery Notes

A shot-firer should not charge any shot-hole until he has thoroughly examined all accessible places within a radius of 60 ft. from the shot.

There is so little known as to how the elements are combined in coal that many fuels of the same apparent composition produce entirely different results when subjected to combustion.

Should a shot misfire and after a sufficient lapse of time, the shot-firer decides to authorize the workmen to drill another hole, it is most important to see that the second hole is located at a distance not less than 12 in. from the misfire.

There are but few cases where a superintendent is justified in erecting dams to keep back gas in old workings; if an explosive mixture is shut off in this way, it must be so effectively dammed back that the gas will not assist in furthering any future explosion. The safest method of dealing with all accumulations of gas whether in old or new workings is by efficient ventilation.

As a general rule, a coal-cutting machine requires a space of 4 ft. clear from the face, so that it may work continuously and without danger of being buried; for this reason, many superintendents advise against the adoption of coal cutters in a mine where the roof has a tendency to fall. It may be stated in this connection, however, that mining machines are now being successfully used under a bad roof, the timbering being done from behind.

Firing shots with a covering of paper, waterproofed with wax or other inflammable material, is a doubtful practice. It is, of course, necessary to preserve the explosive from dampness while it is being stored; however, this could easily be accomplished by having two coverings, the inner one of non-inflammable material, and the outer one of damp-proof paper; the outer cover should, therefore, be removed immediately before the shot is inserted into the shot-hole.

A sinking shaft may be satisfactorily ventilated by employing a small blowing fan 4 or 5 ft. in diameter; the mouth of the fan is connected to a column of 15-in. diameter circular galvanized air pipes, these pipes being conducted from the fan to within a few yards of the bottom of the sinking shaft. The ventilator is driven by belting from an engine. One end of every pipe should be tapered so as to fit into the end of the next pipe, and the two sections can then be attached to each other by bolts passing through lugs riveted on each end of every pipe. The pipe column can be suspended in the shaft by stays located 18 or 20 ft. apart.

When the water in a steam boiler is dangerously low, the first precaution is to close the draft and bank the fire with ashes or damp earth. After awhile, if the boiler has cooled and the fire been made "dead," the fuel may then be withdrawn if the operation can be performed without increasing the heat. The safety valve must not be opened with the mistaken object of decreasing the steam pressure, for just as much steam as escapes will again be generated and add additional dangers by further decreasing the supply of water that remains in the boiler. If, when the evil is discovered, the engine is stopped, the recoil of the steam is likely to form a serious danger; it is advisable, therefore, to keep the engine running until the danger has been somewhat lessened. A further precaution is to avoid starting the feed pump, for should this be done, the overheated plates are liable to snap when suddenly cooled.

When a miner or other workman receives a severe electric shock rendering him insensible, remedial measures should be persevered with until a medical man has pronounced life extinct. A victim subjected to a severe shock often exhibits symptoms that cause observers to conclude life extinct; however, death should not be assumed. One recent case occurred where a workman received a 2000-volt shock from hand to hand, but was not badly burned; the man was insensible, and those present could not feel his heart beating; his eyes were turned up so that only the whites could be seen, his jaw dropped, and his breath did not cloud a mirror. The victim, to all appearances, was dead, but after 45 min. artificial respiration the man recovered. It is almost certain that in the earlier days of electricity, many people were given up for dead after receiving an electric shock when they might have been restored by the immediate application of artificial respiration.

Every mine should have a fixed rule making it necessary for a workman to first secure permission from the manager or superintendent, before being permitted to fire shots upon any main haulage or air roads, up to a stipulated distance, say 50 yd. from the face. The reason for this precaution is that haulage-roads and airways generally hold an accumulation of very fine dust due to the passage of loaded cars and the tramping of miners going to and from work. The high velocity of the air current in these main entries causes the smallest particles of dust to be located in the roof, sides and floor, and creates a more dangerous condition than exists at the face of entries or chambers. The mine manager is not taking too great a precaution, should he go still farther and require that all shots of this kind should be fired between shifts, or at night when all men except the shot-firers are out of the mine. If such shots are fired by electricity, the

cable should be from 45 to 50 yd. in length, so as to enable the person who fires the shot to be out of reach of the flying stone.

An English company has installed a 2000-kw. steam turbine mounted on a special rubber foundation, which latter has been introduced to obviate any possibility of vibration. The turbine set is bolted to a special slab of concrete about 2 ft. thick, reinforced with a steel grid and supported by a series of circular rubber stools, which rest on the ordinary concrete built into the ground. The top of the floating concrete slab is level with the engine-room floor, but the edges do not come in contact with the floor, so that there is no connection between the concrete slab to which the turbine set is bolted, and the foundation, except through the rubber. This eliminates the possibility of vibration due to the reciprocating engines which are located nearby. As a further precaution in this unique installation, a trench is provided around the floating slab so that the rubber stools can be inspected. Each rubber stool is a cylinder of about 4 in. in diameter and 3 in. in height when compressed by the weight of the turbine set. The rubber stools are all separately renewable, and can be withdrawn and reinserted by further compressing them, by tightening of the "jacks" in which they are held by means of screws. This is the largest turbine ever mounted in this way.

Since the Royal Commission appointed to investigate the life of the coal supplies of England, reported that the fuel beds of that country would not last more than from 500 to 800 years, the chief scientists of Great Britain have been theorizing as to what source of energy they can turn when the coal supply has been exhausted. The oilfields are already showing a decreased production, and the water power in Europe is estimated not to exceed 2,000,000 h.p., while the industries of England are expending approximately 100,000,000 h.p. at the present day. The extraction of power from the tides as well as the use of engines worked by solar heat are ideas of doubted value. The only possible alternatives, according to Sir William Ramsey, are to either obtain a supply of heat in the form of steam by drilling a hole in the earth's crust at least 10 miles deep, or to extract energy from the ether. As to the extraction of steam from deep drill holes, Mr. Parsons, of turbine fame, states that execution of such a project would cost \$25,000,000, and could not be accomplished in less than 80 years. The best scientific opinion also asserts that the possibility of a discovery to extract energy from ether is highly remote; it therefore appears that for all practical purposes the scientific world is unable to dethrone King Coal from his enviable position as the greatest necessity of man.

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Consumption of Copper in 1908

The statistics of the Copper Producers' Association enable us to approximate the deliveries of copper in the United States in 1908, for which in our issue of Jan. 9, 1909, we reported "no reliable data available." The table may now be completed as follows:

	1907.	1908.
Stock Jan. 1....	9,000,000	120,000,000
Imports of refined.....	5,000,000	None
Production.....	1,152,747,890 (e)	1,105,000,000
Total supply..	1,166,747,890	1,225,000,000
Exports.....	508,929,401	661,876,127
Remaining in U. S.....	657,818,489	563,123,873
Stock Dec. 31....	120,000,000	122,357,266
Delivered for consumption.....	537,818,489	440,766,607
(e) Computed as per footnote, JOURNAL, Jan. 9, 1909, p. 56.		

The delivery for consumption in 1908 appears therefore to have been about 82 per cent. of that in 1907, and 66 per cent. of that in 1906. The basis for comparison is well established, our own statistics and those of the Geological Survey for 1907, each computed from data collected independently, having been in close agreement, our own figures with those of the Geological Survey in brackets having been as follows: 537,818,489 (545,000,000).

While the production of crude copper increased in 1908 about 70,000,000 lb., that of refined is computed to have decreased about 48,000,000. This was because the refineries were operating at reduced capacity in the early part of the year. The increase in the smelting production overlapped into 1909 as is clearly shown by the refinery production of 112,135,200 lb. in January. Even if the smelters should now restrict operations the refinery output would continue at substantially undiminished rate for nearly two months.

Some criticism has been directed against the association statistics of stock on hand on the ground that they do not disclose the whole quantity of merchantable copper. We understand, and believe, that they do—including the Lake, electrolytically refined, and the bessemer bars that are sold for casting—being in fact all of the merchantable copper in first hands, whether sold or unsold, excepting that which may be in the hands of smelters of scrap and junk—probably a very small amount. An insignificant quantity may also be in second hands.

The swelling of the figures of the copper accumulation by adding the copper in transit and in treatment at the re-

fineries is deceptive, because about two months' production must always be in that state. It would be quite as logical to go further back and reckon the copper in ore awaiting treatment at the smelteries of which there were some large reserves on Jan. 1.

Because the delivery for consumption in 1908 appears to have been about 440,000,000 lb., it does not follow that consumption was so large, inasmuch as the manufacturers probably had stocks in their yards. The large deliveries in January were to a great extent the filling of orders placed in November. Of course, no one believes that consumption was going on at the rate of nearly 600,000,000 lb. per annum in January. The inference is obviously that the requirements of manufacturers are still well provided for, which explains the small sales in February so far and prepares us for the report of a further accumulation of stock, the shipment of the November sales approaching completion.

If the price for copper should become attractive to the manufacturers so that they would transfer the whole, or a part, of the present stock to their yards, the producers would be relieved, but after all we must look to the final consumer who takes the metal out of the market and puts it to use.

Earthquakes and Colliery Explosions

It is proper for us to remark that the suggestive article by Mr. Spalding, which appears in this issue, was written many months ago, and if he had had an opportunity to revise it, he would have been able to make some important citations from recent experience. It is well known that the period of great seismic disturbances, culminating with the catastrophe in Italy last December, has been accompanied by an unusual number of colliery explosions. An argument on the basis of *post hoc ergo propter hoc* is inconclusive. Nevertheless, it must be admitted that the coincidence between earthquakes and colliery explosions is such as to warrant careful study of the conditions. In this connection, full credit must be given to James T. Beard, who has for many years been drawing attention to this matter, as the readers of the JOURNAL are well aware.

The subject has now become one that is attracting international attention. Our Paris correspondent, in his letter in this issue, remarks that M. Moreux, manager of the observatory at Bourges, is an exponent of the earthquake theory. Of equal importance is the suggestion made before the Meteorological Congress, recently sitting at St. Petersburg, where it was pointed out that oscillations of the earth frequently cause the escape of gas in mines. This led several delegates to suggest that a seismograph be installed at every mine to record the least earth movement and thereby warn the engineers of the possibility of danger.

This, together with the atmospheric theory, that we have previously discussed, continues to demand the careful attention of colliery engineers. Our propaganda as to the probable effect of atmospheric conditions has led many operators to install barometers at their mines and observe them carefully for warning of approaching low pressure. Such warnings are generally recognized in Europe as being of great practical benefit.

Two Efficient Colliery Safeguards

We have remarked some scores of times that there is no great mystery about colliery explosions, which are not "acts of God," but rather are due to the carelessness of men. The greatest safeguard against them is obedience to the laws and eternal vigilance. However, it is human to err and perfection is not to be expected as long as there is a personal equation. What the engineers and investigators are really aiming to develop is a system of safeguards which by application will make a "fool-proof" mine. In this connection engineers are directing their attention principally to the control of shot-firing and to methods of underground sprinkling. Mr. Harrington, formerly chief engineer for the Utah Fuel Company, has written an admirable discussion of these two safeguards. In the *JOURNAL* of Jan. 23 was published his article on "Spraying Coal Dust," while the *JOURNAL* of Jan. 30 contained an article on "Shot-firing." We consider these articles to be a highly important contribution to knowledge as to their subjects, both of them being distinguished by an eminently practical character.

It is doubtful if any other coal company in America has applied these systems so thoroughly as the Utah Fuel Company, and it is, therefore, important to learn that after years of experience the officials of that company heartily indorse the installation of similar systems in all coal mines.

A complete spraying system as outlined by Mr. Harrington costs approximately \$7000, which expenditure if distributed over a year would amount to about $2\frac{1}{3}$ c. per ton at a mine where the annual production is 300,000 tons. If the same outlay were distributed over a period of five years, the cost would be less than 0.5c. per ton of product. The total operating cost of this spraying system amounts to less than 1c. per ton. The cost of installing a shot-firing system like the one described in Mr. Harrington's second article is about \$1250, which, if paid by one year's output at a mine producing 300,000 tons annually, would add but 0.4c. per ton of product. The annual operating cost of this latter system does not exceed \$1900, according to Mr. Harrington's figures, which would increase the cost of coal about $\frac{2}{3}$ c. per ton. At other collieries the cost has been found to be a little more than that, but even so, it is insignificant in comparison with the advantage gained.

The greatest objection from mine operators to such systems as those suggested has been the increased cost of coal. Now that actual figures are placed before us, there remains no reason for doubt on this score. Many coal-mine managers, whose properties are in bad condition, are at present making much noise in promoting the notion that our so-called ideal mines have been the ones lately visited by serious disasters. It will not be surprising if the same individuals soon claim that a well planned, carefully operated mine is the very one to be shunned as dangerous to the welfare of the mining industry. Of course, those who have planned and developed ideal mines should be commended for their enterprise and condemned only for having overlooked the personal factor of neglect and carelessness on the part of individual miners.

If a blown-out shot should cause an explosion in a mine after all of the employees have reached the surface, it is certain no human lives would be destroyed. It is also indisputable that dust explosions, from whatever cause,

cannot well occur in workings where the fine coal is reduced to a point of saturation. Consequently, it appears that the precautions suggested by Mr. Harrington are the proper measures to perfect and make our so-called ideal mines really safe.

The time is fast approaching when miners will be punished for violations of rules, and mine officials will be compelled to prove that they are really guiltless in event of a serious disaster. On Jan. 25, a mine superintendent and foreman at Wilkes-Barre, Penn., were found guilty of negligence which resulted in two disasters, one causing the death of 12 and the injury of 13 men, and the other the death of six and the injury of five miners. Although the judge who rendered the decision suspended sentence, declaring that the conviction will serve the ends of justice and carry with it its own punishment, the incident is interesting because it lends hope to the desire that justice be meted out equally to all.

American Smelting and Refining Company

The statements made in the application of this company to the New York Stock Exchange for transfer from the unlisted department to the regular list includes some interesting technical data, although these appear to have been somewhat carelessly prepared. Of course the attention of the committee of the Stock Exchange is directed chiefly toward the financial details, as to the accuracy of which no question is here raised.

According to the statement of the company, its present smelting capacity is 4,465,000 tons of ore per annum. Of this, 1,600,000 tons is in the live Colorado plants, five in number. (However, we believe, that all of the Colorado plants, including the Grant and the Philadelphia, that are now shut down, have never smelted more than 1,000,000 tons of ore per annum). The smelting capacity in Utah is 523,000 tons, which of course does not include that of the Garfield works, belonging to the Securities Company. The capacity in Montana is 235,000 tons. The three Mexican plants are able to treat 1,333,000 tons, while the El Paso works, which is to be considered both as an American and Mexican plant, has a capacity for 492,000 tons. In connection with the refineries at Omaha, Chicago and

Perth Amboy, there is a smelting capacity for 282,000 tons.

The company says that "The actual amount smelted has averaged about 3,500,000 tons annually." That is decidedly a vague statement and leaves much to guess. However, it is the first time that the company has ever given any indication of the amount of ore smelted. We guess that 3,500,000 tons may be close to the amount smelted in the year of banner profits, viz., 1906-07.

In an article in the JOURNAL last summer, it was estimated that the amount of ore smelted in 1902-03 was probably about 2,500,000 tons, on which basis, the net profit to the company was a little less than \$2.20 per ton. Assuming 3,500,000 tons for the amount smelted in 1906-07, the profit in that year was \$2.83 per ton, which of course includes not only the profits in smelting directly, but also that from the various commercial and mining enterprises of the company and the gain upon metals in hand arising from a strongly advancing market. However, as we have previously pointed out, the income account of the Smelting Company does not allow, in our opinion, as much as necessary for amortization of plant, and probably actual profits are less than will appear from any way of figuring.

Pig Iron in 1908

The complete statistics of pig-iron production in the United States in 1908, as collected by the American Iron and Steel Association, show a reduction of 38 per cent., as compared with 1907, the heaviest proportional loss for many years. The production last year was less than two-thirds of that of the preceding year, and was only a little above that of 1901; being less than that of any intervening year. The make was only about one-half of the total capacity of the furnaces.

The division according to the purposes for which the iron was intended is as follows:

	1907		1908	
	Tons.	PerCt.	Tons.	PerCt.
Foundry & forge	6,397,777	24.8	4,307,734	27.0
Bessemer pig	13,231,620	51.3	7,216,976	45.3
Basic pig	5,375,219	20.9	4,010,144	25.2
Charcoal iron	487,397	1.7	249,146	1.5
Spiegel and ferro	339,348	1.3	152,018	1.0
Total	25,781,361	100.0	15,936,018	100.0

Steel-making irons were 73.5 per cent. of the total in 1907, and 71.5 in 1908; indicating that the demand for foundry pro-

ducts decreased in a slightly less proportion than that for finished steel. The most interesting point of comparison is the increased proportion of basic pig made last year.

The production of pig iron apportioned by districts was as follows:

	1907.	1908.
N. England, N. Y. and N. J.	2,052,060	1,258,661
Pennsylvania	11,348,549	6,987,191
Ohio, Ind., Ill., Mich., Wis. & Minn.	8,467,045	5,050,303
Maryland	411,833	183,502
Southern states	3,033,388	2,143,290
West of the Mississippi	468,486	313,071
Total	25,781,361	15,936,018

This classification is based chiefly on ores used. It is not possible to make an exact division in the report by States, but the errors will nearly balance. Thus the New York furnaces which use Lake ores offset those in eastern Pennsylvania which use local ores. Maryland production is largely from imported ores. The table shows that approximately 75 per cent. of the pig iron made in 1908 was from furnaces using Lake Superior ores, and 13.5 per cent. in Southern furnaces. Over 88.5 per cent. of the raw material came from those two districts.

Perhaps the only encouraging feature of the statement for 1908 is that the second half of the year showed a gain of 2,100,010 tons, or over 30 per cent., over the first half. This is a sign of improvement in business; but 1908 will stand out—for a long time, let us hope—as a pre-eminently lean year.

The Anti-Japanese Turmoil

The hostile legislation by some of the States on the Pacific coast against the Japanese appears now to have been sidetracked through the efforts of the Federal Government, but inasmuch as the projects discussed at their present sessions were but the recurrence of previous agitations, it is to be feared that the snake has not yet been fully scotched. It is time for the engineers and business men of the Pacific coast, as well as elsewhere in the United States, to think over what this thing means. At the last meeting of the New York Section of the American Chemical Society, when Dr. Baekeland announced his marvelous discovery of baekelite, Dr. Takamine, the eminent Japanese chemist who resides in New York, spoke feelingly as to the present attitude of America toward his country. He was, of course,

promptly assured that it was not the attitude of America, but of only a small portion thereof.

Nevertheless, the agitation of these trouble-makers is undoubtedly having an adverse effect upon our commercial relations with Japan. Prominent Japanese residents in this country, as well as Japanese engineers visiting here, have called attention to the likelihood that, unless the repetition of such agitation be stopped, our important trade relations with Japan will be injured. While the intelligent class of the Japanese may understand that the agitation is local, yet it is feared that persistence in it will eventually engender ill feeling between the people of both countries and undermine the amicable relations that have heretofore existed. It is, of course, difficult for the foreigner to draw a sharp line between the Americans in California and the Americans in other States.

Indeed, we understand that orders for material contemplated for this country have already been placed in Europe. Our business with Japan in railway material, mining machinery, manufactures of iron and steel and other articles amounts to many millions of dollars per annum. This immense business has been gained by years of persistent effort on the part of American manufacturers. Unless this agitation against Japanese residents in this country be checked promptly, we shall inevitably lose much of the ground that we have gained. The more enlightened among the citizens of the Pacific coast must exert earnest efforts not only in behalf of fair play, but also for the sake of American interests in a highly important place, namely the pocketbook.

ACCORDING TO THE New York Sun, the officers of the Amalgamated Copper Company asked the Government experts who went to Montana to investigate the smelter smoke nuisance if they could suggest a remedy. "The only thing they could offer was convert the poisonous products into sulphuric acid and build a pipe line to the Pacific Ocean, dumping the product into the sea." The Butte correspondent of the Sun says that this suggestion was made in sincerity; yet we feel that the Government experts must have been joking.

Mine Explosion in England

One hundred and thirty-seven miners were imprisoned Feb. 16 by an explosion in the West Stanley mine, at Durham, England. At present writing, all attempts to reach the men have been unsuccessful. The West Stanley shaft is 700 ft. deep, and is badly damaged. It is feared that the entombed men, if still alive, will perish before rescuers reach them. At practically the same time that the explosion occurred, a severe earthquake did much damage to property and lives on the northern frontier of Asiatic Turkey.

American Smelting and Refining Company

In its application for transferal to the regular list of the New York Stock Exchange this company made the following statements:

The American Smelting and Refining Company operates directly by itself and owns in fee the following smelting and refining works, all of which are equipped with the most modern machinery and appliances:

SMELTERS

At Denver, Colo.: The Grant Plant occupies about 120 acres of land within the city limits, but is not now being operated and has been virtually dismantled. The Globe Plant occupies 150 acres just outside the city limits. It has seven furnaces, with an annual smelting capacity of 322,000 tons.

At Pueblo, Colo.: The Pueblo Plant—100 acres, seven furnaces, 328,000 tons annual smelting capacity. The Eilers Plant—80 acres, six furnaces, 295,000 tons annual smelting capacity.

At Durango, Colo.: The Durango Plant—200 acres, four furnaces, 146,000 tons annual smelting capacity.

At Leadville, Colo.: The Arkansas Valley Plant—200 acres, 10 furnaces, 509,000 tons annual smelting capacity.

Near Salt Lake City, Utah: The Murray Plant—60 acres, eight furnaces, 523,000 tons annual smelting capacity.

Near Helena, Mont.: The East Helena Plant—250 acres, four furnaces, 235,000 tons annual smelting capacity.

At Monterey, Mexico: The Monterey Plant—300 acres, 10 furnaces, 460,000 tons annual smelting capacity.

At Aguascalientes, Mexico: The Aguascalientes Plant—300 acres, 10 furnaces, 720,000 tons annual smelting capacity.

At Chihuahua, Mexico: The Chihuahua Plant—200 acres, three furnaces, 153,000 tons annual smelting capacity.

At Chicago, Ill.: The National Plant—six acres, two furnaces, 60,000 tons annual smelting capacity.

At Maurer, N. J.: The Perth Amboy Plant—40 acres, three furnaces, 140,000 tons annual smelting capacity.

Making a total smelting capacity of 4,365,300 tons. The actual amount smelted has averaged about 3,500,000 tons annually. (This appears to include the capacity of El Paso and Omaha, stated below.)

REFINERIES

At Chicago, Ill.: The National Plant, with a capacity of 84,000 tons of refined lead and 16,400,000 oz. of refined silver and gold.

At Maurer, N. J.: The Perth Amboy Plant, with a capacity of 66,000 tons of refined lead, 66,000 tons of refined copper, and 36,000,000 oz. of refined silver and gold.

OTHER INTERESTS

The Consolidated Kansas City Smelting and Refining Company owns and directly operates a smelting plant near El Paso, Tex., known as the El Paso Plant—1500 acres, 10 furnaces, 492,000 tons annual smelting capacity. Every share of the capital stock of the Consolidated Kansas City Smelting and Refining Company is owned by the American Smelting and Refining Company.

The American Smelting and Refining Company operates a smelter and refinery at Omaha, Neb., known as the Omaha Plant, upon a leasehold running for 18 years from the present time. The smelting plant consists of two furnaces, with 82,000 tons annual smelting capacity. The refining plant has a capacity of 156,000 tons of refined lead and 36,000 oz. of refined silver and gold. The copper-converting plant has a capacity of 12,000 tons of blister copper annually.

The Omaha and Grant plants are subject to a mortgage issued by the Omaha & Grant Smelting Company, one of the original constituent companies making up the American Smelting and Refining Company. The bonds still unredeemed amount to \$349,000. By the condition of the mortgage they are still being redeemed yearly, and will be all redeemed in 1911. There are no mortgages other than the above on any of the plants or mines of the company, or of its constituent companies.

The annual value of the products of the smelters is approximately \$70,000,000.

The annual product of the refineries is as follows: Gold, 1,250,000 oz.; silver, 66,000,000 oz.; copper, 66,000 tons; lead, 225,000 tons; giving a total value of refined metals sold annually approximately \$97,000,000.

The company also owns and directly operates the following mines for the purpose of supplying ores which are most largely competitive:

At Sierra Mojada, in the State of Chihuahua, Mexico, the company operates five mines, with an annual output of 33,000 tons.

At Santa Eulalia, State of Chihuahua,

Mexico, four operating mines, with an annual output of 60,000 tons.

At Asientos, State of Aguascalientes, Mexico, one mine with an annual output of 72,000 tons.

The American Smelting and Refining Company guarantees the payment of quarterly dividends at the rate of 5 per cent. per annum on \$30,000,000 par value of the American Smelters' Securities Company preferred stock, series "B."

The investment account, in the statement of assets and liabilities, is made up very largely of 13,889 shares of preferred stock of the American Smelters' Securities Company, series "B," as well as 1600 shares of the preferred and 4500 shares of the common stock of the United States Zinc Company.

The company owns 177,510 shares of the common stock of the American Smelters' Securities Company, par value \$100 each, but as yet the value of this stock has not been included in the investments of the company.

Chihuahua Copper Company

SPECIAL CORRESPONDENCE

The property of the Chihuahua Copper Company, of which James Parker, of El Paso, Texas, is general manager, is situated 22 miles west of Moctezuma, Mexico, a station on the Mexican Central Railway, and 110 miles from El Paso. The hills in the vicinity reach an elevation of about 500 ft. A good wagon road leads to the property. The prevailing country rocks are limestones, andesites and quartz porphyries. The eruptives are massive, and well defined dikes are to be found from a few feet to several hundred feet in thickness. Large croppings of hematite and brown oxide of iron appear in the vicinity of the company's mines. Copper in various forms is found in these croppings and also disseminated throughout the bedding planes of the limestones. The mine shows native copper, malachite, azurite, chalcocite and chalcopyrite. Fluorspar is encountered in places. The chief development to date has been in the carbonate ores. Over 250 tons of ore has been shipped to the El Paso smelter, the copper content of which ranged from 6 to 9 per cent., with from two to three ounces silver per ton. The shaft is 230 ft. deep. Northwest of the shaft 200 ft. is a tunnel 100 ft. in length. This follows the bedding planes in the limestone and shows from one to three feet of good grade copper ore. Most of the ore shipped has been mined about 150 ft. from the tunnel, from irregular workings following the bedding planes in the limestone. About 2000 ft. northwest of these workings there is a large body of low-grade chalcopyrite. Here the ore seems to thoroughly impregnate the fractured seams of the limestone.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and
Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

Sampling by Machine

T. R. Woodbridge's classic diagram in the JOURNAL of Jan. 30 explains why the scoop of a sampling machine does not eliminate from 10 to 50 per cent. of the coarse particles from the sample at once, thus condemning the entire system without more ado. I can not speak for John A. Church, but my objections to the falling-stream principle are not quite so crude as that explanation seems to imply.

The theoretical division of the area is quite as it should be, that is, if the action of the machine were also according to theory. The explanation assumes that the lumps of ore which strike the edge of the scoop are regular in shape, that they slide gently upon it without impact and that they then invariably choose the side of the division toward which the center of mass inclines. It does not take into account the fact that the impact upon the hard-steel edge always causes more or less rebound, and that the chance of the flying particle's coming to rest in its proper receptacle is small, depending as it does largely upon the relative extent of the areas upon which it may fall. What is the area of the scoop as compared with that of the entire sampling room?

The rebound of the particles from the edges of the scoops is the great objection to sampling by slicing a stream of falling ore, and that is also the objection to the use of the assayer's scoop in the final division of the sample. In every one of the four positions of the scoop shown in Mr. Woodbridge's diagram, the edge interferes with the free fall of material, and the chances of the larger particles striking and rebounding are greater than those of the finer particles by the ratio between their respective diameters.

A simple experiment carried out as outlined below will prove whether my statement that it is possible to remove all coarse particles from a sample by repeatedly passing it over a sampler's scoop is correct or not. To make the process as little tedious as possible, prepare a sample by mixing clean dry screened quartz sand with a third to a quarter of its weight of 3/4-in. quartz lumps; 25 lb. will be enough. Take a single sampler's scoop, 2 in. wide between the edges and 2 in. deep. Remove the bottom and fix it upon a corresponding slit in the cover of a box. Now pour the sample upon the scoop with a shovel at any angle whatever. After all the material has been applied, there will be two

lots, the sample in the box which we may call "tails," and that upon the outside, which we may designate as "heads."

Repeat the operation upon the two lots separately, the tails yielding two products, tails and middlings, and the heads only heads and middlings. The middlings will be again separated into heads and tails. It would, of course, be still more effective if more classes of material were made, but three classes will usually tell the story before long. Continue the operation for, say, an hour, and then see whether a difference is not apparent.

I agree with Mr. Woodbridge's statement that, "sampling is a commercial enterprise calling for continual compromises between the theory of the subject and local requirements and conditions, and the allowable cost of plant and operation." Nor do I wish to condemn utterly the present sampling machine. It is simple and inexpensive and may be modified indefinitely with a minimum of ingenuity; moreover it answers the purpose very well except in unusual cases. It satisfies everybody but the captious ore shipper who is not a good gambler and refuses to take an even chance. It seems to me that that is saying a great deal for any mechanical device. Then why claim for it all the remaining virtues and deny that it has certain defects?

A. VAN ZWALUWENBURG.

New York, Feb. 4, 1909.

Successful Prospecting with Churn Drill Under Unfavorable Conditions

In the JOURNAL of August 1, 1908 in the article, "Steam Churn Drill in Hot and Cold Climates," J. P. Hutchins takes a pessimistic view of churn-drill prospecting when done under trying conditions. He used a steam-operated drill while under either class of conditions that he describes a gasoline-operated drill would have been better. In fact from Mr. Hutchins' article one would infer that if the weather is very hot, or very cold, or if the ground is very marshy, or water is very scarce, or if several other conditions occur in unison or singly, the power churn drill as a prospecting apparatus is very unsatisfactory.

This impression which he conveys, either intentionally or not, I desire to refute and to do so I am going to give a brief description of a type of churn drill, which we are successfully using, in pros-

pecting for coal in a country where there is little vegetation other than sagebrush, where the "wagon" roads are nothing more than sheep trails, where water is ten miles away and where moves from hole to hole often have to be made over every steep grades.

THE CHOICE OF THE TYPE OF DRILL

In churn drilling the important thing is to use a machine suited to the conditions under which the drilling is to be done, for it cannot be expected that one type of drill will be successful under all the conditions met with in drilling. When a man knows beforehand the conditions under which the work is to be done he should try to provide himself with a machine so constructed as to successfully meet those conditions. This at least was the idea followed out by the purchasers of our drill, and the success we have had with our drilling work seems to warrant me in recommending it to others.

If the holes to be drilled do not exceed 500 ft. in depth, it is folly to invest in a machine capable of drilling to a depth of 1000 ft. simply because some time in the distant future you might want to drill that deep a hole. Not only does a large machine cost a great deal more in the first place, but its weight is much greater, it takes more time and power to move it from hole to hole, and it takes more fuel to run it after it is set up. This item is not of such great importance when all conditions are favorable, but it increases in importance in direct ratio as conditions become adverse. If water and fuel are scarce and can be obtained only by long hauls, then steam as a motive power is not to be considered. If the country is rough and mountainous, with no roads and is sparsely settled, then a drilling method must be used which, without sacrificing speed in work or accuracy in results, will involve the least weight in outfit. If the work is to be done in a country where low temperatures prevail, then the outfit must be so arranged that nothing about it will freeze and interfere with the work. Contingencies such as I have mentioned and all such as have a bearing upon the work must be considered and planned for, in the purchasing of a drilling outfit, if the drill work is to be successful. As I have said before, and it is a point which cannot be emphasized too strongly, first find out the work which the drill will have to do and the conditions under which it will have to work, and then buy a drill to suit the conditions.

THE GASOLENE-OPERATED CHURN DRILL
USED BY ROUNDUP COAL
COMPANY

The drill work that I will describe is being done near Roundup, Mont., for the Roundup Coal Company. The machine is a little hollow-rod outfit, with a rated capacity of 500 ft., especially designed and constructed for meeting the adverse conditions such as prevail in this country. The power is furnished by a gasolene engine, the only kind which, owing to scarcity of water and the long hauls it would be necessary to make in order to get fuel, it is possible economically to use here. The engine is of special construction, being well adapted to the hard service of drill work and to undergoing the low temperatures which prevail at times. The drilling machine proper is mounted upon one set of trucks and the engine upon another set. This arrangement, while it necessitates a little more time in setting up, is especially adapted to haulage on steep grades, or over soft ground.

As gasolene power is continuous in its operation and admits of only a limited throttling, the drilling machine must be made so as to meet this condition. In the machine that we are using this difficulty has been overcome by placing a double clutch in the bull-wheel shaft, which, with the operating lever in one position throws the spudder in motion, and in the reverse position throws in the hoisting gear, but which, when it is on center, prevents the engine from gearing with either. The objection to the use of a clutch on the spudder has been overcome by making the clutch with an automatic positive attachment, which, however, does not engage until after the friction has taken hold, and then only when a heavy overload occurs; at such times the positive clutch engages and continues to hold until the clutch lever is thrown to the neutral position. This positive feature of the clutch is an arrangement which is highly recommendable in a clutch machine, when drilling in "heavy" ground. I mention these mechanical details simply to show that when special conditions are to be met special machines must be designed to meet them.

THE WORK ACCOMPLISHED

The holes being put down are 2½ in. in diameter, and at present range in depth from 100 to 300 ft. The Republic Coal Company, which is working coal lands near the Roundup company, has an exactly similar machine and has put down holes more than 650 ft. deep. I might add as a further evidence of the great usefulness here of the churn drill that the Republic Coal Company also owns a diamond-drill outfit which, owing to its high cost of operation in comparison with the churn drill, has been stored away, so that now all the prospect drilling is done with the churn drill.

The drilling done by the Roundup Coal Company is mostly in sandstone and shale,

with some limestone and slate. In an eight-hour day with the temperature 10 to 20 deg. F. below zero from 40 to 70 ft. is drilled. From 3 to 4 gal. of gasolene, and, in starting the hole, from 1 to 1½ bbl. of water are used per day. After a depth of about 100 ft. is reached the holes "bleed" a small amount of water and, as the rods pump it out as the water runs in, the hole supplies all the water that is necessary. Consequently, in drilling a hole it is often not necessary to haul more than 3 bbl. of water. This is an important item when the water often has to be hauled many miles over rough country.

Those who have spent a winter in Montana, or who have investigated its winter temperatures need not be told how cold it gets here, and yet this gasolene drill is able to operate satisfactorily in any weather in which it is possible for a man to work. From the satisfactory manner in which our little Cyclone machine has worked at the low temperatures here, I feel confident that it would prove equally satisfactory in any climate where man or beast can live.

If the churn drill is properly constructed mechanically and is adapted to the work it is expected to do, my experience has taught me that for certain kinds of prospect work, regardless of weather or other unfavorable conditions, churn drilling is one of the surest and cheapest methods of prospecting.

R. R. SANDERSON.

Roundup, Mont., Dec. 22, 1908.

"Concrete Lumber" and Forest
Preservation

In a recent number of an engineering paper appears an editorial entitled, "How 'Concrete Lumber' Has Made Forest Preservation a Farce." The article opens with the following words:

"The fast-perishing forests of America have been the theme of many a statistical lament. 'Behold the loss of this wealth, this criminal waste of natural resources!' cries the statistician, until we find ourselves almost sniffing in sympathy. Amid all this *illogical agitation* (sic) for forest preservation it is well to turn an eye toward the timber of the future, 'concrete lumber,' as it has been aptly called."

Are we to understand that engineers and contractors are willing to look forward to a concrete age, which will be independent of the waste of natural resources? The statistician tells us that the production of cement in 1890 was 335,000 bbl.; in 1907 it was 52,000,000 bbl., worth \$56,000,000. Will someone tell us how many tons of coal will be required to manufacture the cement which the world will require during the present century? And then will someone go further and estimate how many board feet of lumber

are likely to be used to make the forms required for concrete construction? The organized effort which is now being made to educate the people, so that wasteful extravagance shall cease, should receive the hearty support of the engineering profession and press. The following statement of Dr. I. C. White, State Geologist of West Virginia, is likely to become classic and cannot be too often reprinted:

"Just as sure as the sun shines and the sum of two and two is four, unless this insane riot of destruction and waste of our fuel resources which has characterized the past century shall be speedily ended, our industrial power and supremacy will, after a meteor-like existence, revert before the close of the present century to those nations that conserve and prize at their proper value their priceless treasures of carbon."

ALLERTON S. CUSHMAN,

Assistant Director, Office of Public Roads, U. S. Department of Agriculture.
Washington, D. C., Feb. 8, 1908.

Automatic Scale for Weighing Coal

The use of an automatic scale in weighing coal has heretofore been limited by the fact that no machine was designed to weigh coal unless the pieces were previously crushed to a diameter of less than 6 in. The Richardson Scale Company, of New York, has recently designed a machine which is capable of handling pieces of 15 in. and more in diameter. When this scale is used, the general practice is to first deliver the coal to a large bunker; this bin is then tapped on its sloping side to feed the automatic scale. When the exact quantity of coal has passed into the weighing hopper, the feed gate of the scale automatically closes and the hopper is discharged into a tapering spout, which carries the coal into the power house or other point of consumption.

This new scale is of 1500 lb. capacity, and is capable of handling about 100 tons per hour. The most unique feature of the machine is the method of feeding from a side gate rather than from an under-cut gate, as was employed in the former types. This new type of side-feed chute and gate entirely overcomes the difficulty of passing large lumps, and also the inability to raise the feed gate when it is closed, which were the chief troubles attending the use of the under-cut gate. It has also been found that only one-third as much power is required to raise the gate, as was necessary with the old type. The angle of the chute leading from the scale is about 40 deg. and the construction is such that it is impossible for the coal to bridge.

The deepest mine at Kalgoorlie, Western Australia (Percy Ifould, *Aust. Min. Stand.*, Nov. 18, 1908), is the Great Boulder whose shaft is 2400 ft. deep.

Electrically Driven Mine Pumps

By SYDNEY F. WALKER*

At mines, pumping was the first important work to which electricity was applied, and apparently the first electrically driven mine pump was installed at the Trafalgar colliery in the Forest of Dean, Gloucestershire, England. This pump was a small one using only about 1 h.p. In the United Kingdom, a great many collieries are worked through shafts, and a number of them are troubled with water. In slopes a self-contained, three-throw plunger pump, with an electric motor, mounted on a truck that travels along the ordinary slope track is a good arrangement for following the water down. A drum can be arranged that holds enough wire to allow the pump to be lowered a considerable distance; this way there is no change in the resistance of the conductors for a considerable time.

THE SERIES-WOUND MOTOR FOR MINE PUMPS

In the early days of the electrically driven mine pump, the series-wound motor was universally employed, partly because the shunt-wound motor was not then properly understood, and partly because alternating currents were not then used at mines. The method employed at that time in England, and I believe, very largely at the present day, was, and is, to run the pump for a certain number of hours during the day, lowering the water that had run into the workings sufficiently to allow work to be continued until the next pumping period. One of the difficulties was starting the pump. It usually had to be started against the resistance of the inert column of water in the pipes leading to the bottom of the shaft, and sometimes in the entire column up to the surface. Considerable torque was required at the moment of starting, and the series-wound motor furnished that quite easily. Unfortunately however, starting was only a part of the work that the motor was required to do, and starting against the inert column of water was only one of the conditions under which the pump was required to work. It was not unusual for the pump to be started and left to run by itself for a certain time, an attendant going to it occasionally, or it even being switched off at surface. This would have been all right if the quantity of water to be pumped had been the same day by day, but in a great many cases at least in Great Britain, especially at shallow mines, the quantity of water varies with the rainfall on the surface, the water making its way into the workings, not immediately after the rainfall, but at some later time depending

upon the overlying strata. This is the case of the series-wound motor led to trouble for, when the pump began to lose water, the series-wound motor would run away, and unless the current was promptly switched off, often injured itself, or the pump, but more particularly itself. This is one of the great defects of the series-wound motor. It changes its speed so much with a varying load. In coal cutting for instance, when a nodule of pyrites is met with, the series-wound motor will slow up and, providing there is power behind it, will cut its way through, but immediately the nodule is passed, it will commence to race unless the attendant is on the lookout, and is able to switch off the current, or stop it in other ways.

At the present time, there is apparatus on the market, that would enable the series-wound motor to be employed for pumping with perfect safety and without the necessity of constant attendance. Automatic appliances are arranged to start a motor when the level of the water rises to a certain point, and to stop it when the level has fallen to a certain point. The automatic appliance consists of a solenoid electro-magnet with a tripping contact, actuated either directly or indirectly by a float. The solenoid electro-magnet then actuates the ordinary starting resistance.

SHUNT-WOUND AND THREE-PHASE MOTORS FOR MINE PUMPS

The shunt-wound motor is undoubtedly the best all-round motor for general work about a mine, including pumping, and the three-phase motor is quite as good, except for the one objection that while the speed of the shunt-wound motor can be increased from one to six times, regulation of the speed of the three-phase motor is difficult. Both the shunt-wound continuous motor and the three-phase motor are self-governing, and both run at nearly constant speed—within about 4 per cent.

Where it can be arranged so that the pumping is done for a certain number of hours during the day, either the shunt-wound, continuous motor with continuous current, or the three-phase motor with alternating current will answer perfectly. They will deal easily with any variations of load incidental to the ordinary working of the pump. So long as the water that is made during a certain portion of the 24 hours can be pumped out so as to leave the workings free during working hours, the shunt motor, or the three-phase motor, running during those hours at constant speed, will do the work. Also with varying quantities of water, if varying times can be applied to getting the water out, again the shunt-wound and three-phase motor working at constant speed will do the work. But where large increases in the amount of water must be pumped at certain seasons of the year, after heavy rains, or due to other causes, and increased

time cannot be given to getting the water out, the pumps must be run at a higher speed.

The shunt-wound motor lends itself readily to increased speed. By adding a resistance to the field coils of the motor, which is thrown into the field circuit at the time that a higher speed is required, the speed may be increased as much as 20 per cent., and even in certain cases 25 per cent. But with the ordinary construction of the continuous-current motor, as the speed increases, and particularly as it approaches 20 to 25 per cent. above the rated speed, sparking commences and becomes somewhat violent at the brushes. This difficulty is easily overcome, if it is known, when the motor is ordered, that a varying speed will be required, for motors are now made with what are called commutating or auxiliary magnet poles, placed between the ordinary field magnet poles. These auxiliary poles suppress the sparking which takes place when the speed is greatly increased. There is not space here to explain the full action of the apparatus, but it may be mentioned that the increased sparking is due to the weakening of the magnetic field, produced by the insertion of the resistance in the circuit of the field coils. As the resistance added to the field coils is increased, the magnetic field produced by the field magnets is decreased, and the speed of the motor may be proportionately increased. By the aid of the commutating poles, the speed may be increased up to as much as six times the normal. Probably the ordinary motor, with resistance added, would answer the purpose, because the pump could hardly be allowed to run at more than 20 or 25 per cent. above its normal speed.

In the case of the three-phase motor, a similar method of regulation is not available because the speed of alternating-current motors depends, not upon the current strength, but upon the number of alternations of the current. A certain variation in speed can be obtained, say half speed, three-quarter speed, if it is known beforehand that it will be required, by altering the connections of the coils of the stationary part of the motor, but no intermediate speeds can be obtained, except by the use of wasteful resistances.

CENTRIFUGAL MINE PUMPS

It may perhaps be noted, that while the three-throw plunger pump has been such a great favorite, and such a good servant, the centrifugal pump now has many advocates. Not very long ago the centrifugal pump could only be employed for low heads, but now single centrifugal pumps are made for heads of 100 ft., and by placing two or more pumps in series, any head that may be desired can be worked against. I understand that the Worthington company has supplied centrifugal pumps raising water as high as

*Consulting engineer, Bloomfield Crescent, Bath, England.

2000 ft. in a single lift. The centrifugal pump is much more convenient than the three-throw plunger pump. It occupies less space for it can be connected directly to the axle of the driving motor, and the later designs of centrifugal pumps are certainly more efficient than the older forms of the three-throw pump. It also, however, has certain features that have to be reckoned with, when applying pumps. The centrifugal pump can be designed for constant quantity, constant speed, or constant head, but when the conditions for which it was designed are changed much, the efficiency of the pump decreases rapidly. Thus, in the case of the pump designed for constant quantity, its highest efficiency is when it is delivering that quantity. If the quantity is increased, the efficiency commences to fall, and with a comparatively small increase, falls very rapidly. On the other hand, if it is not delivering that quantity, its efficiency is also very much less. I have the results of a test of a pump designed to deliver 1250 gal. per min. against a head of from 100 to 117 ft., the pump to run at 700 r.p.m. At 700 r.p.m., the efficiency of this pump was about 72 per cent.; at 750 r.p.m., it was still 72 per cent.; at 800 r.p.m. it had fallen to 70 per cent.; at 900 r.p.m. it was only 58 per cent. and at 950 r.p.m. it was only 40 per cent. Similar conditions are met with in pumps designed for constant speed, or constant head. So long as centrifugal pumps are working within a short margin of the condition for which they are designed, they work at high efficiency, but when those conditions are departed from the efficiency falls very rapidly. These facts, it appears to me will bear upon the question of centrifugal pumps for mines.

The best form of pump would probably be that designed for constant speed, provided that the quantity of water to be dealt with did not vary much. In those cases where the water might vary, probably the pump designed for constant head would be the best. With constant speed, the pump may be driven by either the shunt-wound motor, or the three-phase motor, and should give at least as good results as the three-throw pump, but if the speed has to be altered, the shunt-wound motor is practically the only one available. With reference to the matter of the starting torque, in which the shunt-wound motor is comparatively weak, this difficulty may be overcome by having a few turns of wire on the motor, making it temporarily a compound-wound motor, the few turns being in series with the armature. These few turns will give the starting torque required and can be cut out after the pump is running at full speed. It should be mentioned, that the improved efficiency of the centrifugal pump has produced the natural result, improved efficiency in the three-throw pump.

The Utah Copper Company

The company's statement for the quarter ended Dec. 31 shows net earnings of \$530,658; rents, etc., \$9623; total net, \$540,281. The production of copper was 11,776,664 lb., or 224,261 lb. less than in the third quarter of 1908. The report says that 11 sections of the Garfield plant were in partial operation until Nov. 20, when the 12th and last section of the plant was placed in commission. Owing to the deficiencies in tonnage, largely due to transportation difficulties, but partially to unusually rigorous winter weather, the entire plant has not yet been operated to its full capacity, excepting for periods of a few days at a time. This deficiency is reflected almost in direct ratio in a decrease of copper output. The decrease in tonnage, and consequently in copper output, resulted in a proportionate increase in the cost per pound of copper; the average cost for the fourth quarter having been 9.35c., which includes all mining, milling, managerial, general expenses of all kinds, transportation, smelting and all selling costs. This result is readily understood when consideration is given to the fact that the tonnage we were unable to mill because it could not be supplied to the plants, could have been handled with practically no additional cost.

The recovery per ton of ore milled continues to be unfavorably, and very decidedly, influenced by the necessity of milling large quantities of oxidized and low-grade material resulting from the continued unavoidable admixture with the ores mined by steam shovels of a considerable percentage of such surface material, from which little recovery is made.

The earnings are based on an average price of copper for the quarter of slightly less than 14.10c. per lb., which is approximately the average price at which copper was sold during the quarter. The net price received for the last two months of the quarter was 14.30c. At the expiration of the quarter there was no finished copper on hand unsold—sales having been made during the quarter to cover all copper available for delivery up to about the middle of January.

Notwithstanding bad weather conditions, stripping of capping from the orebodies was continued, resulting in the removal of an average of slightly over 88,000 cu.yd. per month. Of the total ore mined and milled during the quarter 25 per cent. came from underground mining and 75 per cent. from steam-shovel operations; the increased percentage from shovels, as compared to last quarter, resulting in a further slight decrease in the cost of mining.

Since placing the last unit of the Garfield plant in commission we have been able to demonstrate, for short continuous periods, when we could secure the tonnage, that the plant has an economical operating

capacity in excess of 6000 tons per day, that being the nominal capacity for which it was designed. It has thus been determined that the two plants can handle more than 200,000 tons per month as soon as that quantity can be delivered to them.

Progress has been made toward the application to our operations of better and more secure transportation facilities, and we expect to be able to report definite measures for relief from existing difficulties in our next quarterly issue.

Events Following the United Mine Workers' Convention

The last of the coal miners' delegates and the district officers, who came from all parts of the country to attend the recent international convention at Indianapolis, have left that city. President T. L. Lewis has gone to Pennsylvania to open negotiations with the anthracite operators. The international board remained for several days to complete consideration of the things referred to it by the convention. The board discussed earnestly the situation in the anthracite district where the present scale expires April 1. It was decided to send committees into West Virginia and Pennsylvania to investigate troubles in those districts.

Just what will take place in the anthracite districts is a serious problem. Much is depending on President Lewis, and he is hopeful of getting the operators into a conference with a view of making and adopting a scale. The anthracite owners do not recognize the miners' organization except to permit them to hold their union meetings and to post notices in the mines regarding these meetings. The operators have for years refused to make contracts with the miners as a unionized organization. The mine workers do not believe a strike would be wise at this time, and will avoid such a thing if possible. The executive board will meet again in Indianapolis March 15.

Gold in Western Australia

Gold returns from Western Australia show a production of 139,160 oz. fine in December, which is 2160 oz. more than in November, but 15,295 oz. less than in December, 1907. For the full year ended Dec. 31 the report of the Council of Mineowners gives the total at 1,697,552 oz. in 1907, and 1,647,912 oz. in 1908; a decrease of 49,640 oz. The output of 1908 was \$34,062,341 in value.

The tin mines of Tasmania, according to a late report of the Secretary for Mines, employed during the last quarter of 1908 a total of 1747 men, 1641 of whom were Europeans and the balance Chinese.

Personals

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

John E. Rothwell, of Denver, Colo., has been seriously ill.

A. von der Ropp has been a visitor in New York, on his way to Europe.

Ernst F. Eurich, of New York, has gone on a trip to Panama and the West Indies.

Prof. Henry M. Howe, of Columbia University, New York, has returned from Europe.

Albert Maltman is superintendent of the Three Stars mine at Ophir, in Placer county, California.

James M. Barr has been appointed manager of the Woodstock Iron Company, at Anniston, Alabama.

Prof. J. W. Richards, of Lehigh University, South Bethlehem, Penn., has returned from his European trip.

Glenville A. Collins has opened an office for the practice of civil and mining engineering at Seattle, Washington.

C. W. Whitley, manager of the Utah smelters of the American Smelting and Refining Company has gone to San Francisco.

Doctor Heroult, of Paris, France, recently visited the Electro-Metals Smelter Works at Welland, Ont., in which he has an interest.

Sherwood Aldrich, president of the Ray Consolidated Copper Company, and D. C. Jackling, general manager, are at Kelvin, Arizona.

Neil McL. Curran, manager of the North Star mine at Kimberley, East Kootenay, B. C., has lately been in Montreal, on business.

Francis Henry Shepherd, of Nanaimo, Vancouver Island, B. C., has been appointed chief inspector of mines in the province of British Columbia.

Thomas Hoatson, managing director of the Keweenaw Copper Company in the Lake Superior district, is in New York, attending a meeting of the directors.

Archibald A. C. Dickson now has his office located at Rejoulie in the Gaya district, India. His telegraphic address is at Nawadah, on the East Indian railway.

J. M. Gray, who recently resigned the position of State mine inspector of Alabama, is now superintendent of the Empire Coal Company in Walker county in that State.

John B. Hobson, who for years has been engaged in hydraulic mining for gold in the Cariboo district of British Columbia, has been spending the winter in California.

Alexander Faulds, superintendent of the coal mines of the Nicola Valley Coal and

Coke Company, at Middlesboro, B. C., has resigned, and James Gray has been appointed in his stead.

James W. Malcolmson, mining expert for the Kansas City, Mexico & Orient Railroad Company, is in the City of Mexico. He is accompanied by L. M. Lamar, of Sabinas, Coahuila.

J. W. Carse, of the advisory committee of the Steel Corporation, has been in the Birmingham district in Alabama, inspecting the works of the Tennessee Coal, Iron and Railroad Company.

J. E. McAllister, general manager of the British Columbia Copper Company, attended the annual meeting of the company at New York, and returned to Greenwood, B. C., Feb. 10.

S. V. Tench, formerly superintendent of the Red Ash Coal Company at Wilkes-Barre, Penn., has been appointed superintendent of the Eastern division of the Lehigh Coal and Navigation Company.

Hon. Wm. Templeman, Canadian Minister of Mines, has been returned to Parliament as representative for the Comox-Atlin district in British Columbia, which enables him to retain his position in the Cabinet of the Dominion.

James Chynoweth, president of the recently organized Arizona & Michigan Mining Company, has returned to Calumet, Mich., after a visit to Globe, Arizona, where he has been inspecting the property of the new company.

Dr. F. H. Hatch, of London, well known for his work in the Transvaal, has been appointed mining expert for the colony of Natal. His first work will be the preparation of a report on the mineral resources of the colony.

George Gordon Crawford, president of the Tennessee Coal, Iron and Railroad Company, and Charles S. Stillman, Southern manager for Rogers, Brown & Co., have left Birmingham, Ala., for a trip to Europe and Egypt, which will last two months.

A. F. Holden, managing director, and the executive committee of the United States Smelting, Refining and Mining Company, have been at Salt Lake City. They are on a general trip of inspection to all the company's properties in the United States and Mexico.

H. L. Charles, formerly superintendent of F. Aug. Heinze's smelting plants in Utah and Montana, has taken a similar position with the Colusa Parrot Mining and Smelting Company, at Butte, Mont. This is a Clark property, generally known as the Butte Reduction Works.

Frank A. Keith, formerly general manager of the Tonopah Mining Company, Tonopah, Nev., has been engaged as directing engineer for the Pioneer Mining and Leasing Company. The position of superintendent of the Tonopah will be filled by W. H. Madder, formerly with

the Devereaux Engineering Company of New York.

Obituary

Arthur G. Yates, who died in New York Feb. 9, aged 65 years, had been president of the Buffalo, Rochester & Pittsburg Railroad Company for several years. For many years he was a member of the firm of Bell, Lewis & Yates, of Buffalo, extensive coal operators in the western part of Pennsylvania. He was instrumental in organizing the Buffalo, Rochester & Pittsburg Coal and Iron Company, and was its president for several years before going to the railroad company.

Societies and Technical Schools

Royal School of Mines—The 36th annual dinner will be held at the Hotel Cecil, London, March 30. The secretary of the committee is George T. Holloway, 57 Chancery lane, London, W. C. In accordance with the usual custom of selecting a distinguished graduate to preside, the chairman this year will be F. W. Rudler, past president of the Geologists' Association. The secretary particularly requests old graduates to notify him of any change in their addresses.

Appalachian Engineering Association—At the fifth annual meeting at West Virginia University, Morgantown, W. Va., Feb. 6, the following officers were elected for the ensuing year: President, E. A. Schubert, Roanoke, Va.; vice-president, Baird Halberstadt, Pottsville, Penn.; secretary, Dr. Henry M. Payne, Morgantown, W. Va.; treasurer, C. E. Krebs, Kanawha Falls, W. Va. At the afternoon session the visiting members were welcomed by Dr. D. B. Purington, president of the university, to which President-elect Schubert responded in behalf of the association. After the auditing of the reports and the transaction of routine business the following papers were read and discussed: "Methods Used and Results Obtained in Triangulation of the Fairmont Region," by John G. Smyth, chief engineer of the Fairmont Coal Company; "Municipal Shortsightedness," by Prof. D. C. Weller, Waynesboro, Penn.; "The Surveyor vs. The Engineer," by Guy B. Hartley, Morgantown, W. Va. The evening session was opened with a stereopticon address on "Machine Mining with the Electric Puncher," by John L. Wagner, Syracuse, N. Y., who was followed by E. A. Schubert, of Roanoke, Va., upon the subject, "Side Lights Upon the Iron Ore Deposits of the World, with Special Reference to the Virginias." Prof. R. L. Morris, of West Virginia University, then spoke on "Good Roads," and the session closed with an address by Dr. I. C. White, State geologist of West Virginia, on "The Barren Zone of the Northern Appalachian Coal Field."

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Goldfield, Salt Lake City, Denver, London and Paris

REVIEWS OF IMPORTANT EVENTS

San Francisco

Feb. 10—The Northern California Dredging Company is about to move its office from San Francisco to Eureka, Humboldt county. Thos. Blair is president and Frank H. Tooby is secretary, both of Arcata, and most of the stockholders are residents of Humboldt county. If the dredge now at Hamburg Bar comes up to expectations others will be put on the rivers in Humboldt county. The one at Hamburg is on the Klamath in Siskiyou county. The company has about 4000 acres of possible dredging ground in Humboldt county and it is probable that other dredges will be put in between Weitchpec and the mouth of the Klamath.

The Byron Jackson Machine Works are building at Berkeley the new machinery for a dredge to be put in use in the southern part of this State. It will be of large capacity and is being built for Los Angeles capitalists.

Since the renewed activity of the smelting companies in Shasta county more and more mining claims are being opened in that county. In the first two weeks of January of this year 150 claims were located, most of them for gold and silver, but some for chrome. These claims are in the districts of Shasta, Old Diggings, Centerville, Spring Creek, Lower Springs, Quartz Hill, Churntown, South Fork, Harrison Gulch, French Gulch, Pittsburg, Backbone, Texas Springs, Ono, Whiskeytown, Flat Creek, Muletown, Stella, Buckeye, and Slate Creek. Some of these claims were relocations, but many are new prospects.

The Weather Bureau is arranging to establish stations for reporting on the amount of snowfall in the mountains of California so as to determine how much water may be available from this source when the spring rains melt the snow. Some stations will be in the higher ranges for the purpose of getting snow measurements. This will be of great advantage to the miners of the State as well as to those raising crops. Two divisions are arranged for California. One division will be in the Sacramento valley and the other at Los Angeles, and a number of permanent observers will be employed at different points.

In northern Plumas county in the channel between the Sunnyside and Glazier mines, a distance of about four miles, a number of drift mines are being reopened and developed. These include the Sunnyside, Alum Cove, Last Chance, San Jose, Scott, Cameron and Glazier properties.

Work is also being done on the Pliocene and Salmon Falls claims which are continuations of the same channel on the north bank of the North Fork. There is apparent more activity also in the drift mining sections of Sierra county where some large enterprises are contemplated. Both Sierra and Plumas counties have vast tracts of ancient channel gravel not yet touched.

Goldfield, Nevada

Feb. 9—The milling output in Goldfield for the week ending Feb. 6 was from Goldfield Consolidated mill, 4200 tons valued at \$168,000; Florence mill, 630 tons valued at \$12,600; Nevada Goldfield Reduction Company's mill, 475 tons valued at \$23,750; Combination mill, 750 tons valued at \$30,000. This does not include ore shipped to the Western Ore Purchasing Company.

The output for Tonopah for the week ending Feb. 6 was Tonopah Mining Company, 3050 tons; Montana Tonopah, 745; MacNamara, 295; Tonopah Belmont, 650; Tonopah Midway, 50; Jim Butler, 300; West End, 250; total of 5340 tons having an estimated value of \$132,000.

The hole being drilled by the Bay State Oil Company at Salt Marsh, near Blair, is now 575 ft. deep; at that depth the drill is in blue clay heavily impregnated with oil. Several days ago it was reported that the drill had reached cap rock, but later developments proved the statement in error.

Coal has been reported to have been opened in paying quantities six miles north of Blair by H. C. Petty. The existence of this deposit has been known to Mr. Petty for the past five years, but little work was done. Three miners are now hoisting the coal from the 200-ft. level where a vein 24 ft. wide is disclosed; 42 in. of this is of a good coking grade.

After a litigation extending over a period of 15 years, Judge Pike recently rendered a decision in the district court at Reno, giving to the plaintiffs, B. A. Gamble, F. S. Chadbourne, et al, the power to enforce an option, to buy, dispose of or work the Pittsburg-Silver Peak mine from the time the judgment becomes final. The property in question is one of the large mines of the State and has been operated by the heirs of John I. Blair with a large output.

Charles S. Sprague, president of the Goldfield Chamber of Commerce, was

notified Feb. 1 that the American Mining Congress will hold its 1909 meeting at Goldfield. An attempt will also be made to have the meeting of the American Institute of Mining Engineers held here at the same time.

John Q. Critchlaw, president of the Chafey Investment Company, last week made the statement that his company had decided to install a 30-ton custom mill in the Chafey mining district; the intention is to enlarge the mill as conditions warrant.

Salt Lake City

Feb. 12—A blizzard of several days' duration has tied up the Utah Fuel Company's mines at Winter Quarters and Clear Creek, as well as those of the Union Pacific at Scofield. At Alta the snowfall has been greater than in many years. At Park City there has also been much snow. The Silver King Coalition is running out its regular tonnage; the Daly-Judge has kept its roads broken, and the Daly-West has been working through the Ontario tunnel. Most of the smaller properties, however, have been shut off by the snow and forced to discontinue work.

The storms throughout the State caused the smelters considerable annoyance. Some trouble is always experienced during the winter season, but this year it is far worse than usual. The American Smelting and Refining Company is operating five furnaces; three are idle. The United States Smelting, Refining and Mining Company has four in commission and three idle. The net earnings of the United States Smelting, Refining and Mining Company for November were \$398,000, for December about \$350,000, and for January probably in the neighborhood of \$300,000. The mines and plants of this company are said to be in excellent shape. President Sharp, Managing Director Holden and Messrs. Storrow, Winslow, Rice and Clark of the United States Smelting, Refining and Mining Company are here on a trip of inspection to the company's Western plants and properties.

E. P. Mathewson, who is in charge of the railroad and smelter construction for the International Smelting and Refining Company at Tooele, arrived here from Butte a few days ago. It is said that the company will soon let contracts for rails, structural steel and other equipment. The roadbed from the main line of the Salt

Lake railroad to the smelter site is now being built, and plans for the smelter are nearing completion.

A party of 25 Chicago capitalists under the guidance of W. C. Orem, made a trip of examination to the Boston Consolidated company's plants at Garfield. The Utah Apex mine, at Bingham, is shipping 90 tons of lead-silver ore and concentrates per day.

The shaft at the Black Jack mine, now 1400 ft. deep, will be sunk to a depth of 2000 ft. The Uncle Sam is drifting on the 210-ft. level and it is expected that the new orebody will be found within 200 ft. On the 100-ft. level they are also driving for this orebody.

The Sioux Consolidated has declared a dividend of 8c. per share, or \$59,631.12. This company has paid 33c. per share during the last five months. The Colorado company also posted a dividend of 8c. per share, or \$80,000.

The Utah Copper Company produced 4,174,859 lb. of copper in December, so that the production for 1908 amounted to 43,689,875 lb. The mill at Garfield consists of 12 sections of 500 tons capacity each. Two of these were placed in commission in July, 1907, and the remainder were started up as they were completed, the last unit being added in December, 1908. Since July, 1907, the production has been as follows: July-September, 1907, 5,305,368 lb.; October-December, 1907, 7,716,712; January-March, 1908, 8,527,939; April-June, 1908, 11,568,390; July-September, 1908, 12,000,925; October-December, 1908, 11,592,621 lb. During this time the shares have been selling at \$13 to \$52. As soon as the price of copper improves the mill will probably be enlarged. At present the company is said to be clearing a little over 5c. on each pound of copper produced.

The drain tunnel on the 1200-ft. level of the Daly-Judge mine is being driven toward Bonanza Flat, paralleling the Daly fissure. The Daly company extracted \$9,000,000 worth of ore along a distance of 1500 ft. on this fissure. The Daly-Judge company is now able to handle the water on its 1400- and 1500-ft. levels. This will give to the company an immense area of stoping ground, that up to date could not be worked owing to the large quantities of water coming from the Daly fissure.

Denver

Feb. 13—The United States Reduction and Refining Company, in its annual report, shows that the company's operations from Aug. 1, 1907, to Jan. 1, 1909, gave a net profit of \$372,876, of which \$225,250 was paid in interest on bonds, and \$59,187 paid in preferred dividends, leaving a balance of \$88,439 to be put in the treasury.

The two chief owners and organizers of

the Western Metals Company, owning the electrochemical ore-reduction process, are about to show that they have the courage of their convictions, by erecting a plant at two mines, one in Georgetown, and one in Idaho Springs, of which mines they are respectively one the owner and the other the general manager.

It is also announced that a custom cyanide mill of 150 tons capacity, for the treatment of low-grade telluride ores, is to be built at Sugar Loaf in Boulder county.

Toronto

Feb. 12—On Feb. 11 the Judicial Committee of the British Privy Council rendered its decision in the case of the Dominion Iron and Steel Company vs. the Dominion Coal Company for breach of contract, sustaining the judgment of the Supreme Court of Nova Scotia in favor of the steel company and remitting the case to that court to have the damages assessed. This is probably the most important Canadian civil action on record. For a time the coal company was leased and operated by the steel company. This arrangement ceased in 1903, and on Oct. 20 of that year an agreement was entered into under which the coal company agreed to furnish the steel company with all the coal required for 90 years at \$1.24 per ton, with 4c. per ton for use of cars. The steel company, in accordance with the terms of the agreement indicating that the coal was to be taken from the Phelan seam of the Dominion coal areas, as most suitable for its purposes. In the year 1905, the coal company made default as regards furnishing a sufficient supply. The steel company in April, 1906, notified it that during August, September and October it would require 80,000 tons per month. The coal company only supplied 58,270, 50,525 and 62,618 tons for these months, respectively. The steel company offered to take slack and banked coal without prejudice to contract rights to make up the quantity, but on the coal company's failing to deliver, it was notified that the steel company would not take coal except from the Phelan seam. After Nov. 1, 1906, the coal company's cars were sent to the steel works labeled, "Run-of-Mine Phelan Seam," without indicating the pit from which the coal was taken, thereby compelling the steel company's analyst to analyze the coal to ascertain its quality with the result that much of it was rejected as unfit for steel manufacturing.

The coal company thereupon gave notice that the contract was terminated on the ground that it had been broken by the rejection of the coal. The steel company closed its works Nov. 6, 1906, until it could arrange for securing coal elsewhere, and a temporary agreement was made for a supply from the coal company at a price much higher than that

specified in the original contract. The steel company sued for damages and, after a trial lasting 16 days, Judge Longley, of Nova Scotia, found in its favor. The coal company took an appeal to the Privy Council.

Lord Atkinson, in an elaborate judgment declared that it was not a case into which it was necessary to import by implication words into the contract to effectuate the intention of the parties. The contention of the coal company that the phrase, "reasonably free from stone and shale," appearing in the contract implied that the coal supplied should be only as free as reasonable and proper picking could make it, apart from impurities in the laminae permeating the coal, could not be sustained. The provisions of the contract were only explicable on the assumption that of the coal to be supplied, 90 per cent. was to be reasonably suitable for use in the operations it was known the company intended to carry on in the works described. The plaintiffs were entitled, owing to the wrongful repudiation of the contract by the defendants, to treat the contract itself as at an end, and recover damages in respect to breaches of it committed before its repudiation, viz., to Oct. 31, 1906. The coal company was ordered to pay the costs of the appeal.

About \$57,000,000 of capital are affected by the decision, the stock and bond issues of the Dominion Iron and Steel Company amounting to about \$34,000,000 and those of the Dominion Coal Company to \$23,000,000.

Victoria, B. C.

Feb. 8—The Dominion Government is making provision for a representative display of the minerals of British Columbia, as well as of the products of other parts of Canada, at the Alaska-Yukon-Pacific Exposition to be opened at Seattle, Wash., next summer. R. W. Brock, director of the Geological Survey of Canada, has requested that the district boards of trade collect the minerals for the exhibit; he has intimated that a Dominion official with wide experience in connection with mineral exhibitions will be detailed to look after the final selection and display. It is suggested that mineral specimens shall be 1 cu.ft. in size, with a few very large specimens of high-grade silver-lead and copper-gold ore; also specimens illustrative of the metallurgical processes and products, building stones, clays and clay products, and in fact all natural economic substances.

The matter has been taken up energetically by the Associated Boards of Trade, which at their recent annual convention appointed a committee to make arrangements for a representative exhibit from the Kootenay and Boundary districts. As yet, though, there has not been similar

practical interest shown in the Coast district of the Province, and the Provincial Government has not announced any intention to promote the object in view in making a large exhibit, leaving arrangements to the Dominion Government as being more within the jurisdiction of the latter.

William Hutchinson, Canadian exhibition commissioner, accompanied by an architect from Ottawa, was in Seattle early in February, making preliminary arrangements for the Canadian building at the exposition, for which structure an appropriation of \$75,000 has been made.

At the seventh annual convention of District No. 18 of the United Mine Workers of America, held recently at Lethbridge, Alberta, an important departure was made in connection with Asiatic labor. Heretofore, in the constitution under which the affairs of the district were carried on, an invitation was extended to all men employed in and around mines, without regard to race or color, excepting Chinese and Japanese, to unite with the organization. The constitution committee advised the striking out of the words "except Chinese and Japanese," and after a spirited debate this was agreed to by a majority of those in attendance at the convention.

At Edmonton, Alberta, in the district court, a judgment was lately given, by Judge H. C. Taylor, which is of importance to laboring men employed in that province. This was in the matter of an action brought by 18 employees of the United Collieries Company against two directors of that company for the recovery of wages due, amounting to about \$760. The action was regarded as a test case and the judgment shows that wage-earners may recover the wages due to them by the company from any or all of the directors of a joint stock company, in the event of the company failing to pay.

London

Feb. 2—The West African goldfield continues to interest speculators and there is a considerable traffic in shares. The popularity that the goldfield is now enjoying is founded more on anticipation of future prosperity than on successful results already achieved. For on the whole, mining on the Gold Coast has, in the past, been a disappointing business. It is claimed, however, that improved results have lately been obtained by the crushing mines and further improvements are promised if capital is provided to enable operations to be carried on on a larger scale.

Whether these optimistic views, upon which the present boom appears largely to be founded, will be realized, remains to be seen. The recent records of the prominent mines indicate that dividends are still a considerable way off. In the report

of the Fanti Consolidated Mines, Ltd., for the year ended Sept. 30, 1908, it is stated that at the Presta Block A mine, one of the best quartz mines of the colony, the costs for August, September and October last were \$5.52 per ton milled exclusive of development. Allowing 96c. for development, which was the amount allowed in 1907, and 40c. for London expenditure, the total working costs comes to \$6.88. During these three months the value of the gold recovered was about \$7.44, so that the margin of profit is very small. At the Abbontiakoon Block 1 mine, one of the basket group, the costs for August, September and October were \$7.80, exclusive of depreciation, and the revenue \$8.74 per ton.

At the Wassau mine, another basket mine, the yield for the year, 1908 works out at \$6.72 per ton milled. The costs during 1907 were \$8.64, and during January, February and March \$4.80 exclusive of development and London expenditure, which may be put at \$2.40, making a total cost of \$7.20. There is no profit here. The Abosso and Taquah mines, both on the basket field, show more favorable results.

The Taquah commenced crushing in September, 1907, with a new 50-stamp mill. For the period to June, 1908, the yield was \$16.32, and the costs \$10.56. For the year 1908 the yield has been \$16.56 per ton. At the Abosso mine the yield and costs for the year ending June, 1907, were \$14.44, and \$9.12, respectively, and for the year ending June, 1908, the yield and costs were \$12 and \$8.40. During the last six months of 1908 the yield has fallen to \$10.80 per ton milled. The reduction in grade that the mines develop with increased production is very noticeable.

In the face of the above figures it is difficult to get up much enthusiasm about West African gold mines; and it is somewhat surprising that fresh money is being found by one or two of the South African mining houses to develop some of the dormant properties floated during the last boom.

Until the old established mines have been placed on a sound dividend-paying basis, it seems premature and incautious to attack areas of the basket field, where the indications of value are less favorable, as far as is known at present, than in the present working mines.

Paris

Feb. 3—T. Moreux, manager of the Observatory of Bourges has recently advanced an explanation of firedamp explosions. He finds that these explosions are in close relation with the tempests of the sun and consequently with the spots that are observed frequently on the surface, and that earthquakes also take place during the same periods. In fact, in No-

vember last two enormous spots were observed on the sun causing magnetic deviations on Nov. 12, the date of the disastrous explosion at Hamm, Westphalia. On April 29, 1896, violent earthquakes accompanied by storms were observed at the time of the disaster in the Ciphy mine and the explosion at Micklefield. On July 3, 1898, earthquakes and storms in Italy and Austria accompanied explosions of fire-damp in Belgium in a mine where that gas had never been detected before. Among many other dates given by T. Moreux is that of the Courrières disaster in March, 1906, which occurred during a period of solar crisis.

The French mining law of 1810 has been frequently discussed in the Chambers with a view of altering it, but so far no fundamental modification has been adopted. A new mining law will be submitted soon to a vote of the deputies. The commission which is preparing it has decided to adopt the principle of the nationalization of the mines, i. e., to cause the mines to be worked by the State, or at least to make an investigation with that end in view. A sub-commission will examine conditions in Switzerland and Holland where mines are operated in this manner. The proposal of the commission will be submitted to the Chamber of Deputies before spring.

Portable electric lamps are now used underground at the Bruay and Carvin collieries. They weigh a little less than 5 lb., last 12 hours, have a capacity of 1.2 candlepower under two volts, consuming two watts per candlepower. The accumulator alone weighs 2½ pounds.

The largest producers of gold in Madagascar, Mortages & Grignon, are erecting a complete 950-lb. 25-stamp mill at their mine of Andavakoera in the northern part of the island 100 kilometers from Diego-Suarez. Owing to the difficulties of transportation the machinery supplied by Fraser & Chalmers, Ltd., was sectionalized to 500 kg. It is reported that it safely reached the mine and the erection is well advanced. The mill will probably be started in March. The Governor of Madagascar intends to attend personally the starting of this mill, which will be the first stamp mill running in the colony. Up to the present time the Andavakoera ore has been picked by about 3000 natives, crushed by hand in small mortars and then washed in *bateas*. A native crushes about 12 lb. of ore per day. As the natives chose only the pieces showing visible gold, considerable ore is on hand for the mill besides the ore not yet extracted by the natives. Assays made on ore carrying invisible gold show 100 gram per metric ton. The ore of Andavakoera has been worked by the owners for 17 months, and the average monthly production has been 100 kg. gold containing about 25 per cent. silver. The richness of the ore is increasing for the production of a single fortnight recently was 180 kg. of gold.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Arizona

COCHISE COUNTY

Bisbee—The Phelps-Dodge copper smelting companies have filed with the Interstate Commerce Commission, at Washington, complaints against the Baltimore & Ohio and other railroads, alleging discrimination in the rates for transportation of coke from Eastern cokefields to smelters in Texas and Arizona. The complaints say that the railroads charge 30c. a ton more from the coking region to Chicago on coke used for smelting copper, than on coke used for smelting iron. Practically all the coke used by the Southwestern smelters is shipped by way of Chicago and complaint is lodged only against the charge made for the haul to that point, the rate beyond being satisfactory.

GILA COUNTY

Arizona Commercial—At a depth of 710 ft. in the Eureka shaft, a station 36 ft. square is being cut.

California

AMADOR COUNTY

Boardman Hill—Joseph Garibaldi has commenced hydrauliclicking the gulch on the Boardman Hill, the last spot which has never been mined in the Volcanic Basin. The top dirt only is washed. The claim is in dispute before the Land Office, but Garibaldi is so sure of winning the contest that he has begun work.

BUTTE COUNTY

Big Blue Lead—Test washes of gravel show \$3 per car in coarse gold, the fine gold not being saved.

CALAVERAS COUNTY

Benson—A 15-ft. vein of satisfactory quartz has been found in this mine at Altaville; George F. Walker, superintendent.

Bovee-Fritz—This is a reorganization of the company owning the Sultana mine near Angels. Capital has been secured, and active operations will shortly commence.

EL DORADO COUNTY

Golden Hatchet—Garretson, McLellan & Co. are about to secure the gravel mine on Webber creek, 10 miles from Placerville. The mine is on one of the well defined gravel channels of the county.

INYO COUNTY

Dodd's Springs—Jas. L. Butler is opening a new mine under the superintendency of John McCormack in the Saline Valley section at Dodd's Springs. The ledge carries gold, silver, copper and lead.

KERN COUNTY

Tungsten—The tungsten mines at Atolia have started up again with about 60 men at work.

Yellow Aster—The company at Randsburg is now employing 300 men and taking out large quantities of ore. Mining is quite active at Randsburg and Johannesburg.

MODOC COUNTY

Fort Bidwell Consolidated—From the Mountain View claim, R. L. Mason, superintendent, some high-grade ore is now being taken at a depth of 70 ft.; ore is being taken out from this and other mines in Hoag district to be ready for the 20-stamp mill to be erected this spring.

NEVADA COUNTY

Lecompton—This Nevada City mine, Samuel Colt, superintendent, has been compelled to close down owing to water due to the heavy storms. Work will not be resumed until winter is past.

Niagara—At a meeting of the company at Grass Valley it was decided to move the offices to Santa Barbara. It is possible that the mine may be reopened after the rainy season is over.

Yellow Metal—A 12-in. ledge at this property near Bowman's dam is yielding high-grade ore. The mine is being developed by A. D. Keller for Nevada City and Grass Valley men. The mine is in the granite gold belt, in a new district.

PLACER COUNTY

Northern California Gold Mining Company—W. R. Leonard and A. F. Sawhill, of Pittsburg, Penn., are examining the Herman mine and the financial standing of the company in Placer county.

Three Stars—The work of pumping out has commenced under superintendence of Albert Maltman.

SAN BERNARDINO COUNTY

In the district 10 miles north of Bagdad and Amboy, several companies are developing orebodies. One company has a mill and others in the district are working on the same ledge.

SIERRA COUNTY

No Better—At this group, owned by the Forest Green Gold Mining Company at Forest, J. C. Chandler, superintendent, the shaft is now down 165 ft., and will be continued to 500 ft., when drifts will be run.

SISKIYOU COUNTY

Bennett & Co.—This firm now has five big hydraulic plants at work near Forks of Salthon with plenty of water for effective work.

Dakin—This copper mine at Happy Camp continues working, and, having moved the power house, now has plenty of power.

Gardner & Weed—On this claim in Quartz Valley 15 men are at work with several giants, and have plenty of water for hydrauliclicking.

Grouse Creek Gravel—This company near Callahan, has a full head of water for all its giants. This is an ideal season for hydraulic mining.

TRINITY COUNTY

East Fork District—On the Yellow Jacket a small force of men has been set at work in the tunnel to develop the orebody found last fall. Development work is also being done on the Meier, Weedman & Condon, Johnson, Oversight group and Golden Chest. The Hoodoo is being developed by Grant Day near the Enterprise, with George S. Fenwick as superintendent.

TUOLUMNE COUNTY

Nonpareil—Arbuckle & Morrison have commenced work on this claim under a bond given them by the assignees of the creditors. The property is expected soon to become a producer.

Soulsby—This mine at Soulsbyville has resumed operations with a full force of men after running some time with only one shift.

Colorado

LAKE COUNTY—LEADVILLE

Bertha—In this mine, Breece hill, the body of ore opened in the lower level has widened out to a fair oreshoot; the ore running well in gold. It is more than likely if a satisfactory extension of the lease is granted to the present lessees, that they will sink the shaft to a depth of 500 ft. to open the orebody at greater depth.

Dinero Tunnel—In this adit, Sugar Loaf, the upraise, that is being carried from the tunnel level to make connections with the old workings, recently ran into a body of high-grade silver ore. In about three weeks the upraise will have made the connection and developing the body of ore at the breast of the tunnel will be started. Shipments will be started as soon as the wagon road is opened to the smelter.

Iron Silver—This company is increasing its force of men on the Moyers, Iron hill, and also the Tucson, and the daily output is materially increased. As long as spelter remains at its present figure the company will gradually increase the working force and its output. The same can be said of the A. Y. & Minnie.

Jennie June—In this mine, Tennessee Pass district, drifting from the bottom of the shaft to the north on the vein has been going on during the winter, following a small streak of ore that carried gold. The vein is now widening.

Sunday Tunnel—The footwall of the recent strike has been caught and the vein from wall to wall is 12 ft. wide, with 6 ft. of solid mineral; the balance is milling ore. The ore is a lead sulphide carrying 60 per cent. lead, with gold and silver. At present the tunnel is being driven ahead and when sufficient ground is cut for a large station and compressors, etc., installed, the work of connecting with the shaft will be started and also drifting on the vein, both sides.

TELLER COUNTY—CRIPPLE CREEK

El Paso Consolidated—The annual report of this company shows that the property produced during the past year ore to the amount of \$432,000, or 19,600 tons of the value of about \$23 per ton. In January, 1908, the property was leased to a number of operators who have taken out the ore. No ground below the water level, or 600-ft., was leased. No work was done on company account. Good headway is being made on the drainage tunnel. El Paso will be one of the first mines to be unwatered. A. L. Burris, of Colorado Springs, is the president of the company.

Gold Issue—The surveys from the railroad to the mill of this company have been completed and it is understood that the construction work will soon commence. The mill, which is known as the Wish Bone mill, is situated on the north side of Mineral hill, away from the railroad, and the surveys that have just been made are for the purpose of running a line from Hoosier pass, so that ore can be taken from all parts of the district to the mill. The mill owners have leases on several mines and dumps in the district. P. M. Collins, of Cripple Creek, is in charge of the mill. Some new machinery is being installed.

Golden Cycle—Ground is being broken

for a new mill on this property, designed to treat the very low-grade ore at the mine and in the dumps that will not stand the freight to the valley mill of the company. It is understood that the mill is to be a concentrator and is to have a capacity of 500 tons per day. A large amount of ore is produced by this property. H. McGarry, of Colorado Springs, is general manager.

Trail Mountain—Some prospecting is being done on this hill, which is some distance south of the town of Victor. Several years ago a mill was erected in this vicinity and some ore treated. The mill is not running at present, but some values are reported as having been found in prospecting. As this is outside the known mineral belt, developments are being watched with interest.

Illinois

MERCER COUNTY

Coal Valley Mining Company—This company's mine at Cable has been finally worked out and abandoned after 35 years' continuous operation. The mine was worked on the room-and-pillar system, and all the pillars were successfully taken out, except those immediately around the bottom of the shaft. The company will soon begin work on another shaft, three miles from the old one. It will be equipped with the latest machinery.

Indiana

WARRICK COUNTY

White & Wilson Coal Mining Company—This company's shaft on the Lutz farm west of Boonville, has reached coal. The vein is 6 ft. thick and of excellent quality. It is 60 ft. below the surface and has a good roof of limestone rock. A switch is being put in from the Southern railway. The company will begin operations in the fall, with a daily capacity of 1800 tons.

Michigan

COPPER

Seneca—The shaft being sunk at this property has reached the first level, a distance of 200 ft. from the surface. A crosscut is being driven to the lode from this point. The shaft is in the footwall approximately 60 ft. from the lode.

Ojibway—The lode has been encountered in cutting the station at the 650-ft. level of No. 1 shaft. The face of the formation is well charged with copper. The lode opened in the level above consisted of two beds separated by about 14 ft. of trap.

New Baltic—This exploration company operating on lands adjoining the Arcadian property has opened up the lode and disclosed an amygdaloid formation. The

ledge is covered with but a few inches of overburden and is badly disintegrated, but it is believed to be an extension of the Baltic lode.

Wyandot—This company continues driving the crosscut from the bottom of its exploratory shaft, a distance of 700 ft. from the surface, and is now cutting the third amygdaloid formation. Drifting northward on the first formation continues and the same minerals, epidote with some copper. No. 2 lode is being opened to the south and is about the same as the first formation.

Osceola—This company has stopped stamping Ahmeek rock in its mills, which in all probability means an increased production from its own shafts. No. 4 shaft of the North Kearsarge branch will soon be in condition to begin producing.

Allouez—The Kearsarge lode recently encountered in No. 2 shaft of this company is proving up exceptionally good.

Calumet & Hecla—This company has put in commission a series of electrically driven centrifugal pumps in No. 5 shaft, which will take care of all the water from the northern portions of the mine, and has discontinued water hoisting at the Red Jacket shaft.

Montana

BUTTE DISTRICT

Butte & Balaklava—The shaft is down 1248 ft. and ore has been encountered at that depth. Sinking has been temporarily stopped and a station is being cut on the 1200-ft. level from which a crosscut will be run. Sinking will then be continued to the 1500-ft. mark. The management states that a modern surface plant will be installed and orders have already been placed for the machinery. The last 110 ft. of the three-compartment shaft were sunk and timbered, and all rock hoisted to the surface during a period of 30 days, which is a record for the camp at that depth.

Butte-Montana—A plan for reorganization is under consideration by which the capital will be increased to \$2,000,000, with shares of the par value of \$10. Ten of the old shares are to be exchanged for one of the new and a portion of the new stock will be sold for the purpose of carrying on further development work. Development work is now being carried on in the lower levels and shipments are averaging two railway cars per week.

Raven—Operations were suspended Feb. 8 by order of the board of directors. It is understood that the stockholders have failed to support the directors' efforts to refinance the company by subscribing for the treasury stock recently offered to them, and the directors, being unwilling to advance more money for continued operations, have shut down the mine. The time in which the stockholders may sub-

scribe for the new stock has been extended to Feb. 24, and if no response is forthcoming by that time the property may be closed permanently. The mine was formerly worked through the Buffalo shaft of the Amalgamated company, which was leased for that purpose to the Raven company, but since a dispute arose as to the ownership of several bodies of ore opened up through the Buffalo, the further use of the shaft was refused and the company then began to sink on its old shaft and reached a depth of 1300 ft. before the suspension of operations.

DEER LODGE COUNTY

Washoe Smelter—The new 87-ft. blast furnace was blown in last week and is the largest in operation in the world. The two other blast furnaces are 51 ft. in length. There are eight reverberatory furnaces at the plant. The smelter is producing from 300 to 400 tons of copper daily, depending upon the grade of ores smelted.

JEFFERSON COUNTY

Elkhorn Electrometals Company—The new electrolytic plant was put in operation on Feb. 5. The plant is the first commercial one of its kind in the country.

BROADWATER COUNTY

Keating Gold Mining Company—Final payment was made last week upon the company's group of claims in the Radersburg district. The management has under consideration a plan to use traction engines in place of teams for hauling ore.

Nevada

ESMERALDA COUNTY—GOLDFIELD

Blue Bull—In the Knickerbocker lease on this property, ore of good grade has been cut in a drift from the bottom of a winze sunk from the tunnel level.

C. O. D. Consolidated—The oreshoot that was cut in the drift from the winze sunk from the 200-ft. level has also been cut by the crosscut run for that purpose on the 300-ft. level. The orebody has been penetrated for about 4 ft., and shows high-grade shipping ore the entire distance, with considerable free gold showing.

Combination Fraction—The first shipment to the Nevada Goldfield Reduction Company's mill under the new terms was made Feb. 1. The shipment consists of 105 tons with an average value of \$40 per ton. A daily production of 85 tons will be maintained in the future. Forty additional men were put to work at the mill which is now in position to run, at full capacity, 20 stamps.

Crackerjack—The shaft on the Mitchell & Fairfield lease on the Henry Clay lode of the Crackerjack company is now 135 ft. deep. The low-grade vein that was

cut at a depth of 95 ft. still shows in the bottom of the shaft.

Goldfield Whiterock—This company is doing a large amount of exploratory work. From shaft No. 7 a crosscut is being run to the east on the 540-ft. level to connect with shafts Nos. 4 and 5, about 2000 and 2200 ft. distant, respectively, through ground never before opened up.

Great Bend Diadem Lease—A rich strike was reported in the west drift on the 400-ft. level of this property last week; 20 in. of this ore is very rich.

Hazel Lease—At a meeting of the stockholders of the Hazel Goldfield Mining Company recently held in Chicago, W. H. Jordan was elected president, F. Fitch vice-president and treasurer, and A. R. Cuthbert secretary. John A. Farwell and Geo. H. Phillips are the additional directors. The mine is making about 20,000 gal. of water per day, and a pump is to be installed. The shaft will then be sunk an additional 150 ft., and development work carried on to the east of the shaft.

Little Florence Lease—A double-drum, electric hoist, and a compressor capable of supplying nine drills, are being installed. Development work has been curtailed owing to the inefficiency of the gasolene hoist now in operation; with the new hoist in operation both hoisting compartments of the shaft will be used. The crosscut on the 357-ft. level recently cut the hanging wall of a promising looking vein, but where cut it is low in gold. The crosscut has passed through 14 ft. of vein matter without reaching the footwall.

Red Top Consolidated—A dividend of 2c. per share, amounting to \$20,000 was declared Feb. 1, affecting stockholders of record Feb. 20. Ore is being mined at four different points in the mine; all the ore is of high grade.

ESMERALDA COUNTY—HORNSILVER

Great Western—The west drift on the 300-ft. level recently opened a large body of good gold-silver ore. This ore is considerably richer than that in the same shoot on the 200-ft. level. The property is shipping an average of one carload a week to the Western Ore Purchasing Company.

ESMERALDA COUNTY—LUNING

Blue Light Copper Company—The shaft, now more than 700 ft. deep, is being sunk deeper; the intention is to continue it to water level. The property has produced some ore, and considerable ore is now blocked out.

Parrot—Work on this property has been resumed by the Nevada Champion company. Much money has been spent in opening this mine, but all work was stopped with the decline of copper.

NYE COUNTY—BULLFROG

Bullfrog Pioneer—This property shipped two cars aggregating 80 tons last week, having an estimated value of \$100 per ton. The crosscut is not yet in the lode proper, though it is thought that the footwall has been cut. A number of new leases have been granted on Pioneer ground adjoining the Bi-Metallic claim, the leaseholds being blocks 200x300 feet.

Gold Hill Mining and Milling Company—This company, operating on the Conservative claim which adjoins the Pioneer Bonanza lease, is planning to sink a two-compartment shaft to a depth of 50 ft. A hoist has been ordered.

Homestake-King—It is estimated that the clean-up for January will show a production of about \$13,000. The mill is now treating about 75 tons per day averaging \$7 per ton.

Montgomery-Shoshone—The mill treated 4600 tons of ore during the month of January. The last shipment of bullion weighed 800 lb., and included the product of the concentrates which are now being treated successfully at the mill.

National Bank—The Logland lease on this property is preparing a shipment for the smelter at Needles; the shipment will be about 30 tons and all comes from the 50-ft. level.

NYE COUNTY—HELENA

Broken Hills—This company is at present sinking two shafts; the main working shaft is about 220 ft. deep. In the drift on the 100-ft. level from this shaft a body of milling ore 25 ft. wide has been opened up. This shaft will be sunk to a depth of 300 ft. before another crosscut is run. Much the richest ore on the property was opened up in an incline shaft about 200 ft. from the main shaft; this high-grade vein was followed from surface to a depth of 90 ft. The vertical shaft, which was sunk from the surface to connect with the bottom of the incline, is now 60 ft. below the bottom of the incline shaft, and has been in ore below the incline. A drift being run on this body from the 45-ft. level found an orebody of shipping grade 12 ft. wide. Twenty blocks of ground have been let to leasers; all of these leases are being worked, and many of them are equipped with up-to-date machinery. A good grade of ore has already been opened up on two of the leases. The town of Helena, which has sprung up since the mine was opened, now has a population of about 300 people. The Broken Hills company is constructing a telephone line to connect the camp with Tonopah, 12 miles of the line being already in operation. This work will be completed in about three weeks. J. C. McCormack, principal owner and manager of the property, states that the Broken Hills ore is a petzite carrying about two-thirds of the value in gold. The survey

has been made for the mill site, but more exhaustive tests of the ore will be made before the plans for the mill are drawn. The company owns water rights ample for all milling and domestic purposes.

NYE COUNTY—TONOPAH

Montana-Tonopah—The mill ran continuously with all the stamps dropping and crushed 1040 tons of ore, 745 of which came from this property and 295 tons from the MacNamara. The contract in force under which the company agreed to treat an average of 50 tons per day from the MacNamara expires March 15 and will not be renewed.

NYE COUNTY—IONE

Ione—Thomas D. Murphy, E. R. Collins and Downie D. Muir, all of Goldfield, are preparing for extensive work on their placer ground, which comprises about 500 acres. A Fairbanks-Morse pump and 10,000 ft. of pipe have been ordered. Ione is south of the Reese River range, from which a large water supply can be easily obtained.

WHITE PINE COUNTY—ELY

Steptoe Smelter—During the month of January, 2,700,000 lb. of blister copper were shipped. The smelter is now treating nearly 5000 tons of ore per day of which two-thirds comes from the Nevada Consolidated and the balance from the Cumberland-Ely companies.

New Mexico

GRANT COUNTY—SYLVANITE

Sylvanite Townsite and Development Company—William Clark has purchased a controlling interest in the Sylvanite Townsite and Development Company. John T. Goshen, who has been the agent of the townsite company since its organization, has resigned as secretary, and C. H. Morse, president of the Eureka Sylvanite Mining Company, has accepted the position as secretary and agent under the new management.

Gold Hill Mine—I. J. Russell, the superintendent, reports 6 ft. of shipping ore in the upper tunnel; the two lower tunnels are both in good ore. A compressor plant is on the way to the mine. Ore bins have been built. Regular shipments were commenced this week.

Sylvanite Queen Mining Company—This company, which owns the Ajax, Alexander, Cowboy and other promising claims in the Eureka district, has elected new officers. Asa T. Hoy is president; E. A. Tovera, vice-president; G. K. Reynolds, secretary, and J. P. Connelly, treasurer, all of Bisbee, Arizona.

Fairview Group—This group of four claims at Granite Gap, four miles southeast of Sylvanite, has been optioned to G. F. Humbert. At this property there is a dike, 40 ft. wide, that carries copper, gold and silver.

Pennsylvania

BITUMINOUS COAL

D. G. La France & Co., of Johnstown, has bought from various owners a tract of 2820 acres of coal land in Quemahoning township, Somerset county, the price paid being \$225 per acre. The coal on the land is the lower and middle Kitanning and the Freeport seams.

FAYETTE COUNTY

Republic Connellsville Coke Company—Plans are in progress for the organization of this \$2,500,000 corporation which has been formed by merging the Republic Coke Company and the River Coal Company.

South Dakota

LAWRENCE COUNTY

Hidden Treasure—Work is to be resumed in the early spring when Supt. Nate Hart, of Lead, will commence drifting on the 200-ft. level to tap the ledge struck in the shaft.

Pennsylvania—Drifting on the 150-ft. level is being prosecuted, and it is expected to strike the vein within a few feet.

Pluma—President T. A. Harding, who spent some days here, announced that the plans for building a 500-ton mill would be completed soon. Work will commence in the spring when the drifting will be continued.

PENNINGTON COUNTY

Deep Down—A new strike has been made in a drift on the 50-ft. level where a body of free-milling gold ore was opened up. It also carries bismuth, and is being developed.

Dakota Power—Work is about to be resumed by L. A. Richards, of Rapid City, who has just returned from an Eastern trip, having completed financial arrangements to finish the flume work and establish and equip a generating plant.

Utah

BEAVER COUNTY

Beaver Carbonate—The new compressor at this mine has been started. Development work in the large orebody on the 700-ft. will now be hastened.

Commonwealth—Two drifts are being driven on the 400-ft. level; both show considerable ore.

Harrington-Hickory—This property owned by the Majestic Mining Company has opened a shoot of fine lead-silver ore on the 500-ft. level, just above water level. The entire face of the drift is in ore.

Peacock Consolidated—Three fissures are being prospected by drifts. In one of these, ore carrying gold, copper and silver has been found, and in another 2½ ft. of good lead-silver ore shows.

DAVIS COUNTY

Buckland Mining Company—This company has been incorporated for \$100,000, the shares having a par value of 10c. The company will develop 14 claims in the Farmington mining district.

TOOELE COUNTY

Shipments—During the week ending Feb. 5, the Tintic mines have shipped as follows: Dragon Iron, 29 small cars; Colorado, 62; Ajax, 4; Brooklyn, 7; Beck Tunnel, 4; Swansea, 6; Black Jack, 2; Horn Silver, 4 small cars. The Centennial Eureka mine shipped 44 large cars; Eureka Hill, 8; Gemini, 2; Yankee, 2; May Day, 2; Eagle & Blue Bell, 1; Bullion Beck, 2; Sioux Consolidated, 14; Iron Blossom, 3; Ajax, 1 large car.

JUAB COUNTY

Bullock—At this property good copper-silver ore has been cut in the shaft at a depth of 190 feet.

Eureka Lilly—The shaft is being retimbered to the 300-ft. level. As soon as this work is completed drifting will commence.

Tintic Standard—A crosscut is being driven on the 400-ft. level, but it will be some time before the vein is reached.

SALT LAKE COUNTY

Big Mitt—A shaft is being sunk on the vein. Some of the ore assays several thousand dollars in gold and as high as 26 per cent. copper.

SUMMIT COUNTY

Shipments—The Park City mines shipped as follows for the week ending Feb. 5: Silver King, 1,951,480 lb.; Daly-West, 1,150,000; Daly-Judge, 683,000; Daly-Judge, zinc, 800,000 lb., or a total of 4,584,480 lb. The smelter settlements for the week ending Feb. 6 were \$675,000.

Woodman—This group consisting of six claims has been added to the property of the Ohana Mining Company. On the Woodman there is a good showing of gold-silver-copper ore; the company also owns water rights. The Ohana company will run a tunnel 700 ft. long, to cut three veins which have promising surface showings.

Wyoming

CARBON COUNTY

Penn-Wyoming Copper Company—The properties of this company, which has been operating mines, mills and a railroad at Encampment, are reported sold to a new \$10,000,000 corporation, the United Smelters, Railway and Copper Company.

Canada

ONTARIO—COBALT DISTRICT

Ore Shipments—Shipments of ore from Cobalt for the week ending Feb. 6 were as follows: Buffalo, 44,260 lb.; Coniagas,

126,590; Crown Reserve, 272,540; Kerr Lake, 81,637; La Rose, 310,620; McKinley-Darragh, 41,000; Nipissing, 255,310; O'Brien, 64,040; Temiskaming, 120,000; Trethewey, 125,400; total, 1,441,397 pounds.

City of Cobalt—In the course of sinking a winze from the 200-ft. to the 300-ft. level a rich strike was made at a depth of 225 ft. from the surface, the vein having a width of 9 in. of high-grade ore. Native silver slabs and argentite were found.

Crown Reserve—A strike has been made in the north crosscut at the 100-ft. level, consisting of two veins, each about 3 in. wide, and 15 in. apart. One of the veins gives an assay of 12,000 oz. of silver to the ton and the other more than 2000 ounces.

La Rose—On the McDonald vein at the tunnel level the width has increased from 2 to 6 in., the ore still showing high silver contents and yielding in places over 10,000 oz. to the ton. In No. 10 tunnel stoping is in progress. The shaft on No. 3 vein is being continued from 125 to 150 ft. or deeper. On Feb. 10 the Imperial Privy Council gave judgment in the appeal case in the suit of the La Rose Mining Company against the Temiskaming & Northern Ontario Railway Commission. The La Rose, owning property on each side of the track, claimed the right to mine under the railway. The Canadian court decided against them and this decision was confirmed by the Privy Council and the appeal dismissed.

McKinley-Darragh—The big concentrator with a capacity of upward of 60 tons per day is now in operation. The winze by which the 200-ft. level is reached will be sunk an additional 100 ft. At the bottom of the winze is from 3 to 4 in. of high-grade ore. On the Savage property No. 2 shaft is down 112 ft. The financial statement presented at the annual meeting showed receipts from sales of ore during the year, \$345,792. The expenditures included additions to plant, \$46,231; operation and development, \$139,921, and dividend, \$202,309. The amount of cash on hand at the end of 1908 was \$46,612.

Peterson Lake—On the leasehold of the Kerry Mining Company, ore showing good silver contents has been found at 95 ft. in the main shaft. A vein 2 to 4 in. wide, which had previously shown niccolite, has run to cobalt with native silver.

Station Grounds Mining Company—This company is negotiating contracts with the Cobalt Lake Company to prospect its holding from the working of the Cobalt Lake. The west drift of the latter company is under the lake for several hundred feet at a depth of 154 ft. and is now within 50 ft. of the Station Grounds boundary.

ONTARIO-GOWGANDA DISTRICT

Bonsall Claims—These claims, comprising 320 acres, the first to be staked and developed in the region, have been purchased by Hon. Clifford Sifton and M. J. O'Brien for \$500,000. Several veins of native silver have been found.

ONTARIO—LARDER LAKE

Dr. Reddick—At the annual meeting held at Ottawa Feb. 1 the shareholders rejected a proposition to amalgamate with the Cleopatra mine and the Richardson claim of the Larder Lake district. It was decided instead to issue \$500,000 more of 8-per cent. cumulative preference stock, bringing the capital up to \$2,500,000—only \$300,000 of the amount to be issued at present. The report of the superintendent showed that the first 30 tons milled yielded \$8 and the next 100 tons between \$10 and \$12 per ton.

Mexico

CHIHUAHUA

Barranca de Cobre—Mendoza and Nesbitt, leasing operators of this mine and mill in the Urique section, are making regular shipments of high-grade copper-gold ores and concentrates to the Aguascalientes plant of the American Smelting and Refining Company.

Cerro de Tarahumares—Promising lead-silver properties are being exploited in this section 30 miles west of Conchos on the Mexical Central. Among the operators are Leon Escobar and Luis Terrezas, Jr., of Chihuahua.

Guazapares—Since the opening up of the Rio Plata silver mine there has been prosecuted successful prospecting at a number of localities tributary to this old camp. One of the best prospects is that opened up by L. S. Ferry and W. E. Orr.

Zinc Ores—Following the recent affirmative decision of the United States Court of Appeals in placing carbonates in the calamine class as duty-free in importation to the United States, there is evidenced a greatly increased demand for Chihuahua zinc ores. Large United States concerns have lately had representatives in the field and the closing of several large contracts with producers in the St. Eulalia, Los Lamentos and other districts is reported. A number of zinc mines and prospects have also been optioned to responsible men and the indications point to an early and marked improvement in the State's zinc industry.

Hidalgo—This Boston company is now preparing for the equipment and operation of its property situated 80 miles north of Parral. J. V. Dignowity is managing director, and E. L. Dignowity is the superintendent.

GUANAJUATO

Production—Shipments of concentrates for the week ending Feb. 8 to the smelter at Aguascalientes amounted in value to

\$90,500. During the same period \$175,000 in bullion was shipped to the refinery at Mexico City.

JALISCO

Chatterton Mining Company—The mines of this company in the Tapalpa district have been sold to W. H. Baldwin, of Delavan, Ill. The Virginia and the San Antonio are the principal mines of the group. There is a 10-stamp mill and concentrating plant.

SONORA

Black Mountain—The new oil-burning machinery for the power house at Magdalena has arrived and will probably be installed ready for operation about the middle of February.

Douglas Copper Company—The company smelter at Fundicion and the mines at El Cobre, which have been idle for several months, are expected to be in operation about the middle of February, according to the resident manager.

Quintera Mining Company—The mill has shut down and some of the old material is being disposed of. The management is reticent as to the cause of the shutdown, but refuses to dispose of any of its new material or stock supplies. The company is controlled and managed by a French syndicate.

San Antonio de La Huerta—The San Antonio Copper Company was organized under Arizona laws last October as a holding company for the San Antonio Copper Company, S. A., of Mexico, which owned this property in Sonora. The holding company has 250,000 shares of stock, par value \$10, of which 100,000 have been issued as full paid, 100,000 shares issued upon which \$1 per share has been paid in and 50,000 shares remain in the treasury. The board of directors of the company comprises John Uno Sebenius, director of the North Butte Mining Company; L. W. Powell, vice-president of the Calumet & Arizona Copper Company; E. G. Kingsford, of Michigan; C. D. Fraser, of New York, and D. G. Kerr, of Pittsburg. Otto C. Davidson is president, J. A. Crowell vice-president and George J. Eisele secretary and treasurer, all of Iron Mountain, Mich. The property is 80 miles from a railroad, but the Cananea, Yaqui River & Pacific railroad should be built to the property by January 1, next. The property is in the early stages of development, but the work to date has disclosed high-grade ore.

Zambona Development Company—The Zambona, at Minas Nuevas, is preparing to resume active operations and will install a new 200-ton plant for fine grinding and cyaniding. This equipment will consist of tube mills, Pachuca agitators, vacuum filters, classifying machinery, pumps, etc. A. J. Yeager is the general manager.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, Feb. 17—The bituminous coal trade in the East continues quiet, no activity having developed since our last report. Manufacturers seem to be using only a moderate amount of coal, and are very reluctant to replenish their stocks.

The anthracite trade continues dull. The decrease in January shipments as compared with last year is apparently a forerunner of other losses to come. The anthracite companies, as a rule, are not running their mines full time. Most of them are operating only three or four days in a week. Even at that, coal is still being stocked in anticipation of the strike or suspension of mining which everyone now believes is sure to come in the spring, when the present agreement will expire. It is understood that President Lewis of the United Mine Workers has notified the anthracite companies of his readiness to discuss with them the question in dispute. No answer has been made, however, and it is quite probable that the companies will refuse to take up the question with anyone outside of their own employees.

In the West there is a little improvement in trade here and there, but no general advance. Steam coal continues dull and the mild weather still restricts the domestic demand. The recent storms brought some cold weather with them, but it did not last long enough to have any permanent effect on the trade.

The committee appointed by the Pittsburgh coal operators has had one hearing before the Interstate Commerce Commission but the matter was adjourned in order to give the railroads time to present facts. The claim made by the Pittsburgh people is that the present rates on coal to Lake Erie ports constitute an unlawful discrimination against the Pittsburgh district and in favor of West Virginia and Ohio coals. The Ohio people—particularly those in District No. 8 and the Hocking Valley—while willing to admit discrimination in favor of West Virginia, maintain that their rates are unequal also. They think that the Pittsburgh people desire an unfair advantage

COAL TRAFFIC NOTES

The coal production of Colorado in 1908 is reported as follows: Anthracite, 69,440 tons; bituminous, 6,824,117; semi-bituminous, 818,216; lignite, 1,991,234; unclassified and small mines, 70,000; total, 9,773,007 short tons.

Tonnage originating on Pennsylvania railroad lines east of Pittsburgh and Erie, year to Feb. 8, 1908, and Feb. 6, 1909, in short tons:

	1908.	1909.	Changes.
Anthracite.....	546,046	492,720	D. 53,326
Bituminous.....	3,275,980	3,496,394	I. 220,414
Coke.....	725,922	1,016,582	I. 290,660
Total.....	4,547,948	5,005,696	I. 457,748

Average daily tonnage, 116,614 in 1908, and 135,289 in 1909; increase, 18,675 tons.

Shipments of coal passing Lock No. 4 on the Monongahela river for the year were 8,336,620 short tons in 1907, and 6,095,880 in 1908; a decrease of 2,240,740 tons, or 26.9 per cent.

Coal receipts at Boston in January reported by Chamber of Commerce:

	1908.	1909.	Changes.
Anthracite.....	141,579	99,855	D. 41,724
Bituminous.....	244,016	226,444	D. 17,572
Total domestic....	385,595	326,299	D. 59,296
Foreign.....	45,702	28,200	D. 17,502
Total.....	431,297	354,499	D. 76,798

The foreign coal comes chiefly from Nova Scotia mines.

Coal and coke tonnage, Chesapeake & Ohio railway, six months ended Dec. 31, short tons:

	Coal.	Coke.	Total.
New River.....	3,288,078	108,855	3,396,933
Kanawha.....	2,638,150	15,205	2,653,355
Kentucky.....	180,860	.....	180,860
Connecting lines....	129,315	35,329	164,644
Total.....	6,236,403	159,389	6,395,792
Total, 1907.....	6,050,533	221,134	6,271,667

Deliveries in 1908 to points west of mines, 3,290,177 tons coal and 96,184 coke; points east, 774,049 tons coal and 63,205 coke; tidewater, 2,164,639 tons coal; anthracite to line points, 4538 tons.

New York

ANTHRACITE

Feb. 17—The anthracite trade locally is in the same quiet condition that it has been in for some time past. It is still a weather market, and the weather has not been such as to stimulate the demand for coal. Many collieries are running short time and this has resulted in a rather smaller supply of the steam sizes. There is enough, however, of these sizes to meet current demand. Domestic sizes are still being stocked on a large scale.

Prices are unchanged. The list prices for prepared sizes are \$4.75 for broken, and \$5 for egg, stove and chestnut. Small steam sizes are: Pea, \$3.25@3.50; buckwheat No. 1, \$2.35@2.50; buckwheat No. 2 or rice, \$1.60@2; barley, \$1.35@1.50; all f.o.b. New York harbor points.

BITUMINOUS

The discussion of yearly contracts is still in order. It is held back for the time by the fact that the railroads have not yet announced the rates for the coming season. It is generally believed, however, that there will be no change from last year and a few contracts have been made. Producers are not willing to make any concessions from the low prices of last year, and it is quite possible that contract prices may be a shade higher.

As far as current business is concerned the Far East is taking no coal. Business is dead and dealers are wondering how consumers have made their stocks hold out. The Sound ports are buying some coal, but not in a large way. New York harbor is a bargain counter and business depends on the small necessities of the buyer. Good grades of steam coal are selling at \$2.40@2.50 f.o.b. harbor shipping port, while lower grades can be had at \$2.20@2.30. All-rail trade seems to be better than tidewater and more coal is being taken. Car supply is abundant and transportation is fair, coal coming through on about schedule time.

The Coastwise market is slow and vessels are hunting for charters. The rates still continue pegged at 75c. from Philadelphia to around Cape Cod. The quoted rates for large vessels from Philadelphia are: Boston, Salem and Portland, 75c.; Lynn and Bath, 85c.; Newburyport, 95c.; Portsmouth, 80c.; Providence, New Bedford and the Sound, 65@70c. per ton.

Birmingham

Feb. 15—The coal trade in Alabama is quiet, and there is a curtailment of production. Never before has there been such a slack demand during the winter as at present. Chief State Mine Inspector Edward Flynn states that the production is off at the present as compared to the latter part of 1908, and that conditions are approaching those that prevailed a year ago.

There is no need for such a large production of coke, and as a consequence some of the ovens are to be cut off while others have been cooled off already. There is a large quantity of coke already stacked up.

Chicago

Feb. 15—Cold weather in the last week has increased the demand for both bi-

tuminous and anthracite, and has bolstered up prices that were inclining downward because of the previous unseasonable weather. This situation is encouraging for the immediate future, but affects domestic coals more than steam and is looked upon by the trade as likely to be of brief duration. The real improvement that is looked for is a general increase in the demand for steam coal and there are no signs as yet that such a change is at hand. Eastern as well as Western coals have been benefitted by weather conditions, though there is still a condition of general overloading of the market by eastern coals.

Illinois and Indiana lump brings \$1.80 @2.40, run-of-mine \$1.60@1.75 and screenings \$1.40@1.60. Smokeless, the leading coal from east of Indiana, continues in such large supply that sacrifice prices are made to escape demurrage, the list being cut 15@25c., making Pocahontas and New River lump \$3.05@3.45, and run-of-mine, \$2.85@3.15. Hocking Valley likewise has been in too large supply, but is now holding up nearer to the list price of \$3.15 than for many weeks, though some has sold at \$2.75 in the last week. Youghiogheny moves almost wholly on contracts at \$3.15 for ¾-in. gas and Pittsburgh No. 8 is slow at \$2.65@2.75.

The anthracite market has notably improved in the last three or four days, but individual sales are small, though widely distributed.

Cleveland

Feb. 16—The cold snap has cheered up the retailers, and consumption of domestic coals has improved, but hardly enough to call for any change in prices. In steam coals there is no alteration in conditions. Slack continues to sell better than lump or run-of-mine. There is much interest here in the movement to adjust rates on coal for Lake shipment.

Indianapolis

Feb. 15—E. L. Wolford, president of the United Fourth Vein Mining Company, has closed a contract with the United States Steel Corporation for from 7500 to 15,000 tons of Fourth Vein coal a day. The Fourth Vein company owns seven mines in the Linton district. Part of these have been idle for several months and others have only been kept in operation as the business permitted. The new contract, with the other business that will be handled, is expected to improve working conditions in this field very materially.

The United Mine Workers have finally adjourned, the most interesting point left unsettled being the anthracite situation, which is now in the hands of President Lewis and the special committee. The

executive board will hold a meeting March 15, in Indianapolis.

Pittsburg

Feb. 16—During the week the Crucible Steel Company of America sent out inquiries for its supply of coal for the year beginning April 1. It usually takes 200,000 tons and the Pittsburg Coal Company has held the contract for several years. They will be strong competition for the business, as annual contracts this year are rare. Consumers who heretofore made contracts in January for the year are buying only as they need the coal. When asked to renew old contracts they say they do not know whether they will need any coal this summer. The mines are running about the same as last week, the river mines being in full operation and the railroad mines running about 35 per cent. The Pittsburg-Buffalo company is doing better than other concerns as its production is around 70 per cent. The Marianna mine, where the great disaster occurred in December, is in full operation. The rivers reached a coal-boat stage this morning and so far about 2,000,000 bu. of coal have gone down to lower ports. More coal likely will be sent out tomorrow. Prices remain unchanged and are on the basis of \$1.15 a ton for mine-run coal at the mine. Slack is selling at 65c. at mine.

Connellsville Coke—Outside of the placing of a few contracts for furnace coke the week was a dull one. Several small orders were received for foundry coke at reduced prices. Most of the producers are holding furnace coke for prompt shipment firmly at \$1.75 and on contract at \$1.90@2. Some sales were made at about 15c. a ton less. Foundry coke has declined and \$2@2.15 is quoted for both spot and for deliveries running to July 1. The *Courier* gives the production in both fields at 262,156 tons. The shipments amounted to 9674 cars as follows: To Pittsburg district, 3488; to points west of Pittsburg, 5306; to points east of Connellsville, 880 cars.

Foreign Coal Trade

German Coal Trade—Imports and exports of fuel in Germany, year ended Dec. 31, metric tons:

Imports:	1907.	1908.	Changes.
Coal.....	13,721,509	11,661,503	D. 2,060,006
Brown coal.....	8,963,103	8,581,966	D. 381,137
Total coal.....	22,684,612	20,243,469	D. 2,441,143
Coke.....	584,221	575,924	D. 8,297
Briquets.....	195,404	192,391	D. 3,013
Exports:			
Coal.....	20,061,400	21,062,362	I. 1,000,962
Brown coal.....	22,065	27,877	I. 5,812
Total coal.....	20,083,465	21,090,239	I. 1,006,774
Coke.....	3,793,073	3,579,278	D. 213,795
Briquets.....	1,301,661	1,493,104	I. 191,443

Coal exports exceeded imports in 1908 by 846,770 tons; coke exports were in ex-

cess by 3,003,354, and briquets by 1,300,713 tons.

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices of coal as follows, on Feb. 6: Best Welsh steam, \$3.42; seconds, \$3.24; thirds, \$3.12; dry coals, \$3.48; best Monmouthshire, \$3.06; seconds, \$2.94; best small steam, \$2.16; seconds, \$1.92. All per long ton, f.o.b. shipping port.

Iron Trade Review

New York, Feb. 17—The iron and steel trades continue to be in a waiting condition. The combined effect of the expected changes in the tariff and the general belief in a coming reduction of prices have kept the markets extremely quiet, in almost all lines. While the tariff discussion has its effect, the price question is really the leading influence at the present time. Cutting is reported in almost every kind of finished material. No open action has been taken by the leading interest, but there is no doubt that some step in this direction is under serious consideration. A significant point is that a contract with the Steel Corporation for plates which has existed for some years on the part of a large steel-car manufacturer has expired, and has not been renewed, the company preferring to buy in the open market.

In pig iron, business is very dull, few new orders coming in. Northern furnaces are nominally maintaining prices, but there is no difficulty in securing concessions on a good order. The foundries are buying only for immediate needs and no placing of contracts is reported. The only melters who seem to be at all well supplied with orders are the cast-iron pipe makers, most of whom have a good deal of work on hand. In the South, furnaces are claiming that the price of \$13 base for No. 2 foundry at Birmingham is maintained, but it is currently reported that business has been taken at 25 and 50c. less.

In finished material there is nothing doing except in structural material and plates. The structural people are taking some contracts and there are a number of building projects ready to be put in hand, but the question of prices is holding purchasers back. The railroads have placed some orders for steel cars which will require a considerable tonnage of plates and shapes. Otherwise there is little railroad business coming forward and rail orders are at a minimum point.

An informal meeting and dinner of steel-trade representatives was held in New York, Feb. 17. No official statement was given out, and it is said that no positive action was taken, though there was a general discussion of the price question. The general belief is that a decision involving a general "readjustment" of prices may be expected at an early date. This will undoubtedly have a favorable effect on the trade.

Baltimore

Feb. 16—Exports for the week included 209,687 lb. tin scrap to Rotterdam; 2,025,542 lb. steel bars, 775,711 lb. galvanized sheets and 158,328 lb. tinplates to Panama. Imports included 1118 tons ferromanganese from Liverpool and 10,800 tons iron ore from Cuba.

Birmingham

Feb. 15—Southern pig-iron manufacturers are confident that there will be an improvement in general conditions before long. There has been no curtailment in the production yet. If inquiries which are coming in develop any business, there will be a demand for all the iron that can be manufactured. The orders which are being received now are in small lots. There has been no change made in quotations and the general price is \$13 per ton, No. 2 foundry. The make in this district is better than it has been for a year and a half. It is believed that production during this month will show an increase over January, though during that month there was more than 148,000 tons of iron reported. The home consumption is holding up well, the cast-iron pipe plants working practically full, the machine shops and foundries doing well and the steel plant of the Tennessee company doing fairly well.

The announcements of the reorganization of the Southern Steel Company and the statement that there will be a resumption of operations in the near future at several of the plants of this company, has had an encouraging effect.

Chicago

Feb. 15—The iron market continues very quiet. Sales of pig iron are in small lots. Everywhere melters seem inclined to go slowly and await developments—tariff legislation and the inauguration of a new President. Prices are weakening generally, though a collapse is apparently not looked for by buyers; even at lower prices, openly quoted, it is probable, to judge from the tone of opinion in the local trade, that buying would not be much larger. Carload lots up to 300 or 400 tons, with an occasional lot for more as the exceptional purchase, will apparently continue in vogue for the next week.

Quotations are not stable, remaining nominally at \$13 Birmingham (\$17.35 Chicago) for Southern No. 2 and \$17.50 for Northern No. 2. Cuts of 25 to 50c. under these figures evidently prevail and a large sale might bring still lower prices. That there is a sagging tendency in Southern cannot be denied, but it is asserted in some quarters that Northern will remain fairly stable because of diminished output of the local furnaces.

Iron and steel materials are in general dull, though structural steel is in better

demand. Coke is weak at \$4.85 for the best Connellsville.

Cleveland

Feb. 16—No buying of iron ore is reported. The furnaces seem to be in no hurry to take ore, and sellers are not pressing. No action has been taken on prices for the coming season, but the general belief is that no change will be made.

Some inquiries for pig iron have been received, but no considerable sales are noted. The tendency is to shade prices where a fair order can be secured. No. 2 Northern foundry is quoted nominally at \$16.25@16.50, Cleveland, but sales are reported at 50c. less.

Finished material is dull, with the exception of some inquiries for structural steel.

Philadelphia

Feb. 17—No progress can be seen in pig iron. Foundry business is in small lots, and little is doing in basic. Some inquiries for this sort are in, but they have not produced results so far. While some furnaces are holding back and standing on their prices, others are hungry for business and are quite willing to make concessions to get it. Buyers are not in any hurry, apparently, and do not seem to think they will lose anything by waiting.

Steel Billets—Business has been disappointing, only a few small sales having been made, at unchanged prices.

Bars—The store demand is reported about the same as last month. The market is not in good shape, and iron bars have been offered at low prices; steel bars are also cut.

Plates—Some demand from car-builders has kept up this market, but prices are uncertain.

Sheets—No change is reported, and business is on a small scale.

Pipes and Tubes—Local business is only moderate, though a little more demand from boiler shops is noted.

Structural Material—New building contracts are talked about, but most of them seem to be held back on the price question. If that is settled right, there will be good business placed.

Scrap—Some dealers are quietly laying in stock, believing there will be a demand for it before long. Others, however, are letting things drift, and are afraid they will have to carry stock too long to make it profitable.

Pittsburg

Feb. 16—Efforts to maintain prices in all lines of finished iron and steel products and crude steel have failed and plans are now being perfected, it is understood, for

a general readjustment. It is known that the serious cutting of the regular rates on several important products by independent producer's has been responsible for the hesitancy on the part of buyers to come into the market for their usual requirements. The jobbers, who in former years replenished their stocks in January, are buying only for immediate needs. In order to bring out this business it has been decided to make a general cut. While these reports have not been officially confirmed by the large interests, indications are that they are not without foundation. Instead of small reductions as were made at the meeting of steel concerns in New York last June it is said the cuts will range from \$4 to \$7 a ton and will include billets, sheet-bars and all lines of finished products. While there has been no cutting of merchant pipe and tinplate, these products will be reduced owing to the cut in raw material. Steel bars will not come down very much, as prices are already low. Steel rails alone will not be affected. The uncertainty regarding the tariff has affected the iron and steel trade and it is expected that this will be removed soon after Congress meets. It is not believed here that any radical changes will be made. With the tariff and the price question adjusted satisfactorily there will be no apparent reason for further delay in buying.

Pig Iron—There is no pig-iron market, the only business being the shipping of iron on old contracts. Production is not being curtailed and stocks are piling up. The Carnegie Steel Company on Monday started its new No. 6 blast furnace at the Ohio works, Youngstown. It will make basic iron for the new open-hearth furnaces. The Midland Steel Company which operates one blast furnace at Midland, 25 miles below Pittsburg on the Ohio river, plans to build another furnace and contracts will be let in a short time. The new furnace will have a capacity of about 90,000 tons of foundry iron annually. Pig-iron quotations, in the absence of actual transactions, are nominal as follows: Standard bessemer, \$16; malleable bessemer, \$15.50; basic, \$15.25; No. 2 foundry, \$15; gray forge, \$14.25, all f.o.b. Valley furnaces.

Steel—There is no change in the market for crude steel. Billets are held at \$25 and sheet-bars, \$27.50, Pittsburg. Plates are still quoted at 1.60c. but sales are made at \$2 a ton less. Merchant steel bars are firm at 1.40 cents.

Sheets—Cutting of sheet prices continues and sales of all sheets are at \$2 a ton under what is regarded as the official prices which is as follows: Black sheets, 2.50c. and galvanized sheets, 3.55c. for No. 28 gage.

Ferro-Manganese—There is little doing, and while there are reports of low prices, dealers continue to quote \$45.50@46, Pittsburg.

Metal Market

New York, Feb. 17—The metal markets generally continue in a rather depressed condition. Demand has not improved, and there has been no recovery in prices.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
Dec. 1908..	\$ 7,358,707	\$ 5,122,538	Exp. \$2,236,169
" 1907..	1,004,441	44,448,515	Imp. 43,444,074
Year 1908..	71,215,456	50,246,099	Exp. 30,969,357
" 1907..	55,215,681	143,398,072	Imp. 88,182,391
Silver:			
Dec. 1908..	4,726,289	4,382,290	Exp. 349,999
" 1907..	4,413,698	4,222,036	" 191,662
Year 1908..	51,837,671	42,196,966	" 9,640,705
" 1907..	61,625,866	45,912,360	" 15,713,506

Exports from the port of New York, week ending Feb. 13. Gold, \$3,382,000, chiefly to Buenos Aires; silver, \$756,194, chiefly to Paris and London. Imports: Gold, \$136,583, from Central and South America; silver, \$104,203, from the West Indies and Mexico.

The mint price of gold in France is 3444.44 fr. per kilogram. A coinage charge of 7.44 fr. per kg. is deducted, making the net price paid for gold 3437 fr., or \$663.34 per kg. This is equal to \$20.63 per troy ounce.

Gold—The price of gold in the open market in London continues unchanged, 77s. 9d. per ounce being paid for bars and 76s. 4d. per ounce for American eagles. The Bank of England this week took nearly all the gold offered, including arrivals from the Transvaal and Australia. The Bank of France is still out of the market. In New York an additional shipment of \$500,000 is reported to Argentina, and it is generally expected that more gold will go out soon.

Platinum—The market is very dull and sales are lighter than for some time past, although they are better than at this time a year ago. Prices continue unchanged, dealers quoting \$23.50@24.50 for refined platinum; \$26 per ounce for hard metal and \$19@21 per ounce for scrap.

Our St. Petersburg correspondent writes, under date of Feb. 4, that prices are unchanged both in Ekaterinburg and in St. Petersburg. The demand is good, especially from Paris. The small miners expect loans from the State bank and an increase of prices as a result. A conference on the question of the loans is to be held soon. The quotation in St. Petersburg is 19,800@20,000 rubles per pood; at Ekaterinburg, 5 rubles per zolotnik, for crude metal, 83 per cent. These prices are equivalent to \$19.60 and \$18.80 per oz., respectively.

Silver—The market has been fairly steady the past week, declining to 23½d. in London on selling by Chinese banks. The market closes steady at 23 11/16d. on buying by India bazars.

SILVER AND STERLING EXCHANGE						
Feb.	11	12	13	15	16	17
New York....	51½	.....	51½	51½	51½	51½
London.....	23½	23½	23½	23½	23½	23½
Sterling Ex..	4.8725	.....	4.8720	4.8710	4.8710	4.8695

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

Shipments of silver from London to the East, year to Feb. 4, reported by Messrs. Pixley & Abell, London:

	1908.	1909.	Changes.
India.....	£ 799,900	£ 467,560	D. £ 332,340
China.....	451,400	80,000	D. 371,400
Straits.....	.....	61,000	I. 61,000
Total.....	£ 1,251,300	£ 608,560	D. £ 642,740

Imports for the week, £180,000 from New York. Exports, £11,500 to India.

Copper, Tin, Lead and Zinc

Feb.	Copper.		Tin.	Lead.		Zinc.
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.		New York, Cts. per lb.	St. Louis, Cts. per lb.	
11	13½@13½	13@13½	59	28½@4.02½	3.85@3.87½	4.72½@4.75
12	.....	.....	.....	.....	.....	.....
13	13½@13½	13@13½	.....	28½@4.02½	3.85@3.87½	4.72½@4.75
15	13½@13½	13@13½	58½	28½@4.02½	3.85@3.87½	4.72½@4.75
16	13½@13½	13@13½	58½	28½@4.02½	3.85@3.87½	4.72½@4.75
17	13½@13½	13@13½	58½	28½@4.02½	3.85@3.87½	4.72½@4.75

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium. Spelter prices given are at St. Louis; prices at New York, Feb. 11-17 were 0.15c. higher than St. Louis each day.

Copper—The lower prices have so far not attracted buyers. On the contrary, consumers, both in this country and in Europe, have withdrawn altogether except for their immediate needs, as they hope to force a further reduction. Business on this account has been more or less of a retail character. Some Lake has been reported sold to domestic consumers under special conditions at a price a little above the real market, but this grade has been freely offered by leading interests at 13½c. without drawing much business. Electrolytic has been dull. The market closes lower at 13½@13½c. for Lake copper; 13@13½c. for electrolytic copper in ingots, cakes and wirebars. The average of the week at which business in casting copper has been done is 12¾@13 cents.

Copper sheets, cold-rolled, 20c.; hot-rolled, 19c. per lb., base. Copper wire, 15¼c. base, carload lots at mill.

The speculative market in London has

been a very uninteresting affair throughout the week and prices close lower and barely steady at £58 7s. 6d. for spot, £59 2s. 6d. for three months.

Statistics for the first half of the current month show a decrease in the visible supplies of 700 tons.

Refined and manufactured sorts we quote: English tough, £62 10s.; best selected, £61 10s.@£62 10s.; strong sheets, £73 10s.@£74 10s.

Exports from New York and Philadelphia for the week are reported at 2571 long tons copper. Our special correspondent states the exports from Baltimore at 426 tons.

Supplies, deliveries and visible stocks of copper on Jan. 31, as reported by Henry R. Merton & Co., Ltd., London, in long tons:

	1908.	1909.	Changes.
Imp. in Jan. N. America...	36,143	19,295	D. 16,848
Chile	3,000	3,000	.....
Australia.....	1,668	2,600	I. 932
Other countries.....	5,789	6,278	I. 509
Total.....	46,580	31,173	D. 15,407
Stocks, Jan. 1.....	19,710	55,677	I. 35,967
Total supplies.....	66,290	86,850	I. 20,560
Deliveries in January.....	45,630	33,915	D. 11,715
Stocks, Jan. 31.....	20,660	52,935	I. 31,275

Deliveries in January, 1909, included 400 tons reshipped to America.

Tin—The London market has become very strong. It develops that supplies are again concentrated, and as shipments from the Far East are of moderate volume only, holders of the present supplies are in a position to advance the market easily, if they decide to do so. The close is cabled at £130 5s. for spot, £131 15s. for three months.

A fair business has been done in this market, especially among dealers, and prices have advanced at the close to 28¾ cents.

Lead—Orders are few and far between and the market is depressed at 3.85@3.87½c. St. Louis, 4@4.02½c. New York.

The London market has had a rally, due to covering of the bear contingent, but closes somewhat below the best price at £13 6s. 3d. for Spanish lead, £13 8s. 9d. for English lead.

Spelter—The lower prices have not as yet helped business, the uncertainty of the future of the iron and steel markets being the main restraining influence. The close is unchanged and easy at 4.72½@4.75 St. Louis, 4.87½@4.90c. New York. More or less speculative business in spelter is going on.

The close in London is cabled at £21 7s. 6d. for good ordinaries, £21 12s. 6d. for specials.

Base price of sheet zinc is 7c., f.o.b. La Salle-Peru, Ill., less 8 per cent.

The European Zinc Syndicate is to continue for two years from Jan. 1, 1909. One important maker—Giesche's Erben—did not go into the agreement, but doubtless will act in harmony with the syndicate.

Other Metals

Antimony—The market is almost dead for the present. In the absence of business prices are difficult to quote, but any sales must be made at a shade below last prices. Cookson's may be quoted 8½¢.; Hallett's, 8¢.; with 7¾@7½¢. for ordinary brands.

Aluminum—There are no new developments in this metal. The Aluminum Company of America continues to quote 24c. base for No. 1 ingots; 33@34c. base for sheets. Foreign metal is still offered at 22c., New York delivery. No considerable sales are reported.

Quicksilver—The market is quiet and business mostly of a retail order. Prices are unchanged, New York quotations being \$45@46 per flask of 75 lb. San Francisco quotations are also unchanged, being nominal at \$45@46 for domestic business and \$43@44 for export. The London price is still £8 7s. 6d. per flask, but down to £8 5s. is quoted by jobbers.

Nickel—Large lots, contract business, 40@45c. per lb. Retail, from 50c. for 2000-lb. lots up to 55c. for 500-lb. lots. These quotations are for spot nickel. The price for electrolytic is 5c. higher.

Cadmium—In 100-lb. lots, 75c. per lb., at Cleveland, Ohio.

Magnesium—This material is offered in New York at \$1.25 per lb. in 100-lb. lots. The price is \$1.40 per lb. for 5-lb. lots.

Petroleum Exports

Exports of mineral oils from the United States in January, in gallons:

	1908.	1909.
Crude.....	5,746,394	13,043,008
Naphthas.....	2,162,176	6,001,809
Illuminating oils.....	80,865,494	82,937,688
Lubricating oils.....	12,948,426	10,096,652
Residuum.....	3,399,627	8,457,198
Total.....	105,122,057	120,536,355

Paraffin is included in lubricating oils. Increase this year, 15,414,298 gal., or 14.7 per cent.

Zinc and Lead Ore Markets

Platteville, Wis., Feb. 13—The highest price paid for zinc ore this week was \$38; the base price for 60 per cent. zinc was \$36@37 per ton.

Lead ore, 80 per cent., sold Tuesday at \$50 per ton, but offerings were later lowered to \$46 per ton.

SHIPMENTS, WEEK ENDED FEB. 13

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville.....	576,240	.....	154,200
Hazel Green.....	350,700	67,700	.....
Benton.....	249,470	.....	.....
Linden.....	221,570	.....	.....
Strawbridge.....	185,000	.....	.....
Cuba City.....	118,340	75,340	.....
Galena.....	75,000	.....	.....
Livingston.....	50,000	.....	.....
Shullsburg.....	.....	50,000	.....
Total.....	1,824,320	193,040	154,200
Year to Feb. 13.....	14,038,826	446,000	1,315,600

There was shipped in the three weeks previous, not heretofore reported, from Highland, 400,740 lb.; from Linden, 367,650 lb.; from Harker, 280,910 lb. zinc ore; from Linden, 50,160 lb. lead ore.

There was shipped this week to the American Zinc Ore Separating Company 146,100 lb.; to the Joplin Separator Works, 271,010 lb. zinc ore.

Joplin, Mo., Feb. 13—The highest price reported paid for zinc sulphide ore was \$40, the base ranging from \$35 to \$38 per ton of 60-per cent. zinc. About 150 tons sold on the highest base, purchased on Tuesday when a blizzard was predicted by the weather bureau. There was no change in zinc silicate, which sold on a base of \$19@22 per ton of 40-per cent. zinc and as high as \$26. It is conceded the bottom has been touched, the market indicating a slightly increased strength at the week-end. Nearly half the lead shipment was from purchases of the two previous weeks, which sold at \$52@53 per ton, but the highest offering of this week was \$51, closing the week at \$50 per ton.

Mine wages have generally been reduced to the level of last year and with almost every day ideal for outputting the production continues strong, but the heavy shipment this week exceeded the output

SHIPMENTS, WEEK ENDED FEB. 13

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville.....	4,492,540	1,478,340	\$114,908
Joplin.....	1,734,830	318,210	38,434
Galena.....	1,076,400	45,860	20,034
Duenweg.....	910,910	117,980	17,018
Miami.....	796,880	116,150	14,856
Prosperity.....	583,730	43,170	11,045
Alba-Neck.....	477,060	.....	8,109
Spurgeon.....	340,460	112,930	6,985
Aurora.....	413,080	20,140	6,556
Granby.....	331,850	6,900	4,255
Quapaw.....	223,620	.....	3,678
Badger.....	174,550	.....	3,045
Sarcoie.....	176,290	.....	2,778
Carthage.....	129,230	.....	2,196
Carl Junction.....	86,880	8,670	1,911
Zincite.....	79,420	4,500	1,542
Stott City.....	40,900	.....	450
Totals.....	12,068,630	2,272,750	\$257,700
Seven weeks.....	72,979,580	11,411,700	\$1,645,519
Zinc value, the week, \$199,142;	7 weeks, \$1,349,617		
Lead value, the week, 58,558;	7 weeks, 295,902		

MONTHLY AVERAGE PRICES

Month.	ZINC ORE.				LEAD ORE.	
	Base Price.		All Ores.		All Ores.	
	1908.	1909.	1908.	1909.	1908.	1909.
January.....	\$37.60	\$41.25	\$35.56	\$38.46	\$46.88	\$52.17
February.....	36.63	.....	34.92	.....	49.72	.....
March.....	36.19	.....	34.19	.....	49.90	.....
April.....	35.40	.....	34.08	.....	52.47	.....
May.....	34.19	.....	33.39	.....	56.05	.....
June.....	33.06	.....	32.07	.....	60.48	.....
July.....	34.55	.....	31.67	.....	59.90	.....
August.....	36.53	.....	33.42	.....	60.34	.....
September.....	37.63	.....	34.44	.....	54.59	.....
October.....	35.95	.....	33.28	.....	52.63	.....
November.....	39.13	.....	35.02	.....	54.53	.....
December.....	42.75	.....	39.63	.....	49.68	.....
Year.....	\$36.63	.....	\$34.31	.....	\$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

about 500 tons, reducing the bin stock to approximately 6500 tons.

Chemicals

New York, Feb. 17—The general situation continues unchanged from our last report. Business is quiet and without any animation.

Copper Sulphate—While demand is still fair, prices are a little lower than last week. The present quotations are \$4.60 per 100 lb. for carload lots, while \$4.85@5 per 100 lb. is asked for smaller parcels.

Arsenic—The market is quiet with small sales, but prices are unchanged. Current quotations are 3@3½¢. per lb. for white arsenic.

Nitrate of Soda—Trade is rather dull. Prices are unchanged, spot nitrate selling for 2.15¢. For futures 2.12½¢. is asked for all positions.

Mining Stocks

New York, Feb. 17—The general stock market has varied from day to day without much significance. Business has been quite moderate in volume, and prices have advanced and receded alternately. Early in the week there was a slightly stronger tendency, but this was followed by a weakening in quotations, and the close is near the point of depression. It is claimed that the tone is good, but the activity is lacking.

On the Curb there was a good deal of trading in the copper stocks, but the close showed some weakness in nearly all the prominent companies. Only one or two held up to the earlier level. The Nevada gold stocks were a little more active than recently, but without any gain in prices. Cobalt stocks were in fair demand. There was free buying, but no advance.

Boston, Feb. 16—There has been prime speculation in the Lake mining issues, particularly those that have got a Calumet & Hecla tag attached to them. Notwithstanding denials, it is believed that negotiations for the taking over of the Bigelow properties by Calumet & Hecla interests have been practically concluded and it is only a matter of detail which prevents an official announcement. There has been some response in other stocks, but it has been feeble. The continued weakness of the metal and the lack of demand mitigates against any sustained upward movement. The closing of the exchange over from Thursday until Monday tended to restrict business and make a short week of it. The declaration of regular quarterly dividends of \$1 each by the North Butte and the Quincy companies had no effect, marketwise.

Isle Royale and Superior Copper divided attention for a spell. The former sold up \$4.50 to \$33, maintaining its strength, and

Superior rose \$6.25 to \$45.25. In the case of the former it is believed that it occupies a strategic position in Calumet & Hecla's plans. In Superior favorable mill runs have been the cause of the speculation largely.

Atlantic rose \$2.50 to \$17.75. Favorable underground developments are reported from that quarter and it is said to be earning mining expenses. La Salle also came in for a rise, moving up \$2.75 to \$16.75. Osceola rose \$4 to \$136, Tamarack \$8.50 to \$88.50, Allouez \$5.50 to \$45, and Centennial \$2.75 to \$34.75.

East Butte has had a good market and rose \$1.87 1/2 to \$13.50 on heavy trading. Boston Consolidated has been weak, falling \$1.75 to \$12.50 on free offerings.

Dominion Iron and Steel is up 15, to \$35, on the judgment awarded in its suit against the Dominion Coal Company.

Superior & Boston mining has been taken from the Curb and put on the unlisted department of the Stock Exchange. The 100,000 shares of Rhode Island Copper have been stricken from the list as practically all of its shares have been exchanged for Franklin. Contest for control of the Victoria Copper Mining Company will appear at the annual meeting Feb. 23.

Seneca and Ahmeek made new high records on the Curb, the former touching \$105 and the latter \$165. They are both Bigelow properties. The curb has temporarily suspended trading in Southwest-ern Development shares.

STOCK QUOTATIONS

Table with columns for NEW YORK Feb. 16 and BOSTON Feb. 16. Lists companies like Alaska Mine, Amalgamated, Anaconda, Balakiala, British Col. Cop., Buffalo Mines, Butte Coalition, Colonial Silver, Cum. Ely Mining, Davis Daly, Dominion Cop., Douglas Copper, El Rayo, Florence, Foster Cobalt, Furnace Creek, Giroux, Gold Hill, Goldfield Con., Granby, Greene Gold, Greene G. & S., Guanajuato, Guggen. Exp., Hanapah, Kerr Lake, McKinley Dar., Miami Copper, Micmac, Mines Co. of Am., Mitchell Mining, Mont. Sho. C., Nev. Utah M. & S., Newhouse M. & S., Nipissing Mines, Old Hundred, Silver Queen, Stewart, Tennessee Cop'r., Tri-Bullion, Union Copper, Utah Apex, Utah Copper, Yukon Gold.

*Ex. Div. †Ex. Rights.

‡Last quotation.

N. Y. INDUSTRIAL Feb. 13. Table with columns for company name and price. Includes Am. Agri. Chem., Am. Smelt. & Ref., Am. Sm. & Ref. pf., Colo. Fuel & Iron, Federal M. & S., National Lead, National Lead, pf., Pittsburg Coal, Republic I. & S., Republic I. & S., pf., Sloc-Sheffield, Standard Oil, U. S. Steel, U. S. Steel, pf., Va. Car. Chem.

BOSTON CURB Feb. 13. Table with columns for company name and price. Includes Ahmeek, Black Mt., Chemung, Globe Con., Hancock, Helvetia, Keweenaw, North Lake, Ojibway, Superior & Bost.

Furnished by Horn-blower & Weeks, N. Y.

ST. LOUIS Feb. 13. Table with columns for company name and price. Includes Adams, Am. Nettle, Centor Cr'k, Cent. C. & C., C. C. & C. pd., Cent. Oil, Columbia, Con. Coal, Doe Run, Gra. Bimet., St. Joe.

LONDON Feb. 17. Table with columns for company name and price. Includes Dolores, Stratton's Ind., Camp Bird, Esplanza, Tomboy, El Oro, Oroville.

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS Feb. 17. Furnished by Weir Bros. & Co., New York.

Table with columns for Name of Comp., Clg., and Price. Divided into COMSTOCK STOCKS, TONOPAH STOCKS, and GOLDFIELD STOCKS. Includes Silver Pick, St. Ives, Triangle, Bullfrog Stocks, Gibraltar, Homestake King, Mont. Shoshone C., Tramp Cons., etc.

COLO. SPRINGS Feb. 12.

Table with columns for Name of Comp. and Clg. Includes Acacia, Black Bell, C. C. Con., Dante, Doctor Jack Pot., Elkton, El Paso, Findlay, Gold Dollar, Gold Sovereign, Isabella, Jindex, Jennie Sample, Jerry Johnson, Mackinney, Pharmacist, Portland, Un. Gold Mines, Vindicator, Work.

Assessments

Table with columns for Company, Delinq., Sale, Amt. Includes Addie, Utah; Atlantic, Ida.; Belcher, Nev.; Bullion, Nev.; East Hercules, Wash.; Gould & Curry, Nev.; Lady Washington, Nev.; Little Chief, Utah; National, Mich.; Oreano, Idaho; Overman, Nev.; Reindeer, Ida.; Seven Bros.-Picoche, Nev.; Sierra Nevada, Nev.; Silver Eagle, Ida.; Socrates, Cal.; Spanish Ridge, Cal.; Surprise, Ida.; Temple, Ida.; Utah-United, Utah; Zeibrigt, Cal.

Monthly Average Prices of Metals SILVER

Table with columns for Month, New York (1908, 1909), and London (1908, 1909). Lists months from January to December and a yearly average.

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

Table with columns for NEW YORK (Electrolytic, Lake) and LONDON, with sub-columns for 1908 and 1909. Lists months from January to December and a yearly average.

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Table with columns for Month, 1908, 1909, and another set of 1908, 1909. Lists months from January to June and an average year.

Prices are in cents per pound.

LEAD

Table with columns for Month, New York (1908, 1909), and London (1908, 1909). Lists months from January to December and a yearly average.

New York, cents per pound. London, pounds sterling per long ton.

SPELTER

Table with columns for Month, New York (1908, 1909), St. Louis (1908, 1909), and London (1908, 1909). Lists months from January to December and a yearly average.

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