The Engineering and Mining Journal

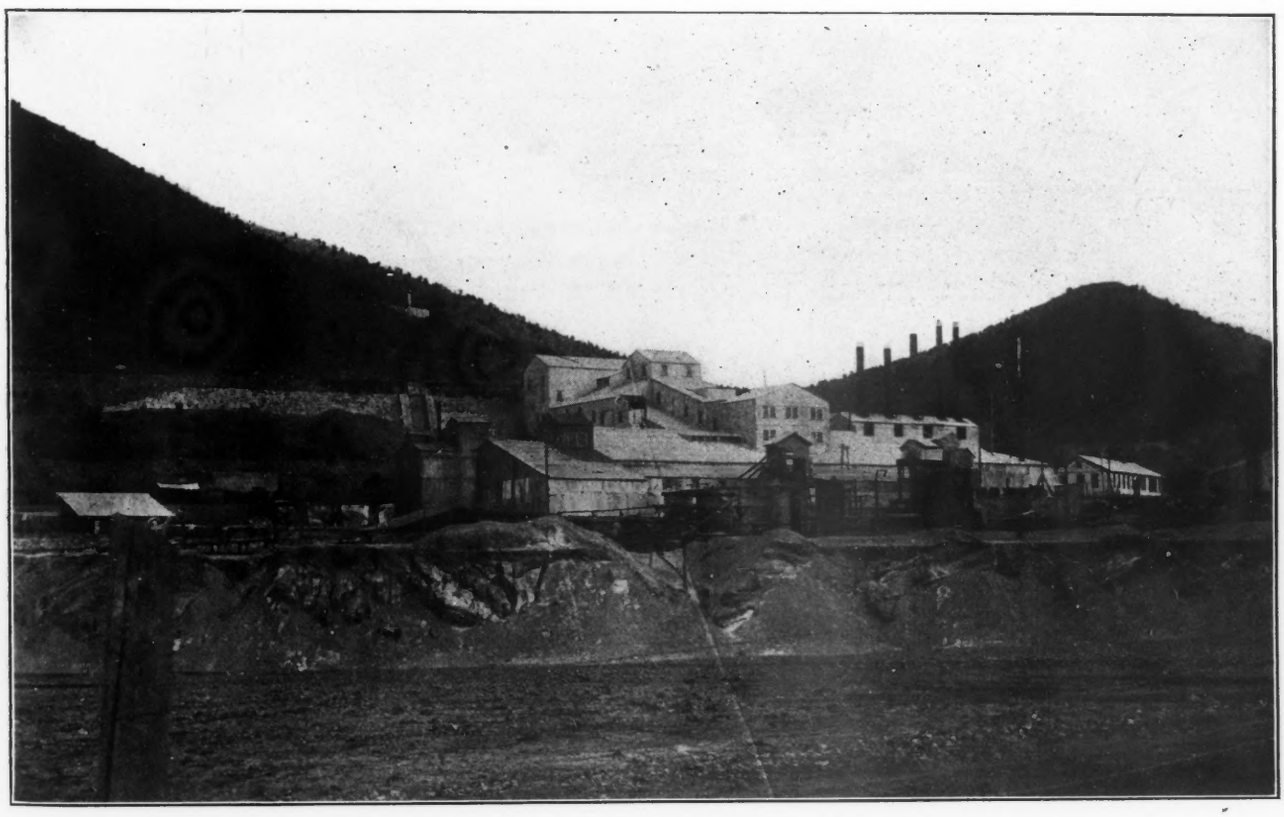
VOL. LXXXVI. NEW YORK, AUGUST 1, 1908. NO. 5

The Silver-Lead Mines of Santa Barbara, Mexico

Milling in This District Has Been Highly Developed Owing to Early Recognition of the Importance of the Mixed Sulphide Ores.

BY CLAUDE T. RICE

The town of Santa Barbara is situated amid rolling hills about 12 miles southwesterly from Parral, and is reached by the branch of the Mexican Central leaving the main line at Jimenez. The town is situated in a narrow gulch, along a stream (almost dry in the hot season) to the west of the ridge, along the western slope of which is the Mina del Agua vein, where ore was first found by the Spaniards in 1547, only 26 years after the conquest.



MONTEZUMA LEAD COMPANY, SANTA BARBARA

History of the District

As at Leadville, Colo., and in the Cœur d'Alene district of Idaho, it was gold (in this case gold ore in place) that first attracted attention, for in the year above mentioned a party of Spanish adventurers on an exploring expedition in northern Mexico found rich ore along the outcrop of the Mina del Agua vein. This was the first ore found by the Spaniards in northern Mexico, and as the ore found was very rich (some writers say that some of this ore produced 12 oz. gold per *carga* of 300 lb.), the district soon began to flourish.

By 1580 Santa Barbara had a population of 7000 inhabitants and was the principal city in northern Mexico; at that time the viceroy of Nueva Viscaya, who reported direct to the King of Spain and who ruled over Chihuahua, Texas, New Mexico, Arizona and California, and also part of Sonora and Coahuila, had his residence and seat of government there.

The veins in the district outcrop boldly, and it was no wonder that the district prospered, for little prospecting was necessary to find the veins. Therefore Santa Barbara flourished for many years and many arrastras were treating the gold ore that was found in the upper part of the different veins, until in time this ore was exhausted, and the miners had to work on the oxidized silver-lead ore which then formed the bulk of the ore in the upper part of the veins. The Mexicans erected adobe furnaces and began to smelt the ore after roughly concentrating it on *planillas*, but the results of this work in 1645 were not especially enticing, for in that year, when Diego Rodrigo discovered ore in the Veta Colorada vein at Minas Nuevas, near Parral, the Santa Barbara mines were almost deserted and nothing noteworthy appears to have happened until English-speaking people obtained control of the district.

In the meanwhile *gambucinos* had continued to work the upper parts of the veins so that in some places a depth of 150 ft. had been attained. The rich ore

was first gouged out, as is characteristic of leasers in Mexico, as in the United States; after "gophering" out the ore, the *gambucinos* had robbed the pillars. Consequently when English-speaking mining men began to work the mines (in the late seventies) they found the upper parts of the veins badly wrecked.

The Tecolotes was the first vein worked by the new-comers, and later an English company obtained control of the Mina del Agua mine. Still, in 1883, when the old Tecolotes company erected a small water-jacket blast furnace to smelt the ore from the Tecolotes vein, the Mexicans were treating considerable ore in their adobe furnaces and were concentrating much ore on *planillas* alongside the creek. The product from the Tecolotes furnace is said to have been shipped at first to Denver, but after 1886, when the smelter at El Paso was completed, it was shipped to that place.

In the last 10 years the Santa Barbara camp has developed rapidly, for mining men recognized that it was not a shipping camp; consequently they began early to solve the problem of milling the sulphide ores.

Geology of the District

The Santa Barbara district is sometimes considered to be part of the Parral camp, but as the country rock is shale and the ore an argentiferous galena carrying some zinc, copper and iron sulphides, instead of a silicious silver ore in an andesite or rhyolitic country rock as at Parral, the district, especially as it is producing more ore than Parral, should be considered separate from Parral.

The country rock at Santa Barbara is shale, locally called "slate," in which no interbedded limestone is found. In places the shale has been much folded, but generally it lies quite flat with a dip to the west. Cutting through the shale are several large rhyolite dikes having generally a northerly and southerly strike, but the large dike on the crest of the ridge between the Tecolotes and the Cabrestante mine is a notable exception. The veins are roughly parallel to these dikes and generally dip from 50 to 60 deg. to the west, although sometimes they are nearly vertical, especially near the surface; a few of the veins dip to the east, notably the Clarinas vein.

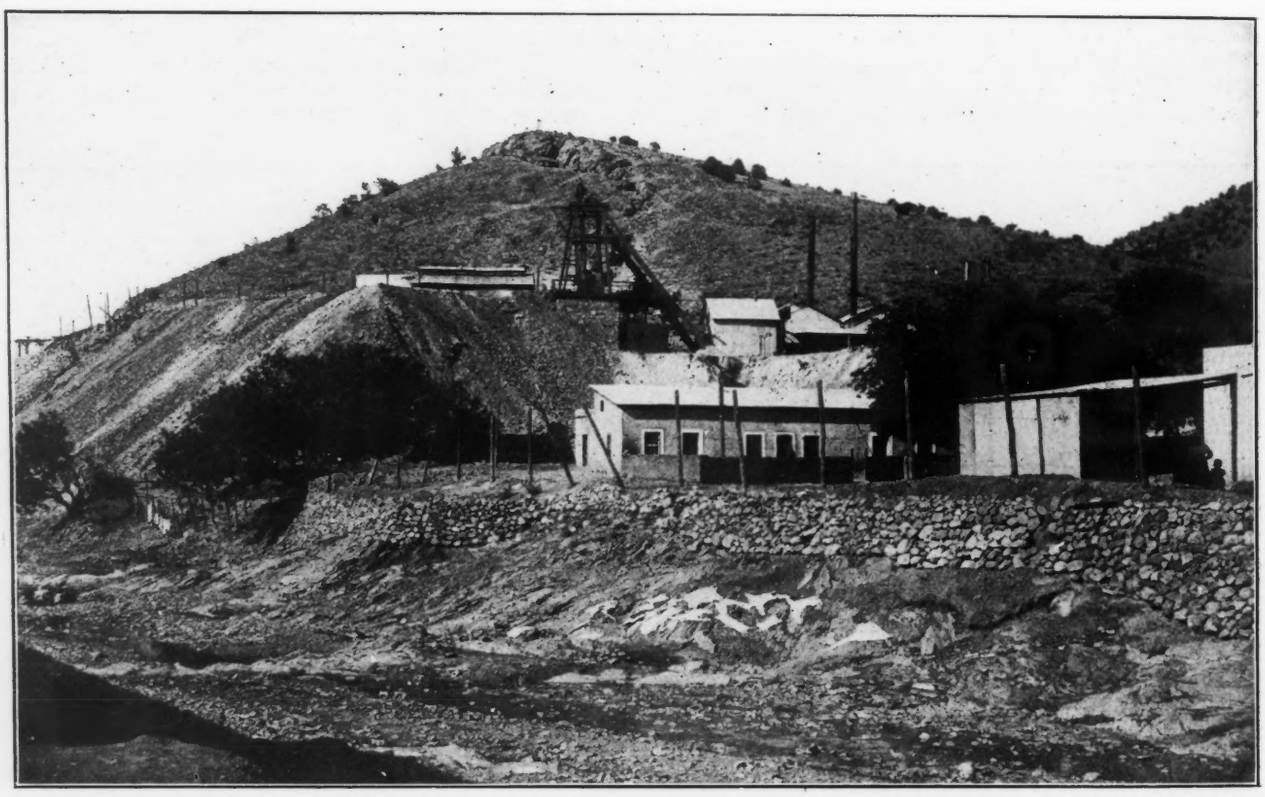
The Mina del Agua is probably the strongest of these veins, since it can be traced for a distance of 2½ miles or more, dying out in the plain to the north and becoming lost in the mountains to the south. It has a very strong, but not continuous, outcrop as have most of the other veins in the camp, and it is no surprise that it was one of the first veins to be discovered. To the east of the Mina del Agua is the Tecolotes vein; this is almost as strong as the Mina del Agua vein, provided that one considers the Central vein and other veins of the Montezuma Lead Company to be the northern extension of this vein series beyond the large dike already mentioned. Farther west are several veins which pass through the Caballo and Clarinas properties, while still farther west are the veins which pass through the property of the Grenadeña company and those that pass through the San Francisco Del Oro property.

Character of the Ores

As has been said, the surface ore carried quite a little gold, but this was almost all worked out centuries ago. In the pillars of the upper stopes there is little indication of this rich ore, so that some in the district are inclined to question the stories of the immensely rich ore found in the first years of the camp's existence. Still some stringers of this rich ore were found by the first foreigners to work mines in the district.

The surface ores of the district are oxidized silver-lead ores which carry little zinc and some gold. The zone of this oxidation is variable so that often on the same level there are both oxidized and sulphide ores. Most of the oxidized ore was mined before English speaking persons entered the district, but a considerable amount of oxidized ore is still produced in the camp. This ore is hand-sorted and the "fines," provided it carries little copper, is hand-jigged before being shipped to the smelter.

The carbonate ore shipped from the camp carries from 300 to 500 grams sil-

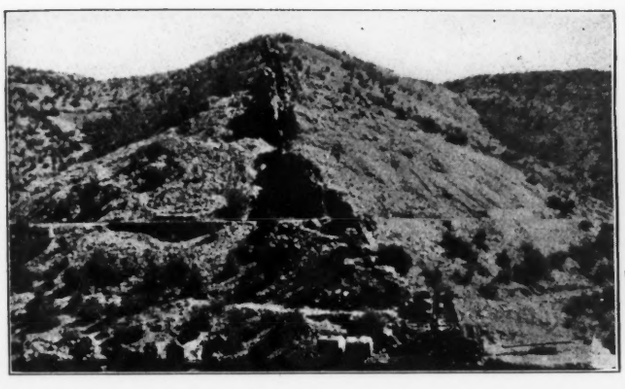


MINA DEL AGUA, SANTA BARBARA

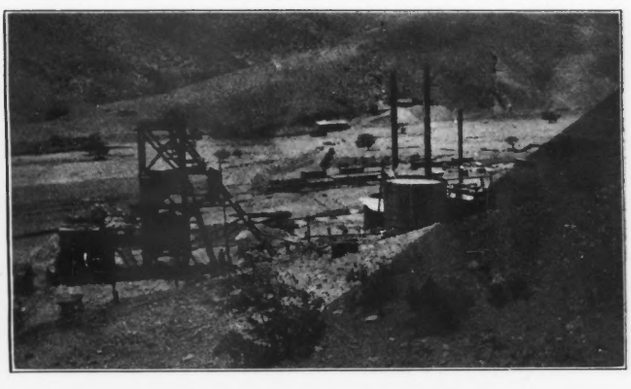
ver and 3 to 5 grams gold per metric ton, and from 10 to 12 per cent. lead, 3 to 4 per cent. zinc, 10 to 12 per cent. iron, and 40 per cent. silica. The sulphide ores vary greatly in their zinc content. The San Diego veins are especially rich in this element, sometimes carrying as high as 30 per cent. zinc. The Tecolotes vein and especially the veins in the San Francisco del Oro property also carry quite a little zinc. In fact all the veins contain some zinc, which apparently increases as depth is obtained. There is copper in some of the veins, especially in those low in zinc, in which case the copper appears to increase in depth. The gold content has a strong tendency to increase as the copper content rises, for the gold occurs mainly in the pyrite and the chalcopyrite. The sulphide ores of the camp carry about 250 grams silver and 2 to 8 grams gold per metric ton, 5 to 10 per cent. lead, 10 to 20 per cent. zinc, 6 to 7 per cent. iron, ½ to 3 per cent. copper, and 30 to 40 per cent. silica.

As has been said, the veins have bold outcrops which cut across the shales, but the walls, although rough and jagged, are strong. The veins, while they are strong and persistent, have a tendency to split and send off branch veins; frequently large ore shoots occur in the veins at such points. The width varies greatly; the stopes are often 30 ft. wide and in places even 100 ft., but the average width is 10 to 15 ft. The ore occurs in shoots and in some veins in large pockets which seem to have no connection with one another; such is especially the case in the veins at the San Diego mine.

The ore is mined both by overhand and underhand stoping and, as the walls are strong, very little timbering is required. The cost of mining is low; in the San Diego mine, where the veins are narrow, the ore is mined on contract at 2 pesos per 16 cu.ft. car, delivered at the shaft station. At the Tecolotes property it is said that the ore is delivered to the mill at about 3 pesos per ton, the drilling and breaking costing 1.75 pesos; the ore is mined by overhand stoping and air-hammer drills are used.

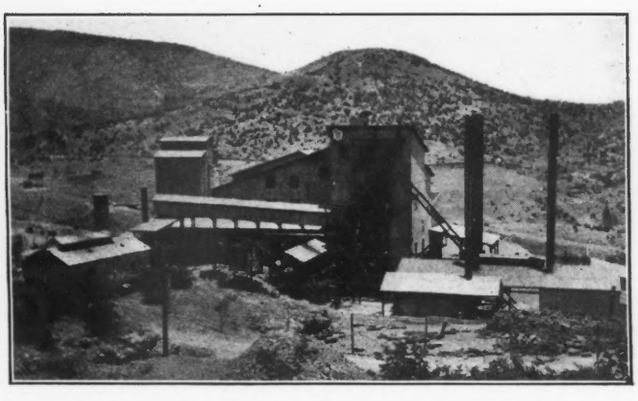


OUTCROP OF CLARISTANTE VEIN, SANTA BARBARA



SAN DIEGO MINE, SANTA BARBARA

TECOLOTES MINE, SANTA BARBARA



SAN DIEGO MILL, SANTA BARBARA

Milling the Ore

The 60-ton mill erected by the old Tecolotes company was the first mill built at Santa Barbara. Later the mill of the Montezuma Lead Company was erected but this, after being run for a few years, was shut down about three years ago. Later the new Tecolotes 600-ton mill, which is run by power generated in gas engines, was built and after much overhauling has finally been running successfully for a little over a year. Other but smaller mills, the Grenadeña, Hinds Consolidated, Alfareña and San Diego, have been built in the district.

The Tecolotes mill is the largest in the district and is said to be doing good work; however, I did not visit this mill. The general milling practice at the San Diego mill, belonging to the Compañia Metalurgica de Torreon, is in some ways the most advanced in the district, the mill being provided with driers and magnetic separators for the extraction of zinc from the ore. The following paragraphs on milling are descriptive of the practice at this mill, which was running until the slump in metal prices, but is now shut down.

Concentration of the Lead Ore

After crushing in a Blake breaker the ore is elevated to a Bartlett-Snow picking belt, where the smelting ore and pieces of shale and barren quartz are picked out. The ore is then sent to another Blake breaker, which crushes it to ½-in. size; it is then crushed in roughing and finishing rolls to 8 mm. size, the undersize being screened out before each crushing so as to avoid unnecessary sliming. The treatment of both the lead and the zinc ore is the same up to this point; here, however, instead of being concentrated coarse as is the lead ore, the zinc ore is passed over a 1½-mm. screen, and after the oversize has been recrushed in finishing rolls to

TECOLOTES MILL, SANTA BARBARA

REMEDIOS, HINDS CONSOLIDATED, SANTA BARBARA

pass this screen all the zinc ore is elevated to a bin. This bin feeds the Robins belt conveyer, which takes the ore to the magnetic separation plant as fast as it can be treated on the separators.

The lead ore is elevated to trommels which separate 6 mm. 2½ mm. and 1½ mm. sizes, while the undersize from the 1½ mm. goes to a hydraulic classifier which feeds the different sizes to Wilfley and Card tables and Frue vanners. The 6 mm. size from the trommels goes to three 4-compartment Hartz jigs, while the other two sizes are distributed to three other 4-compartment Hartz jigs, two treating whichever of the smaller sizes is the greatest in amount.

The tailing from the coarse jigs, which assays 1 per cent. lead and 6 to 7 per cent. zinc, is thrown away after being dewatered; the tailings from the other jigs are all reground in rolls to about 1 mm. size and, after being dewatered in a settler, are sent to a different classifier which feeds to a separate set of tables and vanners. The tailings from the different tables are dewatered in settlers and Callow cones and this water, together with the water from the tailing made by the coarse jigs, is pumped back to the top of the mill.

The tables and jigs made a lead concentrate, a zinc and iron middling, and a zinc concentrate, the ratio of concentration being 9 to 1. The zinc and iron middling is retreated on the magnetic separators.

Magnetic Separation of the Zinc Ores

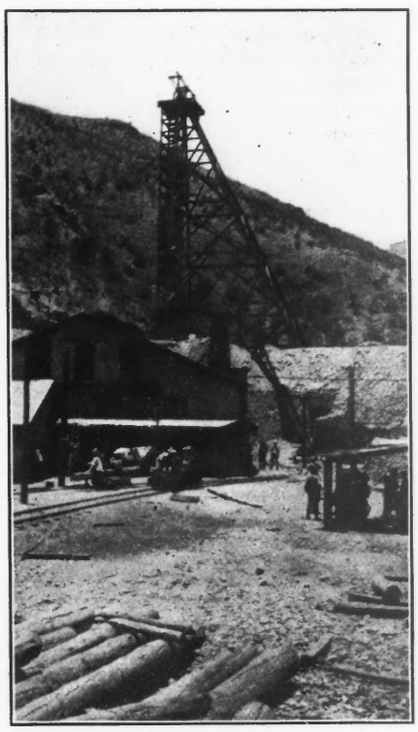
The zinc ore is treated by magnetic separators before being concentrated on the jigs, tables and vanners. This zinc ore assays 23 to 30 per cent. zinc, 4 per cent. lead and 8 to 9 per cent. iron. The iron is in the form of pyrite, and is therefore non-magnetic; the zinc sulphide fortunately contains sufficient iron to render it magnetic, while the gangue is non-magnetic, being quartz and pieces of silicified shale included in the vein or broken from the wall.

In the magnetic separating department the ore from the zinc bins, or the middling from the tables, is fed to a Bartlett-Snow cylindrical drier where it is dried, but not roasted, for roasting would render the pyrite magnetic. The dried product is then fed directly to two units of four International magnetic separators. The four separators composing a unit are placed vertically one above another so that the belt from the pulley of one separator drives the separator below and the tailing from one separator feeds to the separator immediately below.

The ore is delivered to the International magnetic separator by a roll feed, and falls evenly upon the top of a horizontal toothed roll situated between the horizontal pole-pieces of an electromagnet. The roll is made of soft iron and is regulated at 80 r.p.m. As the roll revolves, the ore and the teeth enter the magnetic field of the nearer pole; thus the magnetic material sticks to the rotating roll even when the lower quadrant has been entered. The non-magnetic material then drops off and passes to the separator below for further concentration. The magnetic material is held on the rotating roll until the neutral point between the two poles is reached; here, the magnetism being nil, the zinc drops into a hopper which leads to a spout, in this case feeding to a bucket elevator.

The International separator has the advantage of having a large capacity, but unfortunately it cannot be adjusted to do as close work as the Rowand type of Wetherill separator.

The tailing from the separators is elevated by bucket elevators to the wet concentration system where it is concentrated to remove the lead and pyrite, for the pyrite assays about ½ oz. gold per ton. Unfortunately all the zinc is not removed by the separators; therefore a zinc middling is made in the wet concentration, and this is again treated on the magnetic separators.



TECOLOTES MINE

The magnetic separators at the San Diego mill are run on a 7 to 8 ampere current of 110 volts. The efficiency of the concentration varies with the percentage of zinc in the ore. With an ore assaying 30 per cent. zinc an extraction as high as 75 to 85 per cent. of the zinc can be obtained but, where the ore is low in zinc, the extraction falls to 60 and even 50 per cent. When making an extraction of 51 per cent., 28 per cent. of the total zinc in the ore would be taken off by the first separator, 14 per cent. by the second, 6 to 7 per cent. by the third and 2 to 3 per cent. by the fourth separator. The concentrate assays 40 to 44 per cent. zinc, except when treating ore carrying less than 22 per cent. zinc; then it is impossible to get the concentrate to assay as high as 40 per cent. zinc.

Properties at Present Working

In the Santa Barbara district, the Tecolotes property is running at full capacity; the Compañia Metalurgica de Torreon is shipping some ore to the smelter from the San Diego No. 8 vein; the Montezuma Lead Company is shipping some good oxidized silver-lead ore from its Central and Cabrestante mines; the operators of the Monterey smelter No. 2 are shipping some ore from their Caballo property; the Granadeña Mining Company is doing some development and preparing to install a tramway; while the Hinds Consolidated company is treating a considerable tonnage in a mill equipped as yet only with jigs.

The El Rayo in the Los Azules district, but sometimes considered in the Santa Barbara district, is treating 110 tons of gold ore per day, while the San Francisco del Oro Company, which is sometimes considered to be in the Parral district, is shipping galena-blende-pyrite-iron ore carrying silver. Recently, at a point about eight miles south of the town of Santa Barbara, rich silicious silver ore was found at surface and from the first shipment of about 17 tons, $6000 above smelting charges was received. This indicates the possibilities even in a district where mining has been going on for over 350 years. Although this strike is only a few weeks old, trenching is said to indicate a fair prospect of permanence to the ore shoot. Locally this strike is attracting attention, but unfortunately litigation is threatened regarding some of the later locations.

Conclusion

A peculiarity of this lead-silver district is the absence of limestone in the sedimentary series, and the presence of calcium fluoride in some of the ore. The probable character of the ore that will be found at depth is enigmatic, for only in a few properties has even a comparatively shallow depth below water level been attained. In some of the veins the copper content appears to increase near water level, but in others, where zinc is present in quantity, this tendency is not shown. Nevertheless, as in all the veins the zinc content increases with depth, it seems certain that below water level the ore will become a mixed sulphide of galena, sphalerite and pyrite, carrying some chalcopyrite. However, owing to the rapidity with which the magnetic treatment of mixed sulphides is advancing, this probable change to mixed sulphides of higher zinc content should not present a serious problem.

Short Talks on Mining Law—VI

By A. H. Ricketts*

In the United States a valid lode location is made by appropriating certain surface land which includes the apex of at least one vein or lode. By the terms of the statute such appropriation gives the exclusive right of possession and enjoyment of all the surface included within the limits of the location (not included in prior appropriated territory), and of all veins, lodes and ledges throughout their entire depth, the top or apex of which lies inside of such surface lines. The parallel end lines of the location as laid upon the ground are the end lines of all veins, lodes or ledges within the claim, irrespective of their strike. The location need not be laid along the strike of the vein or lode, nor need its end lines be parallel, nor its side lines be equidistant, nor the surface boundaries be wholly or at all upon unappropriated territory. But no individual location must exceed 1500 ft. in length, nor 300 ft. on each side of the center of the vein or lode at the surface, but should it do so, it is void only as to the excess, unless fraud plainly appears.

If the claim is laid so that its greatest length crosses the vein or lode on its strike, its shortest lines become its end lines and its longest lines its side lines, so far as the extra-lateral rights are concerned. If the end lines of a claim are not parallel with each other, they may be made so and the extralateral right obtained. The straightening of the lines is usually done by an amended location or by the deputy mineral surveyor when making the survey for patent.

It is not necessary that the end lines of one claim shall be parallel with the end lines of any other claim. Irregularly shaped pieces of ground left by their divergence or otherwise may be located so as to secure the extralateral right by placing the boundary marks upon the adjoining claims, although they may be patented to others, if no objection is made to such a course at the time. Subsequent objection would be of no avail.

Placer Claims

Placers are defined by the act as "all forms of deposit excepting quartz or other rock in place," but if any particular deposit, whether "in place" or not, is by the act made subject to location as a lode or as a placer claim, it must be located as such, or the location is void. For instance, marble deposits may lie in lode formation, but must be taken up as a placer claim, and iron, not being placed in either category by the statute, must be located as a lode or placer claim as the character of the particular deposit may warrant. It is essential that a placer location shall include land which is chiefly valuable for some mineral deposit therein. This, under the decisions, runs from diamonds to guano.

Appropriate discovery is necessary to each single location, whether it consists of 10 or 20 acres by an individual or 160 acres by an association; but mineral discovery on a particular part of the location of 160 acres does not conclusively establish the mineral character of the entire claim. Any person, or association of persons, not more than eight, may make as many single locations, whether contiguous or otherwise, as may be deemed expedient, provided that no one location exceeds the maximum limit, that is, 20 acres for one person, or 160 acres for an association of not less than eight individuals. A corporation is deemed to be a single person.

If upon surveyed lands, the location should be made in conformity to the rectangular subdivision of the public surveys as near as may be reasonably practicable. A departure from a "square location" renders the validity of the location open to question, and thereupon the reasons relied upon for the irregularity in shape of the claim, must be explicitly shown. A placer location, whether upon surveyed or unsurveyed lands, is not necessarily void because of irregularity in surface form, and placer locations made in the form of a parallelogram (lode location), have been upheld by the courts. Whether the exterior boundaries of a location made in conformity to the public surveys shall be marked by the locator as an essential act of location, is determined by the local law or local rule, or perhaps the decisions of the courts prevailing in the place where the particular claim may be situated.

No extralateral right attaches to a placer claim held only as such. Any vein or lode known to exist therein may be located by another person, or it may be included in the patent for the placer claim, if included in the application for patent. If open to location and not included in the application such omission is construed as a declaration that the applicant has no right of possession of such vein or lode. The existence of outcroppings or the mere sinking of shafts, etc., may make it a "known vein."

The true rule seems to be that a vein or lode is known to exist when it is already ascertained to be of such extent from actual discovery within the claim, as to render the land more valuable on that account and justify its exploitation. It has been held that if a vein or lode is known to the applicant for a placer patent, or known to the community generally, or else disclosed by workings and obvious to anyone making reasonable and fair inspection of the premises, for the purpose of obtaining title from the Government, it is a known vein or lode. But speculation, belief, or presumption as to the existence of the vein or lode within the claim, is sufficient to charge the placer claimant with notice of its existence.

No person may prospect for any vein or lode within the confines of a placer claim without the consent of the placer claimant, but a known vein or lode may be lawfully located by another even after the issuance of the placer patent, if known to exist at the time of the application for patent and not expressly included therein.

It follows that a placer claimant has only a qualified possession of the surface and no extralateral right to any blind vein or lode discovered within such claim.

Mill and Tunnel Sites

A mill-site location can be made only on non-mineral land not contiguous to a vein or lode not otherwise appropriated. For instance, while a mining location may be validly made upon ground within the unpatented limits of a congressional grant of land to a railroad or a State, still no mill-site location can be made thereon, under the law. The mill-site location must not exceed five acres in area, nor be made by one other than the proprietor of a vein or lode, or the owner of a quartz mill or reduction works, who may not own a mine in connection therewith.

The mining act does not prescribe what acts are necessary to evidence the fact of location, nor does it provide for any annual expenditure thereon. It is sufficient that the boundaries of the claim be marked and record made if such be required by local law or local rule, and that there be a reasonable use and occupation of the mill site for mining or milling purposes. Generally, the mill site may be included in an application for patent for a vein or lode claim, or may be patented separately and paid for at the rate of $5 an acre or fractional part of an acre.

A tunnel may be run either for the development of a vein or lode or for the discovery of such. In the first instance it seems to be contemplated by the law that it is run for such purpose by the person or company owning such vein or lode, and it is provided by the mining act that work done therein shall be considered as work expended on such vein or lode. But a tunnel site may be acquired for either purpose. In the second instance, a tunnel-site location may be made for the discovery of veins or lodes subject to the rights of surface claimants. The mining act does not provide how such a claim shall be located, but limits the right of possession to all veins or lodes within 3000 ft. of the face of such tunnel, that is, the point at which it first enters cover. A location exceeding that length is void only as to the excess.

The tunnel owner is entitled to all veins or lodes within that distance on the line thereof, not previously known to exist, or which have not previously passed into private ownership, to the same extent as if discovered upon the surface. He may locate the same on either side of the tun-

*Member of the San Francisco bar, San Francisco, Cal.

nel or as may be convenient, subject to the rights of others, without further discovery and his rights relate back to the time of the location of the tunnel site. No immediate development of a vein discovered in the tunnel is necessary, but failure to prosecute the work upon the tunnel itself for six months with reasonable diligence is considered as an abandonment of the right to all blind veins on the line of such tunnel.

It has been held that locations made by others subsequent to the tunnel location, if they are within 300 ft. of the vein or lode and within 1500 ft. as located along the vein or lode discovered, are at the risk of such locators. The tunnel owner, as such, can acquire no right to a blind or other vein or lode within the boundaries of a pre-existing adverse valid lode location, nor has he the inherent right to pass through such territory in prospecting for such or any veins or lodes.

The Holman Air-cushion Stamp

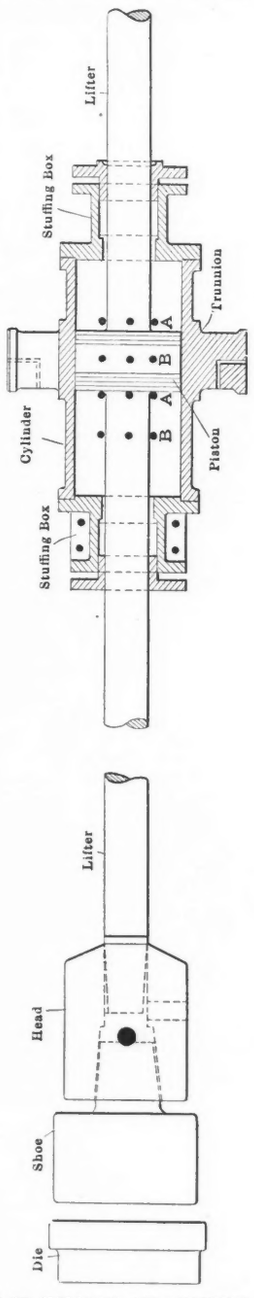
By Edward Walker

In an article dealing with Cornish methods of ore dressing which appeared in the Journal of April 13, 1907, I gave some particulars of the so-called pneumatic stamp. This stamp has not received the attention it deserves because the former makers were not in a position to push it and the name given to it is so misleading that even the highest authorities on ore dressing obtained a wrong idea of its principle. The stamp is not operated by compressed air, as might be supposed. It is steam-driven, with an air cushion interposed in the stem. With due deference to the makers, Holman Brothers, of Camborne, Cornwall, I intend to rechristen it the "Air-cushion stamp," hoping that metallurgical engineers will be attracted to it under its new name.

Details of Construction

I take this opportunity of giving some further details of its construction and its capacity. The accompanying illustration shows a section of the working parts. The cylinder is raised and lowered by connecting-rods which connect the trunnions with the source of power. The lifter or stem passes through this cylinder, and the piston fixed to it traps the air at the top and bottom of the cylinder, thus forming a pneumatic cushion. The air enters the cylinder through holes in its side. In order to allow for the wear of the shoe and die it is desirable that there should be more than one row of holes at top and bottom. There are, therefore, four rows provided. Only two rows are used at a time, either the first and third, marked *A*, or the second and fourth, marked *B*. When new shoes and dies are used, the holes *A* are open, but when they are half worn, these are closed up, and the holes *B* are used instead. In order to facilitate opening and closing the holes, they are tapped and suitable set-screws are provided to close them.

A machine which performs so much work has to be looked after carefully and a good mechanic is required; but



SECTION OF HOLMAN AIR-CUSHION STAMP

the machine is far simpler than other high-speed stamps and conscientious attention to a few points is all that is required. The speed should be kept as regular as possible at about 135 blows per minute. It should not be more than 140 nor less than 120 blows per minute. It is necessary to adjust the piston rings and the stuffing boxes very accurately and to see that the air holes are kept clear. The lubrication also requires careful attention, so that the cylinder shall not work hot. It is preferable to use a hard grease instead of oil to lubricate the cylinder, so that oily matter shall not drop into the mortar box. Every three months the lifter or stem should be removed and annealed. To do this all that is required is to heat it to a red heat and bury it in ashes until it is cold. A spare stem and cylinder should be kept in stock and used alternately. When the stem requires annealing, the cylinder may also be removed and thoroughly cleaned.

These air-cushion stamps are used in a number of Cornish mines and their application is extending. At East Pool mine, two heads have been in use for six months, and the results are so satisfactory that six more are to be erected. In an article in the issue of May 18, 1907, I mentioned that at this mine the old plant was being gradually replaced by more modern machinery, paid for out of the profits and not by the issue of further additional capital. In this way, the old Cornish stamps are being replaced, as they wear out, by air-cushion stamps.

Capacity of the Stamp.

The two stamps that have been working for six months crushed 21 tons each, in 24 hours, reducing the ore to pass a 25-mesh screen. The Cornish stamps treat about 19 cwt. per head in the same time. The ore is very hard and heavy in mineral, and for both these reasons takes an exceptionally long time to crush in the stamps. Judging by what is done at other mines in the vicinity, a California stamp with a 950-lb. head would crush from 28 to 30 cwt. in 24 hours. The ore is fed in fairly large-sized lumps, much of it being in pieces three inches across.

The cost of crushing by the air-cushion stamp at East Pool is 11d. per ton, compared with 14d. per ton by the Cornish stamp; labor, renewals and all other costs are included.

According to the London *Mining Journal* (May 30, 1908) the production of petroleum in Java in 1907 was 1,655,331 cases compared with 1,994,689 cases in 1906. The industry is carried on by the Bataafsche Petroleum Maatschappy at Balik Pappan and is under Dutch management with headquarters at the Hague. The oil refinery has a capacity of about 450,000 tons of crude oil per annum.

Cast-iron carwheels are placed in cylindrical brick-lined annealing pits immediately after removal from the molds. At the beginning of annealing the wheels are a cherry red, and it usually takes four days for them to cool sufficiently to be handled.

Pumping Problems of the Joplin District

Abundant Rainfall, Broken Ground, Numerous Streams Subject to Flood Increase the Difficulties of Keeping the Workings Free from Water

BY DOSS BRITTAIN*

The Joplin district includes the territory lying between Alba and Neck City on the north and Granby, Mo., on the south, a distance of 35 miles, and from Aurora, Mo., on the east to Baxter Springs, Kan., and Quapaw, Okla., on the west, a distance of 75 miles. This irregular area includes portions of Missouri, Kansas, and Oklahoma, and is remarkable for its deposits of lead and zinc ore, the mining of which is one of the principal industries of this region.

The rainfall is abundant, being about 45 in. per year. The surface drainage is to the southwest. The water flows through numerous small streams, the principal one of which is Spring river, which rises about 30 miles east of the eastern boundary of Jasper county in which Joplin is situated, flows northwest to the northern section of this county; thence after its confluence with Center creek, Turkey creek, and Shoal creek, next in importance to Spring river, it turns southwest into Kansas, where at Lowell, 12 miles west of Joplin this stream operates the power plant of the Spring River Power Company, which supplies the district with electric power.

Since the district lies in the foothills of the Ozark mountains, the slopes are decided, no opportunity being given for the formation of marshes and swamps. On the other hand, natural water-power is available with but little assistance from artificial structures, as at Grand Falls on Shoal creek, where power is generated to supply the lights of the various cities of the district. On account of the excellent surface drainage, in spite of the heavy rainfall, there are with the exception of two or three stream valleys, no heavy water problems to be solved. The exceptions, however, required much skill, time and heavy expenditures.

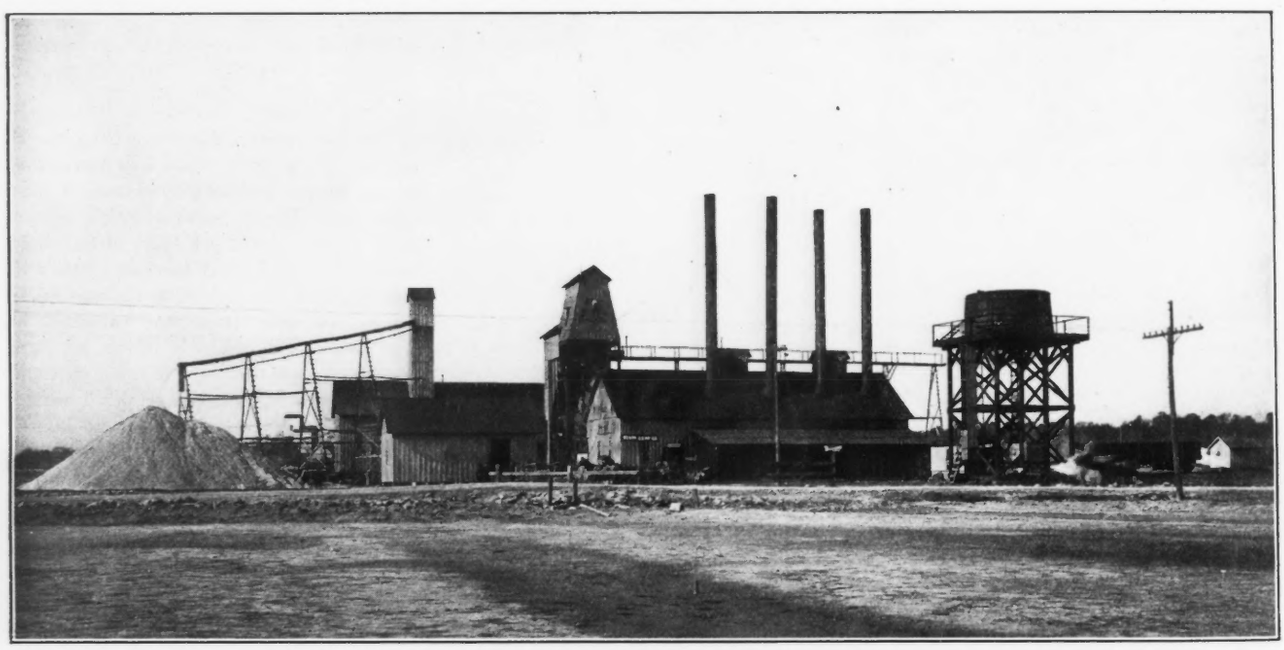
Water in the Mines of the District

Throughout the district there is no general water level. Each camp has its own water level which varies with the mining operations in the contiguous territory. At Galena, Kan., the water level in most of the mines is from 60 to 70 ft. from the surface where no pumps are used. In 1891 the water level under similar conditions was at 40 ft. The extreme variability of water levels even in contiguous mines is illustrated in two mines one mile south of Galena, not more than 800 ft. apart; in one the shaft is 200 ft. deep and free from water, while the other shaft, only 150 ft. deep, is flooded.

Similar examples in various parts of the district lead to the belief that underground streams are numerous, which theory accounts in large measure for the difficulty experienced in draining certain mines and the ease attending the drainage of others. One of the most notable examples showing the presence of underground streams is encountered at Granby. Here Mint spring flows vigorously while no pumping is being done in the mines below it, but when the pumps are started the flow ceases at once. Frequent caves, or sink-holes, as at Porto Rico and Prosperity, where in places the ground has dropped 40 to 50 ft. exposing the bed of an underground stream, also point to the correctness of the theory that these streams below the surface vitally affect the drainage and pumping conditions of the district.

The presence of uneroded lime bars, comparatively difficult for water to penetrate, has also much to do with the difficulty of draining some mines; there are many instances of difficult water problems near mines free from water. In such cases, whether the water saturates the open and broken ground, or whether it exists in the form of an underground stream, the lime bars sometimes extending almost to the surface of the ground will have a like effect, turning the water from some mines into others.

A notable example of this condition is



SURFACE PLANT, OZARK LEAD COMPANY, CENTER CREEK VALLEY, MISSOURI

*Joplin, Mo.

found on the Mastin land, southwest of Galena. On this land most of the mining was carried on at a depth of 85 to 120 ft. On a portion of the land some distance from any other mine a shaft was sunk to a depth of 165 ft. and used as a pump shaft. Pumping from this shaft drew away all the water from the surrounding mines except such as was desirable for ore washing. Soon after the efficiency of this method of drainage had been demonstrated, the property on which the 165-ft. shaft was sunk changed hands, and near-by a deep shaft was sunk on the same ground to be used as a pump shaft. It was soon found that this shaft was not nearly so efficient from which to pump as the first. The difference in efficiency is explained by the theory that the first shaft was sunk in open ground which permitted the water from the surrounding mines to flow through it with little resistance. The second was on a lime bar which effectually diverted the water from the shaft and rendered it worthless for its purpose. With the first shaft the water was kept at 150 ft., while the second affected the water level in the surrounding mines very little.

Condition of the Ground

Another local condition which has a marked effect on the water of mines is the tightness of the roof and its corresponding capacity for shedding surface water. A remarkable instance of the influence of local floods on mine waters occurred in 1883, when a series of unusually heavy rains completely swamped the mines at Webb City and Carterville, many of the mines at Joplin and half of those at Galena. A portion of the water ran into the mines through shafts and drill holes, but by far the greater part of it percolated through the loosely broken open ground forming the roofs of the mines; long after the mines had been unwatered sufficiently for operations to begin, the supply of mine water continued unusually great, and seriously interfered with mining operations. The unusually wet season of 1907 also placed many mines out of commission, but the effect was not so general as in 1883.

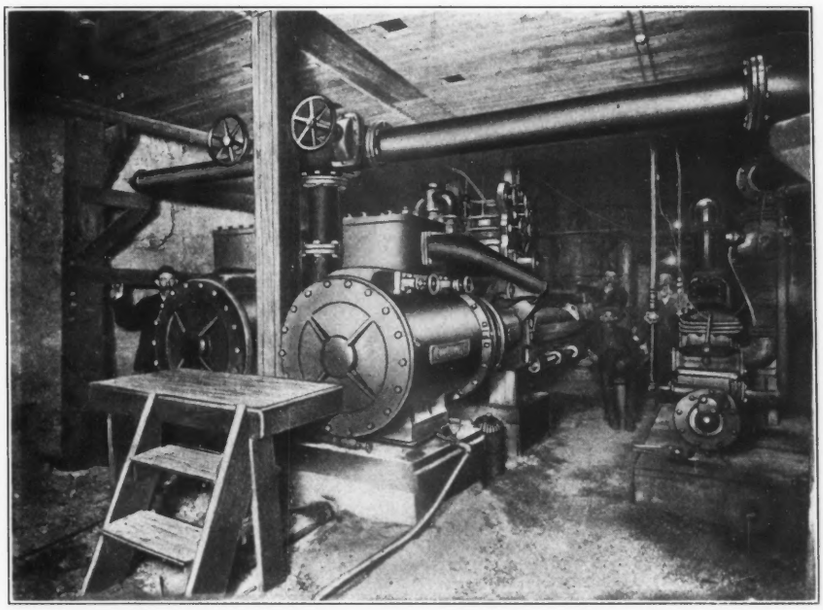
These facts tend to prove much as to the source of mine water concerning which there seems to be much difference of opinion, not so much as to the variety of sources, but as to their relative importance. Some geologists in connection with their theories of ore deposition claim that the underground waters of the Joplin area are largely due to the influence of a catchment area in the high uplands in the vicinity of Cedar Gap, 40 miles east of Springfield. They even go so far as to attribute to this source the waters of Cave springs and other springs farther south. It is also contended by them that local rains are without an appreciable influence.

The Mastin Land Investigation

Some years ago an attempt was made to investigate the sources of the mine waters of Galena, Kan. For this purpose two well known tracts were studied, the Mastin land, southwest of Galena, and the South Side tract, just east. The Mastin land is situated in a valley with low hills on nearly every side. From the north end the water drains northwest into Short creek; from the south end, southward into Shoal creek. Surface water from possibly 240 acres drained into the Mastin tract. Upon the land are many shafts, drill holes, and tailing piles, while in two places the surface is broken by caves of the mine workings into which at every hard rain the water flows unchecked. Some of the water from the pumps and surface ponds likewise finds entrance. The soil is loose and porous and to an unusual extent permits the seepage of surface waters. At the time of the investigation there were six large mining companies operating 8- to 12-in. pumps. Approximate computations based on the size of the pumps and the time operated indicated that the amount of water pumped per year was equal to a rainfall of 45 in. on an area a fraction less than 250 acres. Investigation also showed that of the water brought to the surface by the pumps, 60 per cent. was carried off the tract by the streams, and that the other 40 per cent. in one way or another worked back to the mines, or evaporated. In returning to the mines various factors contributed. A part of the water ran directly back into the mines; much went back through old abandoned shafts and drill holes; the caved areas were also responsible for the return of a large portion of the water, and much also returned by ordinary methods of percolation through the porous soil. Especially was this noticeable under large tailing piles which cover a large portion of the tract investigated, and not only retain the water which comes from the mills with the tailings, but also catch and hold large quantities from rainfall and from the pumps.

It was not believed, however, that 60 per cent. of the rainfall could be obtained from the ground by pumping nor that 40 per cent. was sufficient to account for the surface run-off and evaporation. There is, therefore, 10 to 15 per cent. to be accounted for which came from outside the 240 acres. This is supposed to be probably due to the catchment area near Cedar Gap, and to the territory contiguous to the Mastin land.

During this study special investigations were made regarding the effect of tailing piles upon the flow of mine water. These showed that under large tailing piles leaks occurred, while roofs some distance removed, bearing no tailing piles, but of the same formation as the others, were dry, showing not only the effect of the tailing piles, but also corroborating the theory of the return of mine water to the mines.



JEANESVILLE PUMP, 4500 GAL. CAPACITY, OZARK LEAD COMPANY

Underground Water on the South Side Tract

While investigations were being prosecuted on the Mastin land similar studies were in progress on the South Side tract east of Galena. Here the surface is void of vegetation and probably three-fourths of it covered with large piles of tailings and waste dumps from the mines, so that the surface drainage of the rainfall is greatly checked.

Just south of the South Side land the Cornwall Mining Company operated mines. Still further south a lime bar was encountered running to the northeast, and as usual at the contact of the

bar with the surrounding ground the rock was broken and capable of absorbing an unusual amount of surface water. A portion of the South Side land is open and part very compact, and the amount of water pumped from it was estimated to be equal to that supplied on 100 acres of ground with a 45-in. rainfall. As with the Mastin land about 60 per cent. of the rainfall was found to be returned to the surface through pumps. A small hollow on the southeast is especially favorable for a large amount of outside water to flow upon the South Side land. On the southeast corner of the land the mines have been especially carefully worked; for during the rainy season the water is so strong that mining is almost impossible, while during dry seasons it is almost free from water, hardly enough being obtainable for milling purposes.

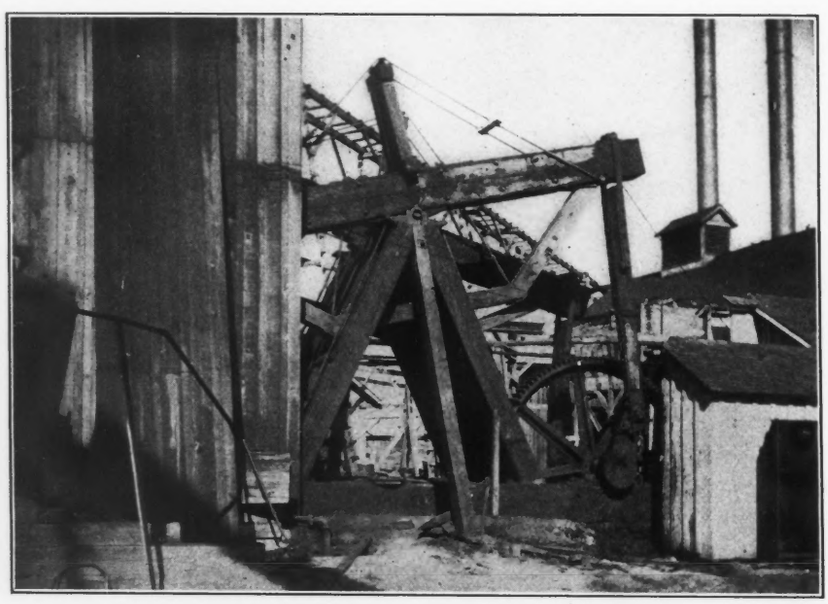
During this series of investigations inquiry developed the fact that some mines were especially sensitive to the influence of floods, while others were almost totally unaffected. At the Oronogo mine at this time the pumps had to be run for a week after a heavy rain. At the Columbia mine the effect of a rain is noticeable within 12 hours, while at the property of the Warren Bros., it was noticeable within three or four hours. On the South Side land at the Big Four mine it was reported that the mine was scarcely affected by rains, however severe. Other reports as various were obtainable in different parts of the district showing that the influence of rains on underground water supply is generally very great and that it is modified to a large extent by local surroundings.

Observation also tends to show that the underground waters migrate to the west down the slope of the Ozark area. It is equally probable that a part of this migratory water comes from the catchment areas of Cedar Gap.

The artesian effect of underground waters in the Joplin district is not very pronounced, a condition impossible without some relief in the pressure somewhere south of Cedar Gap. Deep wells at Joplin, Empire City, and Columbus, show no pressure sufficient to bring the water to the surface, although penetrating the Silurian sandstones. At Fort Scott there is a strong artesian well, but in most other places where deep wells have been sunk in this upland area there is no flow.

Methods of Unwatering

As a relief against the incursions of surface waters, especially down shafts, drill holes, and caves in the surface, various devices are employed in the district. At some of the mines the water pumped from the shafts is hauled away in tanks; at others, flumes are employed, but in most cases the compactness of the cap rocks is depended upon to shed the water from the pumps. Where the mines are situated in the valleys or near the bed of a stream, embankments either of earth or concrete are built along the dangerous ground or about the mouths of the ground openings. At Lehigh an embankment several hundred feet long skirts the south boundary of the Moeler-Smith Lead and Zinc Company's property and has assisted in conquering one of the worst water problems in the district. In the Center creek area north of Webb City a similar device has been used as well as embankments of earth around all openings into the ground. In the Peacock and Badger camps concrete walls have been built around the shafts and drill holes but have proved only partially successful.



WALKING-BEAM PUMP. FIRST PUMP USED IN UNWATERING THE MINES

The method of unwatering a mine in the Joplin district differs little from the usual practice. The pump is usually located in a seat cut near the bottom of the shaft; it is more easily assembled there or removed and cared for. The lift is also shortened by placing the pump near the shaft. In sinking or in first draining a flooded mine the pumps are lowered on cables into the shaft as the water goes down.

The old Cornish lift pump and the Neosho crosshead pump are stationed on the surface of the ground. These old types of pump have done much service in the district and many are still in use. Of the steam pumps employed the prevailing type is the duplex, piston-packed plunger pump varying in sizes from 6x4x6 in. to 16x10x12 in. Some compound steam cylinder pumps are in use, and for sinking some Cameron pumps are employed. The walking-beam pump is the regulation sinking pump, however, down to 150 to 175 ft. A number of steam heads and Neosho crossheads are also used for the same purpose.

Campaign of the Ozark Lead Company

The most serious water problem ever encountered in the Joplin district was that of the mines of the Ozark Lead Company in Center Creek valley, north of Webb City. The valley of Center creek extends from Sarcoxie, Mo., westward a distance of 50 miles to its confluence with Spring river, and varies in width from ¼ to 1¼ miles. A portion of this valley, notably that immediately north of Webb City, had long been prospected with the drill, and was known to contain large deposits of ore including both zinc and lead. Some mining was carried on in spite of the fact that during wet seasons the mines were completely flooded and abandoned. During floods or moderately heavy rains the drifts and machinery were often submerged.

Even under these adverse conditions hundreds of drill holes were put down, many of them in excellent deposits of ore, and from 50 to 60 shafts were sunk by the numerous fee owners and lessees. In many instances large bodies of high-grade ore were encountered. Strikes of unusual richness rewarded the labors of others. Mills were erected at some of the more promising prospects and the area developed one or two of the most famous mines of the district. The old Silver Dick mine was one of the most notable, and for years was one of the famous producers in the Southwest.

This old mine, together with many others almost as rich served to show the possibilities of this section if the water could only be controlled. Hitherto the history of the desultory attempts to drain mines in this valley had resulted in failure. Thousands of dollars had been spent without the slightest benefit in return. Many of the operators had been plunged into bankruptcy. In the face of such a history the Ozark Lead Company undertook,

singlehanded, the gigantic task of draining the whole valley. A lease of 120 acres known to be richly underlaid with lead and zinc, furnished the incentive.

The magnitude of the task, while in no wise overlooked, may have been greatly underestimated. The conditions existing at the time the task was begun were known to be thoroughly unfavorable. The water level during ordinary weather was within 15 ft. of the surface. Every drill-hole, shaft, and cave-in in the valley stood open ready to drink in the floods which Center creek periodically brought down the valley. On Nov. 17, 1904, however, the first pumps were set to work. They were huge 16-in. walking-beam affairs with working barrels 90 ft. below the surface. They were driven at the rate of 12 strokes per minute. They were never idle, and worked alone for months until nearly all the surface water was out and the water level had been lowered from 15 to 45 feet.

Then three 6-in. Cameron pumps were installed, each with a capacity of 450 gal. per minute. With this addition the water was lowered until at a depth of 87 ft. the increased inflow with the increased depth made necessary additional pumping machinery. Then two Emerson pumps, one with a capacity of 1000 gal. per min. and another with a capacity of 700 gal. per min. were installed. With this additional power the water was lowered to the lower drifts at a depth of 153 ft., after constant pumping for 11 months from the time the first walking beams were started.

Second Campaign

Miners went to work in some of the richest ore ever seen in the district, but were called to the surface in a few hours. The day following the drainage of the mine, there came a flood which completely inundated Center Creek valley and, checked by the dam of the Spring River Power Company, at Lowell, Kan., pushed the flood out of the banks and filled every drift, shaft and drill-hole to the surface. Water stood for hours within 3 in. of the fire grates under the boilers. A large cave-in covering acres of ground at the old Englewood mine had allowed the flood to enter and the Ozark Lead Company faced the same obstacle it had taken 11 months to conquer.

During the flood the walking-beam pumps were down, and it was found that the steam pumps on cables were covered with 50 ft. of water but still working. The walking beams were again set to work. More weary weeks were spent in pumping, and the ground drained a second time; but only in time to allow the repacking and repairing of the steam pumps, when a second flood came nearly as high as the first, and the water rose covering the pumps to a depth of 75 ft. in spite of the precaution of building dikes around every opening into the ground that could be found in the Center Creek valley. The south bank of the creek had also been diked, but apparently without result.

Final Success

Upon the second inundation which occurred in September, 1905, an Emerson pump with a capacity of 1800 gal. per min. was added. The walking-beam pumps and all the steam pumps having an aggregate capacity per minute of 6000 gal. were set to work. It took four months with this equipment to drain the ground the third time. During this work the pumps were run continuously 24 hours per day and were not pulled for repairs except for repacking, and then not until they had uncovered themselves.

Within three months from the completion of the work the chamber was cut for the largest pump ever installed in the Joplin district. It is a Jeansville compound-condensing, wood-lined station pump with a capacity of 4500 gal. per min. when running at ordinary speed, but with increased stroke it has a capacity of 5000 gal. per min.; it weighs 81,000 lb., has a length over all of 36 ft., hight, 11 ft., width 11½ ft., and requires a room 50 ft. long, 20 ft. wide, and 18 ft. high, to permit the assembling of its parts underground. It has a 14-in. suction and a 14-in. discharge, and cost $12,000. So well are the pipes protected that under 150 ft. of water the pump works almost as well as if uncovered.

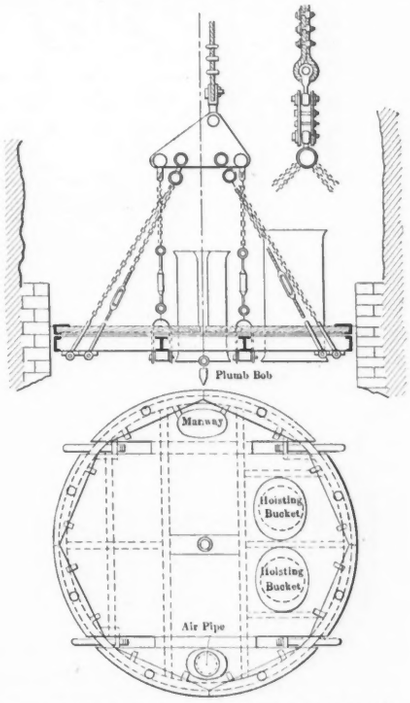
An Improved Swinging Staging

A German contrivance for hanging a staging in a shaft during sinking and lining operations, is described in *Der Bergbau,* April 16, 1908. As shown in the accompanying drawings, it is designed for the usual European circular shaft, the walls of which are carefully lined with brick or masonry, but certain features of it commend themselves to American practice, and its design can easily be changed to suit the rectangular shaft.

Most swinging stagings are hung from a rope in the middle of the shaft, which makes it impossible to hang a plumb line there. According to this design, the plumb line can be hung freely down the center of the shaft, from the surface to the bottom, and all measurements, both for guiding and shaft-sinking and plumbing the walls, can be taken from it.

Between the suspension rope and the six chains from which the platform is hung, is a yoke formed of two iron plates in the form of scalene triangles, bolted together, but with an intervening space. The main rope is attached to one angle, and the suspending chains occupy the other two angles, and the side between them. This throws the rope out of center. A hole is cut at the center of the platform for the plumb line to pass through, and other holes are cut, in the positions indicated, to permit the passage of the two hoisting buckets, the air pipe, and for use as a manway. These openings are all protected by upward projecting cylinders, or otherwise, to avoid accidents to the workmen. The weight of the two guards around the hoisting openings is supposed to balance the tilting which would result from the unsymmetrical hanging of the platform; if necessary, additional weights can be put on the high side.

The platform is built of channels and I-beams, covered with planks. To hold the platform steady, four iron bars are provided, which can be shoved outward into holes in the finished wall. The space



SWINGING STAGING. SECTION AND PLAN

between the platform and the wall is closed by hinged doors in the form of segments of the circle. The apparatus is built by the Grossman firm, in Dortmund, and has given satisfaction in a number of recent shaft-sinking operations.

Consul Alfred A. Winslow, of Valparaiso, reports that during the year ending March 31, 1908, the exportation of Chilean nitrate amounted to 1,978,500 tons, against $1,892,115 tons for the previous year. During the same time the production of nitrate amounted to 2,058,920 tons, a gain of 51,848 tons over the previous year. The world's consumption of nitrate during the year 1907-8 was 1,972,814 tons, against 1,817,402 for 1906-7. This is an encouraging showing for the nitrate industry of Chile. The first three months of 1908 showed a big increase in exportation of nitrate.

A "chicken ladder" usually consists of a round timber, 6 to 8 in. diameter, into which notches are cut for steps.

Steam Churn Drill in Hot and Cold Climates

Transportation Difficulties and High Cost of Fuel, Labor and Supplies Render Operations Expensive at Best. Hand Drills Often Preferable

BY JOHN POWER HUTCHINS*

The difficulties of operating a steam churn drill in the tropics at low altitudes are generally those of moving over surfaces covered with a dense growth of bush and large trees, ground which may be marshy and intersected by frequent water courses. The expense of moving and of bridging the streams is great; in addition there is the cost of transportation to the area under examination, which is often high, and the outlay for renewals and repairs in inaccessible regions. Slow progress is all that can be expected under such circumstances.

Actual drilling also has its troubles. Chief among these are those resulting from the necessity of burning poor, wet wood; accumulations of scale in the boiler, resulting from the vegetable acids contained in the water; and the lost time due to accidents and repairs in a district far from machine shops. A feature peculiar to dredging ground in the tropics is the occurrence of buried timber, which may be several feet in diameter and in such a good state of preservation that the drive pipe cannot be driven through it, even though the drill bit may penetrate it. Some of the hard buried timbers are cut through with a drill bit only with great difficulty.

Deep and very stiff clays occurring as overburdens make driving and pulling difficult. A large proportion of clay in the gravel causes an excessive amount of slime and conditions in the material pumped from the drill holes which call for careful manipulation to prevent losses in panning and rocking. The bedrock may be much decomposed, sticky and clayey. This saprolitic condition, which continues for a depth of several hundred feet in some places, is due to the rapid decomposition that occurs as a result of the percolation by waters containing dissolved humic and other vegetable acids and organic matter. To this same cause also is due the general occurrence of clays as overburdens and interbedded in the gravel in regions having country rocks like granite which, in becoming saprolitic, is like a sticky clay.

In moving in the tropics the drill must rely upon its own traction more than in temperate regions where draft animals are easily procurable. In tropical countries draft animals are not only hard to get, but they do not thrive in hot climates. It is also often a difficult matter to get fodder in the jungle areas where no edible grasses or no grasses at all grow. The scarcity of fodder is very surprising to those unfamiliar with the many peculiarities of the tropics.

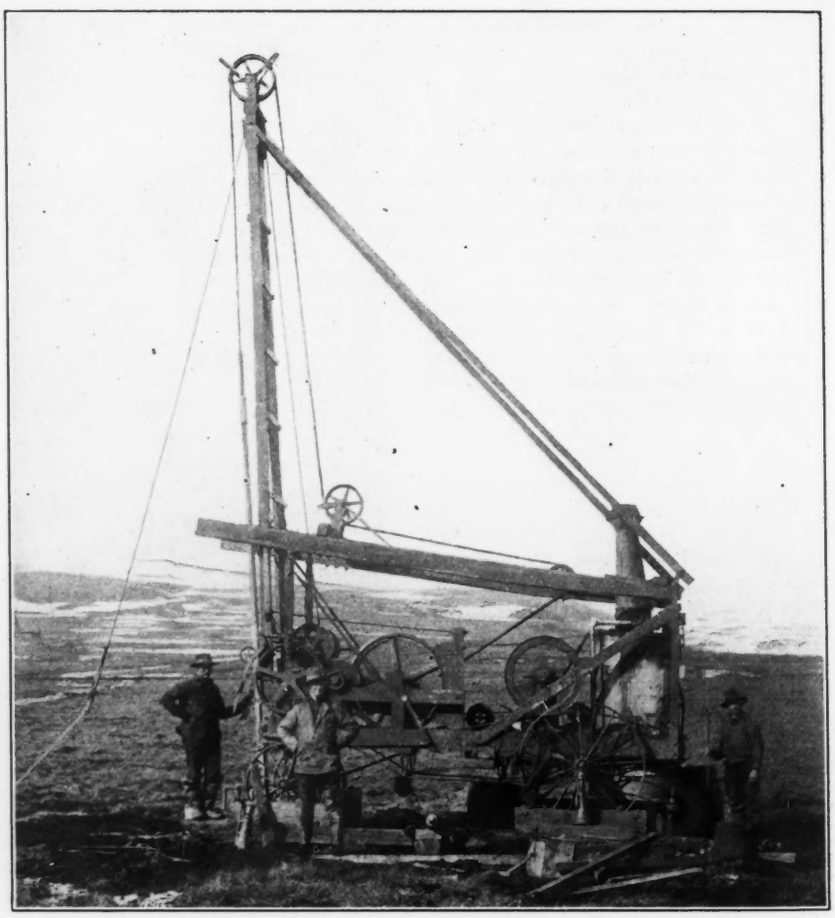
The tropical laborer is not satisfactory as a member of the drill crew. Thus to insure against difficulty in this respect a full crew should be imported. It is good practice to have at least one extra man who is able in case of sickness of either the drill man, the fireman or the panner to act as substitute. It is not unlikely in examination continuing more than three months that the extra man will be constantly needed to keep the drill in steady operation. On short examinations, say, of three months or less, an extra man may not be needed, for generally it takes about this time for malaria to overcome the robust constitutions commonly found among drill crews.

Strange as it may seem, it is difficult to get good fuel in the tropics, and also to keep up steam. The boiler water available has remarkable scale-producing qualities which is a frequent cause of delay.

Equipment for Hot Countries

The equipment for a drill to be used in tropical regions should include plenty of extra parts, especially those more likely to be broken in operation. Parts of the traction device will be needed because there are no draft animals to help over difficult ground. The drilling cable and the sand-pump line rot rapidy in the hot humid atmosphere.

A canvas fly to protect the drill from the heavy rains is absolutely necessary if investigation is to be conducted contin-



DRILLING ON SEWARD PENINSULA

*Mining engineer, 52 Broadway, New York.

uously in the wet season. Even if an investigation is made during the dry season, it is good practice to have a canvas fly to be used if, as if often the case, abnormal seasons occur and rain falls unexpectedly. Abnormal seasons are of frequent occurrence. Investigations of tropical dredging ground with steam churn drills should, if possible, be conducted during the dry seasons. There are large areas of gravel which are several feet under water in the wet seasons. These cannot be crossed with a drill at such times and are difficult of access even in the dryest periods.

TYPICAL PLACER GROUND IN TROPICS

It is better to use a hand drill in investigating alluvium at low altitudes in the tropics. It is preferable from every point of view; cheaper and more rapid work can be done by hand than with a steam drill.

In the Arctic Regions

As in prospecting in the tropics so in cold countries the difficulties of transportation are generally great. Moving over surfaces that may be very marshy or wet as a result of the superficial thawing of the muck surface beneath the moss or tundra covering, is always troublesome in the short summers. This condition continues through the open season, because the ground is constantly thawing and the water is brought to the surface by capillary action. It is often possible to haul only about 500 lb. per animal on areas of this kind. Accidents and repairs are expensive, particularly since machine shops are rarely available

In discussing the difficulties of transportation in Alaska, Alfred H. Brooks, geologist in charge of the Alaska Division of the U. S. Geological Survey, in a paper read before the Association of American Geographers, referred to transportation charges of 5c. to $1 per lb. and said: "Translated into terms more familiar to the average man, this means that the mine operator may have to pay a rate on all his heavy machinery equivalent to the charges for express between New York and San Francisco. In fact, I have known mining enterprises to be carried on in localities to which the transportation charges were greater than letter-rate postage."

BOATS USED IN TRANSPORT IN TROPICS

The actual drill operation is difficult if drive pipe is used, where partly or solidly frozen ground is encountered. Solidly frozen ground is hard and is very like concrete. It corresponds to very hard gravel in that it cannot be worked with a pick; a prospecting shaft sunk in it would require no timbering. It must be treated like the very hard gravel of the temperate zone. Drive pipe may be driven in it about one foot in about 10 min. depending upon the presence of frozen muck which is extremely difficult to penetrate. If boulders are encountered drilling below the pipe must be done before the pipe can be driven. There is less danger of drilling below the pipe in frozen than in any other uncemented ground.

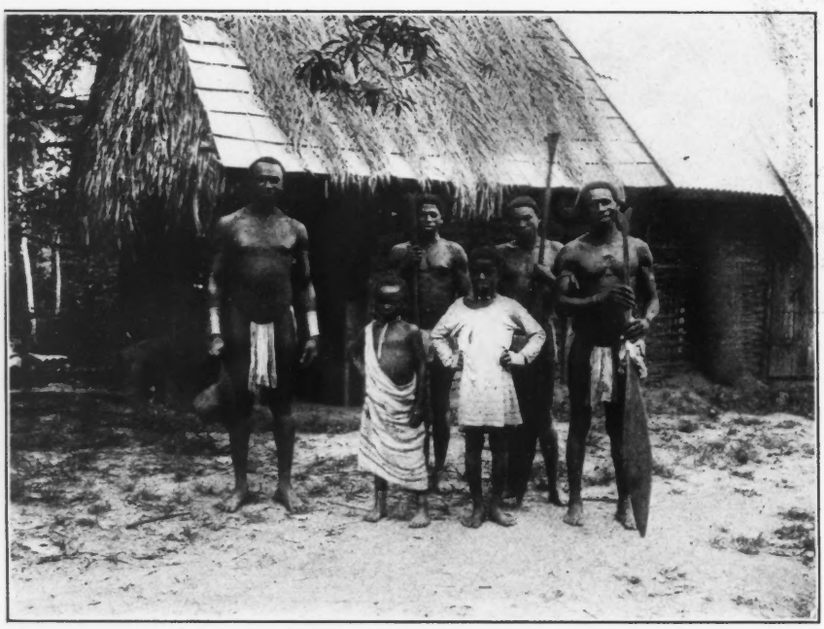
Pulling pipe is very difficult for it seems to freeze solidly, and there also seems to be a greater amount of skin friction due to some rearrangement of the material inclosing the pipe, probably from thawing and subsequently freezing. A probable reason is that when the pipe is driven through the material the ground is broken by the drill and thawed by the drilling water, but on subsequent freezing the material expands gripping the pipe firmly. This is, however, mere supposition; not enough drilling has been done in arctic countries to get a large fund of information on this subject, but considerable pipe has been lost by reason of inability to pull it from the hole, apparently from this cause.

Peculiarities of Arctic Placer Deposits

The alluvial deposits occurring in the North are often much spotted, and paystreaks are narrow and shallow. Therefore the location and number of drill holes may have a most important bearing on the results of prospecting. As a general rule it may be said that the occurrence of much solidly and perennially frozen ground in a placer believed to be suitable for exploitation by the dredging

method is fatal to profit. Some of the frozen ground may be thawed by driving steam points into it at a cost of about 40c. per cu. yd.; but there are frozen areas which contain many large boulders, and these cannot be thawed for this cost. Generally it would be necessary in such cases to drill through the boulders before the steam point could be driven and the additional expense would generally be prohibitive.

Frozen muck is often encountered as overburden on ground or as filling in ground that has been worked by open cutting, the muck being washed in after the cut had been worked out. Muck is a mixture of semi-decomposed vegetable matter, soil, sand, and fine pebbles in varying proportions with a proportion of water often 75 per cent. of the total.



TROPICAL LABORERS

Pure muck contains no sand or pebbles and is like peat. Muck increases the difficulty of drill operations, in nearly all its phases, for it is difficult to drive, drill, and pull through it. When first encountered in the drilling operation, it is so hard that it can hardly be worked with a pick. After the hole is finished it may be thawed around the pipe and difficulties such as those encountered in pulling pipe from dry sand in temperate zones are to be overcome. As in drilling hard gravel elsewhere, much sliming occurs in prospecting frozen ground, also flouring of the gold. This must be borne in mind in estimating results.

Drill prospecting can be conducted throughout the winter even with temperatures of 65 deg. F. below zero by modifying and enlarging the canvas fly used in California in rainy weather, and making it cover the whole machine and the men operating it. A tent of these dimensions would cause difficulty in windy climates, but it is most exceptional to have heavy wind or any wind at all during the cold weather of the far North except on the coast.

There are several reasons why drill prospecting could be done advantageously in winter, the principal one being that the surface of marshy areas is then frozen, which facilitates moving over ground impassable without close corduroy in summer. Streams can also be crossed on the ice, and the beds of rivers can be more easily drilled in winter than in summer. It is easier to operate a drill on the ice in winter than from a scow in summer. The condition of the gravel does not change except by superficial freezing; so that ground can be drilled as well in winter as in summer except for the resulting greater proportion of frozen ground encountered.

The daily expense of operating a steam churn drill in Alaska based upon costs as noted in 1907 are as follows:

Drill runner	$11 to $12
Panner	6 to 8
Fireman	6 to 8
Pumpman	6 to 8
Man and team	20 to 25
Repairs, renewals and fuel	10 to 30
	$59 to $91

In one drill investigation Seward peninsula coal cost $120 per ton. Steam churn drills using drive pipe may, under favorable conditions, drill more than 15 ft. per day. When operating in frozen ground without drive pipe 50 ft. or more may be drilled.

Equipment for Frigid Environment

Drill equipment for cold climates should, like that for the tropics, include more spare parts than for operating in temperate zones. Extra parts of the traction device should be provided generously, for the drill must rely upon its traction for moving very largely if not entirely, although not so generally as in the tropics. Draft animals are generally hard to get and maintain in both tropic and arctic regions.

In drilling in cold weather a large per cent. of breakage is to be expected because of increased brittleness of the metal. Drilling frozen ground is very hard on all the apparatus particularly on the driving and the pulling mechanism and on the pipe. A pipe-cutting and threading machine is useful where circumstances warrant, as in extensive investigations. An auxiliary apparatus consisting of a steam hose and steam points for thawing are sometimes useful in investigating frozen ground; a boiler having 10 h.p. capacity can run five to eight points if shaft sinking is done.

There is a large field for the hand drill in the far North. Where difficult transport is encountered the hand drill can do the cheaper work. As the dredging horizon widens inaccessible areas are being investigated with steam churn drills, and manufacturers have now sectionalized the machine so that the heaviest part weighs about 250 lb. Drills can thus be carried by mule or on the backs of men, but it is generally only with difficulty that such means of transportation are applied. Other drills than those operated by steam should be applied if possible where transportation is so difficult.

Hand drills are often better adapted for determinations in inaccessible areas than power machines. They can put down large holes using casing and thus get an accurate core. Having great advantages of mobility they may be used in inaccessible regions with greater ease and less expense. The steam-percussion drill weighs about six tons; this is for the power function alone. The power plant of the hand drill consists of men, and they in transporting the rest of the equipment on their backs make moving under the extreme difficulties encountered comparatively easy. It is also often the case that the inaccessible region to be investigated has very cheap native labor sufficiently efficient for operating hand drills. Generally the steam-drill crew must be imported and men unused to tropical climate are likely to suffer from malarial fevers and other complaints peculiar to tropic climates to which the native of the temperate zones is most sensitive.

According to a writer on the copper and brass industries, the old form of coke crucible furnace for brass melting is being replaced in large works by more modern coke furnaces using forced-blast, which can be tilted to pour the metal; this saves wear on the crucibles.

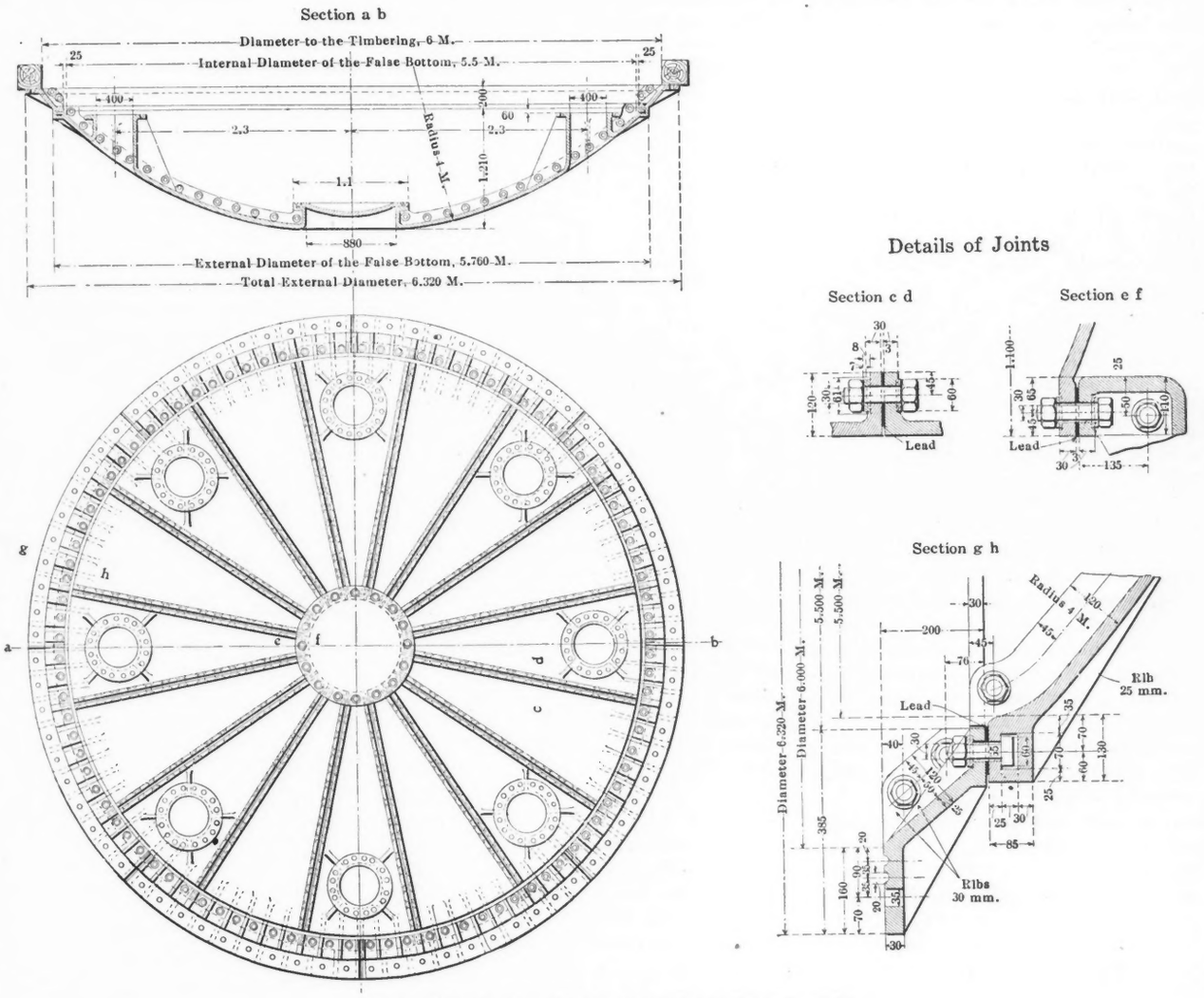
Shaft Sinking by Cementation*

By L. Morin†

While sinking the third of a series of ventilating shafts at the Lievin collieries, a stratum of water-bearing white chalk was met at a depth of 17.9 m., the flow from which, 240 cu.m. per hour, put a stop to sinking operations and necessitated the employment of the process described below. The chalk did not show any open breaks, but rather a great number of narrow fissures of varying directions and inclinations.

finally adopted was that indicated by Duvivier, director of mines at Landres. Briefly stated, the procedure included the placing of a false bottom in the shaft, fastening it to the lowermost fixed lining; boring of holes downward; injection of cement beneath the false bottom and into the rocks, by means of the holes; removal of the false bottom; and continuation of the shaft-sinking operations into the now solidified rock. By alternating the boring and the cementing processes, the flow of water was not allowed to exceed the available pumping capacity.

The pump was a vertical, Otto-Schwade, steel, and was designed for a pressure of 20 kg. per sq.cm. It had an effective diameter of 6 m., but was arranged for a diameter of 5.5 m. if desired. It consisted of an annular crown, 25 cm. wide, which could be attached by screw bolts to the bottom edge of the timbering, and to which the false bottom proper could also be fastened by bolts. The bottom was formed of 16 spherical trapezoids, eight of which had one tubular opening each, of 40 cm. diameter, and located on a circle of 3.60 m. diameter. These openings served for the drilling of the bore-holes, the injection



FALSE BOTTOM FOR SHAFT SINKING BY CEMENTATION

The freezing process was passed by as being too expensive. It was next proposed to create a pressure from within the shaft by pumping water from a number of small shafts surrounding the big one, and emptying their discharge into the latter, at the same time adding cement to the water, but this plan was also discarded as not satisfactory. The process

*Abstract of an article in *Annales des Mines*, Nov., 1907.

†Chief engineer of the Société Houillère de Lievin, France.

capable of lifting 300 cu.m. per hour from a depth of 100 m., with an effective steam pressure of 6 kg. It was suspended by rope in a compartment adjoining that occupied by the electric hoist, and the pipes were cut into lengths of 3 or 5 m. The steam-feed pipe had three sleeve joints, permitting a variation of 6 m. at the pump without changing the pipes.

The False Bottom

The false bottom was made of cast

of cement, and for the passage of the pump's suction pipe. Each opening was thus at a distance of 1.20 m. from the wall of the shaft. The circular opening at the center, 1 m. diameter, was also used for the suction pipe. All joints were carefully dressed, and calked with sheet lead. The grooves on the upper face of the outer ring permitted a tight joint to be made with rope. It was not necessary that the joints be absolutely tight, since the first injection of cement was made with the shaft full of water, and

the escaping cement made the joints tight. For fear that the cement would stick to the underside of the steel, several kinds of coatings were experimented upon, but the adhesion was found to be so slight that no coating was used.

First Application

The first placing of the false bottom was done as follows: Six carpenters dressed smooth the underside of the lowest timbers, and then fastened to them the eight sections of the outside ring, placing hemp in the grooves. The first 15 trapezoids were then placed without difficulty, but fitting the last sector and the central cover was a delicate task. The space below the false bottom was filled with waste, except directly under each opening, which helped hold the bottom in position. Six of the tubular openings were closed with their covers, one of them having a connection by which the underneath space could be filled with cement directly. The seventh was ready to be closed instantly, as soon as the pump suction should be withdrawn. Through the eighth a bore-hole was begun at once, the cover to this opening being fitted with the pipes necessary to make an injection of cement into the hole in case the flow of water should exceed the pump capacity. Sections were added to the injection pipe to maintain its length equal to the depth of the hole as it advanced.

By the time the first bore-hole had reached 5.9 m. below the false bottom, or about 3 m. into the rock, the flow of water had increased to 280 cu.m. per hour, or nearly the full capacity of the pump. Boring was stopped, the pump suction withdrawn, the two openings were closed, the injecting tubes were put into position, and the shaft was allowed to fill up to the static level, the water coming up through leaks in the false bottom. The cement grouting was then forced down the injection pipe until traces of cement were seen coming up through the joints in the false bottom. After allowing 25 days for the cement to set, the shaft was pumped out, and the bottom was then found to leak only to the extent of 2 cu.m. per hour, against 280 cu.m. before the cement was put in.

Four more holes were then bored to a depth of 23 in., reaching a stratum of hard sandstone underlying the chalk. The holes had diameters of 7 to 14 cm., and were not cased except for 1 m. at the top. Boring was conducted from the surface, and the cuttings were washed out by a water jet, care being taken not to allow any water-bearing seams to become plugged with refuse. Before cement was injected into any hole, a stream of water was first sent through the injection pipe to wash out any mud from the surrounding fissures. Each hole was filled with cement as soon as bored.

The apparatus for drilling was very simple, consisting only of a frame carrying a pulley and a drum which was driven steadily in one direction. A rope attached to the drill rod and bit passed twice around the drum, and the man holding the free end of the rope alternately tightened and released the coils on the drum. Two drillers and four helpers averaged 0.50 m. per hour.

Injection of Cement

The cement injections were made from the surface, all the pressure required being that due to the standing column of liquid. A pump was also tried, but it was found that whenever the ordinary pressure, of about 2 kg., was not sufficient to overcome a stoppage, the added 5.5 kg. pressure of the pump would do no better. The grouting was mixed in a cement grinding mill from which the crushing rolls had been removed, but the chasers retained. The mixture contained 5 per cent. by weight of cement, and three times per hour a flushing of water was given to clear the pipe. From the false bottom up, the injection pipe was 5 cm. diameter, and from that point down, it was 3 cm., so that the added velocity of the stream in the smaller pipe prevented stoppages below the false bottom. The pipe reached to within 1 to 5 m. of the bottom of the hole. The cement was a special portland, of which only one-quarter was coarser than 70-mesh.

The first hole was injected while the shaft stood full of water, and took 540 bags. The space under the false bottom took 114 bags. All the other holes were filled while the shaft was kept empty. No. 2 took 321 bags; No. 3 took 179 bags; No. 4 produced only a small flow of water, and was not injected; No. 5 took 226 bags. The total time consumed in all the preceding operations, related to the first position of the false bottom, was 64 days.

Deepening the Shaft

After removing one section of the false bottom, which required some digging, the rest of it was dismantled and hoisted in 24 hours. The flow of water was then 4 cu.m. per hour. The upper layers of the cement were found to be gray in color and rather soft; deeper levels were hard and of darker color. The shaft was then sunk for 20 m., by which time the flow of water had increased to 150 cu.m. per hour. The vertical fissures were found to be filled with cement, but there were not enough of the holes to reach them all. The horizontal fissures were not so well filled, and the cement in them soon gave way.

Second Application

After having lined the last section of shaft, 10 test holes were bored in a circle within 70 cm. of the outer wall, to depths of 1.50 to 7.50 m. Only a little water came from them, the sandstone being usually considered the base of the water-bearing horizon, and shaft sinking was resumed. But at a depth of 1 m., and within 30 cm. of a hole from which no water had come, an open fissure was struck close to the wall of the shaft, which gave a flow of 100 cu.m. per hour. The false bottom was immediately placed the second time, now at a depth of 49.25 m. Two holes were then bored to a depth of 20 m., and two injection pipes were fitted, one connecting with the water-bearing fissure, and the other with one of the holes, which yielded no water. As the screw bolts to hold the false bottom to the timbering had been omitted, it was necessary to make the injection with the shaft full of water, and to prevent the accumulation of cement on top of the false bottom, getting there by going around the edge of it, the following procedure was adopted: During the injection, water was poured into the shaft in such volumes that the added water was slightly greater in amount than that indicated by the rise in the level of the water standing in the shaft; this assured that the cement could not rise above the false bottom. This injection required 1071 bags of cement.

Shaft sinking was again resumed, and at a depth of 59 m. a solid and dry stratum was reached, beyond which no inconvenient flow of water was encountered.

Cost of Cementation

The additional cost due to the flow of water consisted of the following items:

Purchase of false bottom	fr. 7,416
Wages, placing and removing false bottom twice	3,466
Cement, 2451 bags of 50 kg	4,580
Wages, boring and injecting	3,683
Various expenses	1,391
Total cementation	fr. 20,536
Price of pump and accessories	fr. 18,637
Wages, placing and operating pump	30,117
Various pumping expenses	11,911
Fuel for pumping	10,000
Wages, time lost by flooding	1,828
Total pumping	fr. 72,493
Total	fr. 93,029

This additional expense of 93,000 fr., distributed over the 84 m. gained during the process, is equivalent to 1100 fr. per m.; it is fair to reduce this figure to 900 fr. since the pump, pipes, etc., were still in good order, and were subsequently used. The cost of the freezing method, as estimated by the Société d'Enterprise de Fonçage de Puits par Congélation, would have been 2300 fr. per m., showing a saving of about 120,000 fr. for the whole operation in favor of the cementation process. The cost of cementation alone amounted to only 500 fr. per m. While consolidation of the water-bearing rock was not perfect, it was sufficient. The delays were numerous and sometimes lengthy, but it is believed that they were no more costly than they would have been by any other method.

Discovery of the Camp Bird Mine*

By Thomas F. Walsh

In the examination and sampling of mines, be industrious, thorough, honest and conservative. Sample, assay, and measure your orebodies with great care. See to it that your samples are not tampered with. Do not give the small but attractive pay streak any greater representation than its size justifies. Rich specimen assays it is best to throw out; otherwise they will swell your average to a figure that will not be reached in actual results. Rich ore in a mine has a magnetic attraction for some; it certainly has for me, and it is difficult to be conservative in sampling my own mine. To enlarge a pay streak of 2 or 3 in. into one of as many feet, and transform expectations into sterling realities, are feats I have often accomplished in my mind. Mining is an industry so full of hope that it tends to make optimists of its devotees. Beware of this intoxication. Keep cool heads and be conservative in your examination work, always bearing in mind that you are apt to be checked up and confronted by practical results. I have always believed in making almost endless assays, and also in testing every kind of rock in a mine and to this I owe, in part, what success I have had. So I say to you do not be stingy in assaying.

In going over roads or trails, keep your eyes open for rich floats, or rich ore on the dumps of abandoned mines. Whenever you find any you suspect of having value, put a piece of it in your pocket and assay it. In this way you can, in a measure, prospect the mining sections that you pass through. I once found a rich mine, when riding in a buckboard with my wife, by noting and sampling the float that lay on the side of the road. It took me not over 10 minutes to get out and take my sample. This few minutes' work netted me a fair-sized fortune. I have known many instances of mining engineers passing by and over rich float from undeveloped mines day after day and month after month, too lazy and too indifferent to notice it, much less to get off their horses and sample it. Nature deposits her precious minerals in a very small area and in unexpected places; so, look for them everywhere.

Prospecting the Roof of a House

Apropos of this, I must tell you another of my experiences. Did you ever hear of a mine being discovered on the roof of a house? No! Well, I once discovered one on the roof of a log cabin. In 1880 I was interested in properties in the Frying Pan district, west of Leadville. I was stopping for a few days at our mine, wishing to take a look over a near-by hill that I had not examined. I started out one morning with my prospecting pick and a gun. About ten o'clock I was near a miner's cabin that had been abandoned, and, thinking it was about time to have a smoke, went over to the cabin and set the gun down with the barrel between the poles of the roof. Without that gun I should not have gone near enough to the cabin to notice what was there.

Looking at the dirt-covered roof, after lighting my cigar, I saw it had particles of quartz all through it and that it was likely vein matter. I tried to find the vein, but could see no trace of it, but found near-by a shaft sunk in decomposed granite, absolutely barren. The hole at the end of the cabin, from which the dirt was taken, was covered with débris, and there was no quartz or other mineral indications to be seen.

Finally, I went inside the cabin. Here I noticed the floor was uneven because of chunks of partly exposed rock. I soon had my little pick at work; I broke off corners of the rock, and found that it was nice-looking quartz. I immediately sized up the situation, which, after development proved to be correct. The men who made the location built the cabin squarely on the apex of the vein, covered its roof with dirt from the vein, and went 50 ft. away to sink their shaft in barren granite.

True to my first find, I went back to the roof and took my samples from it, assayed them, and got returns of over 100 oz. silver to the ton. Taking chances on my own judgment, before doing any work on the claim, I found the owners, paid their price, put two men to work, and in two weeks had a fine vein uncovered. This claim netted me in two months more than $75,000. The mine has been a large producer, and is producing to-day.

Use Your Own Eyes and Judgment

This brings me to the discovery of the Camp Bird mine. Along in the '80s. millions of dollars were expended in the development of the silver-lead veins and the erection of mills in the Imogene basin, nine miles from Ouray. Miles of adits and shafts were driven and sunk upon the strong veins that pass through that basin. Immense hoisting and concentrating plants were installed to handle and treat the ores, all of which proved failures. As time went on, the mills and machinery were dismantled and sold. The mines were shut down, and when in 1896 I came upon the scene the section was generally condemned as a failure; the country was abandoned, save by Andy Richardson, who was the first white man to cross the range from Red Mountain, 18 or 20 years before, to prospect Imogene basin.

After examining the locality, I concluded that by owning all of the properties in the basin and making a large output, I could make the low-grade mines pay handsomely. Following this up, I commenced buying all the prospects and mines that were offered me, and as no one believed it possible to succeed where so much money had been lost, everyone who owned a claim was anxious to dispose of it to me.

At the particular time I speak of, I had already acquired a large number of claims. I was offered one away up near the summit of the range, and started one day, in company with Mr. Richardson, to examine it. We rode as far as we could, and climbed the rest of the way. The trail ran along the slope and high up the side of a steep mountain. About three-fourths of the way up from where we left the horses we came to a slide of reddish pyritiferous porphyry. It at once attracted my attention as having a very strong indication of gold in or near it.

We went up, examined the prospect and as we came down I took samples from the porphyry slide. I asked Andy if gold were ever found in the basin. He said, "No, Mr. Walsh, there is no gold in Imogene except the little associated with silver and lead."

I said, "Andy, I believe there is gold in Imogene, and I am going to find it."

I had the samples of porphyry assayed, and it ran $2 in gold to the ton. This confirmed my suspicion.

Among the claims I owned at the time there was one situated at about the same altitude about 300 ft. east from where I sampled the porphyry. I never saw the workings of this claim, because a snow slide, that never melted, covered the tunnel to a great depth. I suspected that this vein passed through or near the porphyry dike and that it carried gold.

Sampling and Sampling

Some days afterward I was taken ill, and went to Excelsior Springs for treatment. Before leaving I told Andy to drive a tunnel through the snow and have samples for me on my return. Impatient to get back, I left the Springs against the doctor's advice and returned to Ouray in two weeks, mounted my horse the next morning, and started off for our cabin in the basin.

Andy gave me two or three sacks of samples, saying, "These were the ones you asked me to get."

Something within me said, "Go and take your own samples. Remember Andy has been in the basin for 18 years and has never found gold."

*From an address delivered to the graduating class of the Colorado School of Mines, Golden, Colo., May 22, 1908.

I threw them aside, saying, "Andy, I must see and sample that vein for myself."

He said, "Oh, Mr. Walsh, you're too sick and weak to go up there today."

I said, "No, Andy, I'm going."

He saddled the horses, helped me on mine, and we rode as near the tunnel as possible. With a great effort I reached it. Outside I found a dump of very showy ore having zinc, lead, and some copper pyrites. I went inside and examined the vein. There I found an 18-in. streak of the same kind of ore that was on the dump. Between it and the hanging wall there was about 3 ft. of modest-looking quartz. It had none of the shining mineral in it, and looked so barren that the average miner would consider it no good; but as I examined it closely I saw little specks and thread-like circles of glistening black mineral all through it, which experience told me was gold in a telluride form.

My illness was completely forgotten and I became so alert in sampling the grayish-looking quartz, that Andy grew uneasy, and asked me not to work so hard. Thinking that I did not see the low-grade metalliferous streak, he called my attention to it, saying that was the pay streak.

I said, "Never mind, Andy; I always assay everything in a vein."

However, I took some samples from this lead and zinc streak and got returns from them of $8 per ton, while the samples from the common-looking rock ran as high as $3000.

I came back, looked over the situation and found that the men who did the work, although they were no ordinary prospectors, saved the showy low-grade stuff and threw the modest but rich ore over the dump, from which I afterward shipped it. This mine has already had a net production of many millions, and stands to produce millions more; and it is a strange coincidence that the bonanza part of the mine is immediately beneath the spot where I picked up the piece of porphyry on the trail.

The Great Boulder Perseverance Mine

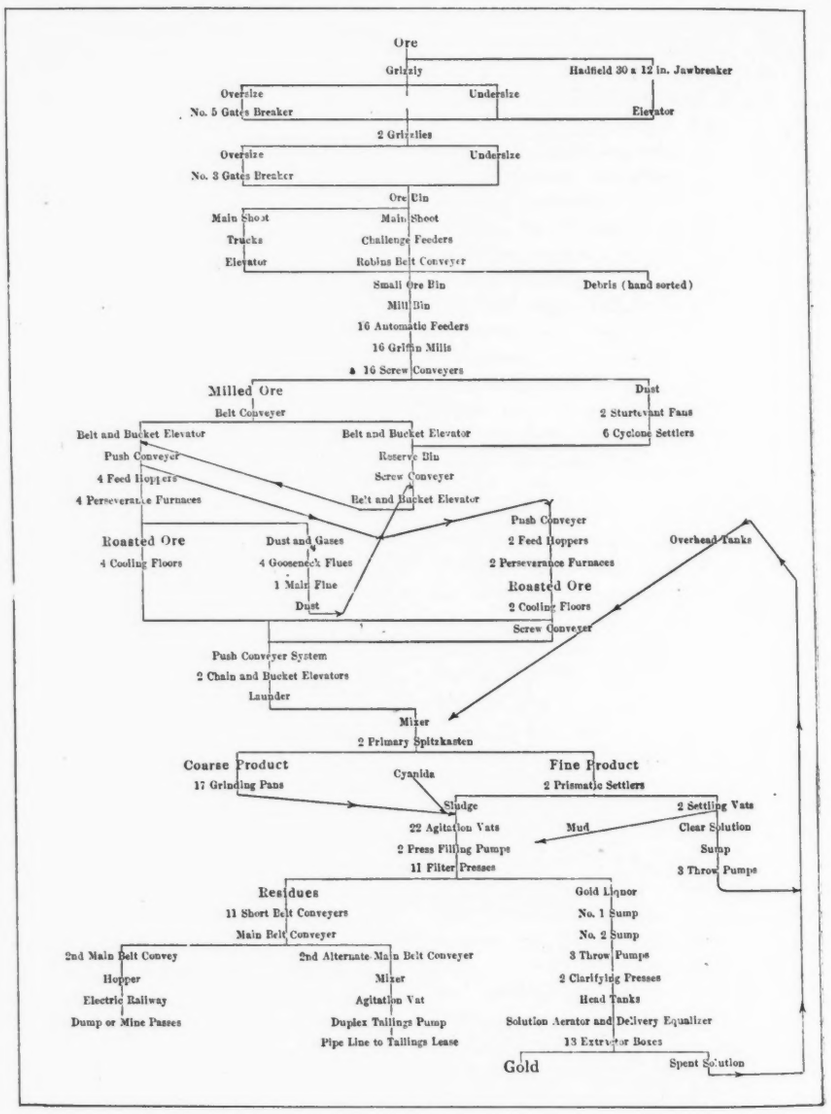
SPECIAL CORRESPONDENCE

The report of the Great Boulder Perseverance Gold Mining Company, Ltd., of western Australia, for the year ending Dec. 31, 1907, has been issued. The issued capital is £1,399,459, upon which a modest 5-per cent. dividend was paid. The ore treated during the year was 199,958 tons, producing bullion to the value of £344,131.

The working costs per ton, or, to be accurate, a portion of the working costs are given as under:

Mining	$1.38134
Treatment	2.64790
Tailings distribution	0.10292
General expenditure	0.22902
Total	$4.36118

A reference to the profit and loss account shows that such important charges as development, depreciation, London expenses, etc., are not included in the above costs. These items, including many small accounts not belonging to capital expenditure, amount to about $1.58 per ton, bringing the actual working costs up to about $5.94. In reporting working costs, there is some excuse for a manager to disregard head office expenses or even depreciation, but to leave out an important and necessary item like development leads to misunderstandings when comparisons are made with the costs of other mines. It is, of course, not suggested that there is any intention to mislead. The report is well drawn up, and in many respects, especially as regards the tables and plans, is a model of what a mining report should be. Anyone reading the report can see without difficulty that the manager's working costs are merely a fanciful expression, and that they only embrace a portion of the cost of winning the gold. Turning to other statistics the report says that the average grade is 7.41 dwt., a figure which he hopes to maintain in the future. The ore reserves on Dec. 31, 1907, amounted to 461,598 tons, excluding 161,597 tons of ore classified as "probable payable ore."



TREATMENT CHART, GREAT BOULDER PERSEVERANCE GOLD MINING COMPANY, LTD.

Attached to the report is an ore-treatment chart, giving particulars of the various processes that the ore passes through during the extraction of the gold. The average grade sent to the mill was 8.541 dwt., and the average recovery 8.094 dwt., or nearly 95 per cent.

The treatment sheet is reproduced herewith.

Mexican *peones* carry a load of 70 to 80 lb. up a "chicken ladder."

Copper for the Foundry *

By F. L. Antisell†

Copper for foundry purposes is required to possess certain properties, determined by the specific use for which it is intended, and that particular grade should be selected which will fill the requirements of the work in hand. To this end, the buyer should carefully consider the following points: (1) Brand; (2) conductivity; (3) analysis; (4) shape; (5) appearance, i.e., color, pitch, etc.

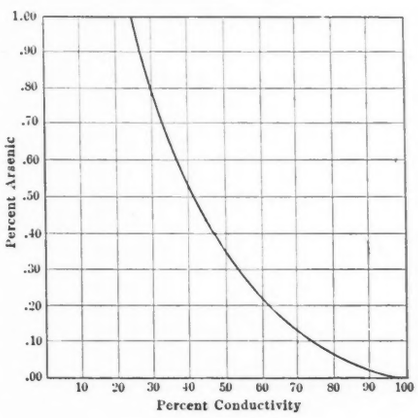
The brand, which I consider as first in importance, conveys the greatest amount of information to the buyer of copper. It insures uniform quality aside from the chemical analysis (as various brands of copper vary somewhat in pitch, or say if you like, gases or oxides), which fact is of great practical advantage to the mixer of copper alloys, as the melting can be conducted largely by a pre-arranged schedule, for a reliable brand of copper can always be depended upon to run uniform; whereas, while the unknown or unbranded ingot may represent the very best grade of copper obtainable, it may be only capable of producing a casting of inferior quality. Again, certain brands stand for a reputation that has required a vast amount of capital to create, and a large plant to produce. It is evident that a non-uniform brand of copper would jeopardize the business of the producing plant. To guard against this possibility, makers of various brands use every precaution to keep their products uniform in quality, it being not unusual to cast over 100,000 lb. of ingots at one charge, 12 ingots being cast simultaneously every 20 or 30 seconds. This large bath of copper is constantly under the inspection of metallurgists, chemists, and physical scientists. It can be said as an almost universal truth that writers on this subject invariably recommend the purchase of branded ingot copper only.

Conductivity

Conductivity may be well considered second in importance only to the brand as it can be said within certain restrictions to be a measure of the ultimate quality of the metal. This test should be carefully conducted with an apparatus of modern design. For the foundryman the best results will be obtained by drawing into wire a specimen of the ingot and testing the hard-drawn wire. The number of dies varies with the grade of copper. The same specimen can then be tested for tensile strength.

If the conductivity of hard-drawn copper wire is 98.75 per cent. (Mathiessen's standard), it will represent a conductivity of about 101 per cent. if properly annealed. Should any impurities appear, the conductivity will be lower according to the specific resistance of the alloy, and quantity of various elements.

The accompanying illustration shows graphically how the occurrence of even the most minute quantity of arsenic will vary the conductivity of copper. Thus, in annealed-copper wire with a conductivity of 100 per cent., we should hardly expect to find more than a trace of arsenic. Curves for the different elements show in an interesting manner the effect of impurities in copper. However, high conductivity in itself does not prove conclusively that between two specimens the higher in conductivity is the more suitable for casting purposes. Within certain limits copper may contain impurities in an oxidized condition, thus reducing the resistance of the specimen as a copper alloy, but at the expense of its tensile strength whereas, on the other hand, the impurity occurring in a metallic state must necessarily reduce the conductivity, and in practically all cases increase the tensile strength. Thus the conductivity



test is of more importance when considered in connection with a tensile test, and though various investigators do not agree in general on the point, it appears that as the rate of conductivity increases, the tensile strength decreases. The specimen for this test must necessarily therefore be treated for ultimate tensile strength only.

While copper refiners always give attention to the proper de-oxidizing of the metal there is almost always present a small quantity of copper oxide that does not appear to decrease either its conductivity or tensile strength.

Analysis

In buying copper on analysis it is generally sufficient to specify the total copper contents. Copper running 99.90 per cent. pure is suitable for the highest grade of copper alloy, and no distinction is necessary in specifying its origin as "Lake," "Electrolytic," etc. The percentage of copper contents may decrease steadily for different requirements according to the nature of the impurities. The principal impurities are arsenic, antimony, iron, sulphur, bismuth, selenium and tellurium.

Shape

The shape of ingots varies with the individual tastes of refiners. In fact, it is not unusual for copper refiners producing two or more grades of ingots, to make them up into different shapes, thereby reducing the probability of mixing qualities. It would appear that a standard shape and weight of casting copper would be very desirable, and should receive some attention from the brass founder.

The principal shapes of casting copper in the market are: (1) The old-fashioned three-heeled ingot. (2) The newer form of two-heeled. (3) The ingot bar. (4) The multiple-ingot bar. (5) The slab. These shapes all have advantages peculiar to themselves, but it would seem that the old-fashioned ingot bar is more than holding its own, and is generally preferred by brass founders.

The ingot bar consists of a number of ingots continuously, end to end, generally in groups of three 3-heeled ingots, the ends being joined by a thin gate, forming an extra deep notch to facilitate detaching the individual ingots.

The multiple-ingot bar is formed by several ingot bars cast side by side and connected at several points by gates. These bars must necessarily be cut apart before melting, and when adequate facilities are not at hand to separate them, the final cost is somewhat greater than for the ingot weighing, say, 20 lb., although the latter has probably to stand a charge for cooperage. Furthermore, the ingot bar when cut apart presents sharp corners that have a tendency to abrade and shorten the life of the crucible.

To get economical results from the slab, it is necessary to use a substantial shearing machine, capable of cutting the slab into pieces of proper size to be placed in the crucible, and the cost of this work must be charged against the shape as an offset to the saving in shipping expense.

Appearance

If the author of the saying, "Appearances are deceiving," had in mind copper when making this remark, he could hardly have explained the situation more clearly. If there is one thing impossible, it is to judge the quality of copper by the color of its skin. The terms, "rose red," "brassy," "black," mean nothing in regard to quality; the most beautiful rose-colored ingot may contain 0.5 per cent. of arsenic, while the blackest looking ingot ever made may be 99.99 fine. The various colors are due almost entirely to the temperature of the copper and pickle, when the casting leaves the mold. The pitch on the back of the ingot should be fairly flat with a uniform wrinkled top surface, and without sharp corners.

*A paper read before the American Foundrymen's Association, slightly condensed.

†Assistant superintendent, Raritan Copper Works, Perth Amboy, N. J.

Ore Shoots at Butte, Montana*

By Reno H. Sales†

The subject of "ore shoots" or "bonanzas" or whatever we choose to call the localized occurrences of relatively richer bodies in a vein or ore deposit, is one of the most perplexing and one of the least understood of all problems relating to the geology of metalliferous deposits. Why there should be a selective action exercised by a mineralizing solution traversing a fissure in a uniform country rock, is a matter difficult of explanation. The usual forms and occurrences of these richer portions in ore veins are generally well known. Their importance in mine sampling, mine valuation, etc., is familiar to all who have had occasion to sample and study closely veins of the ordinary type. The subject has not received any especial attention in recent years, and, while there have been a great many new mines opened up, and many facts disclosed, it is doubtful if any substantial advancement has been made in the study of this most important problem.

The presence of well-defined ore shoots in the copper veins of the Butte district was not recognized in the earlier history of the camp; and it appears that they were of doubtful existence as late as the year 1897, when the Butte *Special Folio* was issued by the U. S. Geological Survey. This may be accounted for in a large measure by the fact that most of the earlier mining operations were upon what are known as the older "east-west," or "quartz-pyrite" veins which are of a remarkable width and uniformity in mineralogical character. The more prominent of these have been stoped for hundreds or even thousands of feet continuously along their strike, showing little, if any disposition to develop shoots. There is, of course, a considerable variation in content of the valuable metals in different parts of the veins, but such may not be properly designated as shoots. Later developments, however, have brought new facts to light, and in at least two vein systems which are known to be younger geologically than the Anaconda or east-west system, the occurrence of ore in large irregular bodies, is a characteristic feature. These later veins have been termed fault veins, because they are known to cut and displace the earlier veins, and because of their physical character. They consist mainly of crushed country rock which may be either granite, aplite, or quartz-porphyry, carrying small amounts of quartz and iron pyrites either as finely disseminated material, or in the form of small stringers or scarf-like masses irregularly scattered throughout the crushed country. The fault, or crushed zone, is usually narrow, varying in width from 5 to 20 ft., exhibiting one or more well-defined planes of movement marked by a dark blue or black, tough clay ¼ in. to 6 in. thick. The above description applies to the barren stretches of vein between the ore shoots.

Some of these fault veins have been opened up on strike for more than a mile, and at intervals which are indeterminate excepting by actual development, immense ore shoots have been encountered. These ore shoots, which are quite irregular in form, show great variations in size from mere bunches or pockets, up to great orebodies over 1000 ft. in length and of unknown hight, in some instances 1500 to 2000 ft. vertical hight having been developed with no bottom yet known. The thickness of the ore varies from nothing up to 20 ft., or the entire width of the fault zone. In the latter case, there may be shown a complete replacement of the crushed country rock by ore minerals, leaving but little evidence of the fault character of the original fissure.

The mineralogical content of these shoots is chiefly quartz and iron pyrites with smaller amounts of blende and the copper minerals, chalcocite, enargite, bornite, covellite and chalcopyrite, the last being of rare occurrence. As far as known to me, there is no method of reasoning by means of which the position or extent of these shoots can be foretold. They usually fade out on strike within a distance of 50 ft. or less; although the limiting boundaries are not always well marked. There appears to be no regularity to the pitch of the shoots, i.e., there is no common direction of pitch. There are many examples of what I may term "shoots within a shoot," or localized areas of rich ore within the main orebody as above outlined. There are also enrichments within the larger shoot due to mineralization along cross-faults which are only local and do not extend beyond the boundaries or walls of the main fault. I have observed many examples of this character, indicating continued movement, or readjustment of the orebody, or other material within the fault zone during the period of vein-forming action. Such internal transverse fissures may be filled by richer ore, or there may be an enrichment of the earlier formed ore adjacent to the fractures, or both conditions may be present. Longitudinal fissuring has occurred during the period of mineralization, and has had an important influence upon the nature of the orebody, but these effects are not readily determinable, as the age of such fissuring is not generally evident.

The conditions under which these ore shoots were formed are somewhat obscure, and no attempt will be made at this time to enter into a discussion as to their genesis with reference to their mineral content, that is, whether the ores, either wholly or in part, were deposited from ascending or descending solutions, traversing the fault fissure. A few observations regarding the extent to which the large fault fissures in the Butte district have acted as channels or passageways for underground mineral-bearing solutions, may be of interest. In the first place, it is evident from the thoroughly altered condition of the crushed granite at all points along these faults, that there must have been, at an early period, a reasonably free circulation of waters throughout the entire extent of the fault zone, producing this intense alteration. But, as these fault zones are explored by mine workings, long distances along the strike are found to be absolutely dry and barren of ore, while the ore shoots themselves are usually wet. These facts indicate, to my mind, that the present positions of the shoots represent the channels or zones through which the ore-bearing solutions traveled. The concentration of all the solutions traversing the fault into these channels I believe, to have been brought about through the development, by continuous earth movements within the fault planes of impervious barriers composed of altered, clayey, crushed granite and attrition clay or gouge. The presence of this impervious material directed the circulating waters along lines of least resistance. In other words, solutions which at first traversed the entire extent of the fault fissure, were corralled, so to speak, and confined to more definite zones, while the walled-off or excluded portions gradually became dry.

The situation of the ore shoots was, therefore, determined in part at least by the physical nature of the country rock composing the fault zone. The size and richness of the orebodies may have been influenced to some degree by the cutting off, or I might say damming back, of the mineral solutions, through the later development of impervious material along or within the fault zone.

I have seen many examples of this phenomenon in various parts of the Butte district where the clay and crushed granite of a fault acted exactly as a dam holding back enormous quantities of water. On the 1000-ft. level of the Six O'clock shaft a crosscut was driven for several hundred feet, directly under the foot-wall of a large fault zone, in an absolutely dry, unaltered granite. After passing through the thick clay and crushed granite foot-wall, a perfect reservoir of water was encountered, the whole mass of fractured rocks for a hundred feet or more being thoroughly saturated. A condition exactly similar was noted on the 1000-ft. level of the Butte & London mine. Alternate wet and dry areas along faults in Butte are characteristic. The wet zones often encountered when drifts intersect faults are usually due to the presence of shattered granite or vein near the fault, and not necessarily from the water traversing the fault fissure itself. Fractured

*From *Economic Geology*, 1908, III, IV, 326-331.

†Geologist for Amalgamated Copper Company, Butte, Mont.

or sheared granite but slightly altered or shattered quartz veins appear to offer the most ready passage for underground waters.

That the immense quartz-pyrite veins of the old east-west system of copper veins in Butte were formed along shear zones having but slight displacement, I have no doubt. Repeated observations show that these earlier fissures are later than and intersect the quartz-porphyry dikes, but the displacement is very slight, even along the largest veins. The wonderful continuity and uniformity in size and character of these veins are due to the very significant fact that they were not formed along fissures of extensive movement, such as I have described above, but were fracture zones along which there was insufficient movement to develop the impervious fault material so characteristic of the larger faults. A free general circulation was thus permitted throughout the entire extent of the fracture zones, finally producing the extensive quartz-pyrite veins, of which the Anaconda and Syndicate lodes are the best examples. Later cross-faulting has cut and displaced the fault veins above described, also the veins of the Anaconda or east-west system, resulting in many instances, in an enrichment of the fractured veins adjacent to the intersecting fissures.

The above is offered merely as a possible explanation, to account for the position of the ore shoots in the fault veins of the Butte district. The circulation of underground water through fault fissures of the character above described does not appear to have been in this district as free and extensive as is generally supposed. During the period of faulting, there was more or less fracturing of the older veins, together with strike faulting along them. The passages for the circulation of mineralizing solutions thus afforded in and along these older veins, were far more important and contain more ore than the main fault fissures themselves.

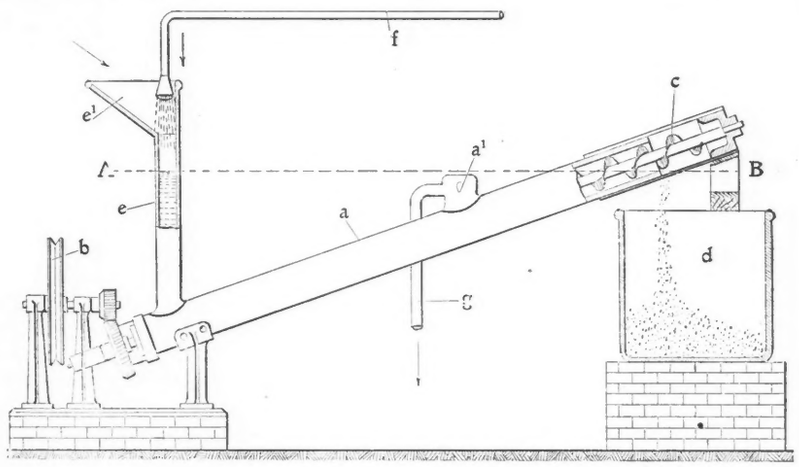
It is absolutely essential that a breathing apparatus to be safe and effective under all conditions of serious work should possess the following characteristics: (1) simplicity; (2) lightness; (3) strength; (4) comfort in wearing; (5) compactness so that it can be worn easily in low roadways; relief valve for the escape of excess oxygen in the breathing bag; absence of complicated parts; (6) adequate supply of air for two hours work; (7) emergency valve for use in case the automatic valve fails to act; (8) large soda surface for the absorption of carbonic acid gas; (9) pressure gage filled in such a position that the wearer can see for himself what quality of oxygen the cylinders contain; (10) the apparatus should be so designed that the wearer can put it on himself in the minimum amount of time.

A Novel Washing and Leaching Apparatus

By Alfred Gradenwitz*

Washing and leaching processes are used extensively in various industries to separate coarse and fine, or heavy and light, materials, respectively, the components of the mixture being obtained in as pure a condition as possible, so as to allow each of them to be worked, or otherwise utilized, separately.

The accompanying sketch shows a novel stirring device which is capable of keeping in constant motion considerable quantities of ore or other material, with a minimum of power consumption; it is especially adapted to the separation of gold from auriferous sand in cyaniding. The apparatus was invented by Reinhold Freygang, of Hamburg, to meet the requirements of a Chilean gold-mining company whose relatively rich ores (20 to 30 grams of gold per ton) were mixed with about 30 per cent. of ferrous clay.



FREYGANG'S WASHING AND LEACHING APPARATUS

The apparatus consists essentially of a bent pipe *a*, tightened at the bottom with a stuffing-box and inclosing the spiral conveyer *c*. The conveyer is driven from *b*. On the top of the vertical pipe *e* is fitted the charging hopper e^1, in which the water-supply pipe *f* terminates. To the pipe *a* is also fitted the outlet a^1, to which is connected the bent pipe *g*.

The working of the apparatus is as follows: After starting the conveyer and filling the apparatus with water, afterward supplying sufficient water to maintain the water level at AB, the material to be separated is poured into the hopper e^1. The charged material falls to the bottom of tube *e*, becoming thoroughly wet by the time it reaches the conveyer. The slime or pulp formed in the water is carried upward by the conveyer, the heavier material receiving a constant churning.

The water supplied through *f*, owing to the special arrangement of the outlet a^1, will leave the apparatus through the pipe *g*, carrying with it the suspended matter. The coarser or heavier particles, on the other hand, are carried by the conveyer to the discharge at the upper end of the pipe *a* and dumped into the tank *d*.

In cases where a single apparatus fails to make a clean separation, the fine material issuing from *g*, or the coarse material issuing from *c*, may be dumped into the hopper of another apparatus; by adjusting the speed of revolution of the latter, a more perfect separation may be obtained. Generally speaking, the degree of purity of the washed material is controlled either by altering the speed of the conveyer or by regulating the water circulation.

If the material issuing from *g* is supplied to the hopper of another apparatus, the two apparatus are said to be arranged in parallel; if the material issuing from *c* is charged into a second apparatus, these are said to be arranged in series.

One of the chief advantages claimed for the apparatus is the saving of water. As all of the light particles are kept in suspension by the constant churning of the conveyer, only that amount of water necessary to take up the light material of the continuous charge will be required. The water consumption can thus be reduced to a minimum, depending on the amount of fine material in the charge and on the number of turns of the conveyer.

The experiments necessary to evolve this device were carried out in private with an apparatus of about 2 tons daily capacity, driven by a 1/40-h.p. hot-air motor. One of these devices was recently constructed for an output of about 20 tons per day; it is operated by a 1½-h.p. motor and serves to wash ferrous clay (25 to 30 per cent. of the weight of ore) out of an auriferous copper ore in a single operation.

*Regensburgerstrasse 3, Berlin, Germany.

Iron Ore in the Dominican Republic

E. M. De. Garston, British vice-consul at Santo Domingo, reports that iron is found in immense quantities in several sections of the Dominican Republic. Near Puerta Plata, on the slope of the Isabel de Torres mountain, there is a large deposit of manganese, which from its volcanic formation seems to indicate that a similar deposit may exist on the southern slope of the same mountain of the Cordillera Setentrional. A deposit of magnetic iron ore, about nine miles in extent, is found on the borders of the Maimon river, municipality of Cotuy, province of La Vega. In order to develop this deposit it would be necessary to canalize the Maimon river as far down as its confluence with the river Yuma, so as to render it capable of floating small boats or barges for the transport of the ore. Iron is also found in Monte Pueblo, Arbol Gordo, Sabana de Santa Rosa, and South of Yamasa, in the province of Santo Domingo; these are limonite deposits. In Sierra Prieta, close to the Ozama river, which is navigable for small craft, there are masses of magnetic iron, samples of which are said to have yielded from 60 to 70 per cent. of metal.

There is an immense deposit of iron pyrites extending from Los Llanos across Hato Mayor to Sabana la Mar. A peculiarity of this region is that near the Almirante river the process of carbonization of vegetable matter has been so rapid that the generality of trees which fell centuries ago near the river are now more or less perfect blocks of lignite. Near Seybo, on the Campiña lake, there are stones so saturated with iron that the existence of an iron deposit in the vicinity is highly probable. Great difficulties would be met with at present, however, in producing pig iron profitably, owing to the great scarcity of labor and the absolute want of means of communication.

Efficiency of Hydraulic Air Compression

In *Glückauf*, March 14, 1908, P. Bernstein discusses the operation of a hydraulic air compressor recently installed in one of the mines at Clausthal. It replaced a piston compressor driven by belt from a Pelton wheel, and, as will be shown, afforded a marked economy in running expense.

The arrangement of the apparatus is shown in the accompanying illustration. A flow of water in the tunnel, *t*, is led through the cast-iron pipe, *a*, of 218 mm. diameter, to the air suction pipe, *b*. With the entrained air, the water then flows through the cast-iron pipe, *c*, 218 mm. diameter and 150 m. long, which is laid, somewhat crookedly, down an inclined shaft. The water discharges into the bottom of the receiver *d*, 1.1 m. diameter and 4.5 m. high, which rests upon an I-beam support in the shaft at a depth of 52 m. below the level of the overflow tunnel at *u*. The receiver is provided with a pressure gage, and a pipe, *g*, which passes up parallel to the discharge pipe and enters it at the discharge level.

The compressed air escapes through the valve, *e*, passing then into the reservoir, *i*, and thence, through the 80-mm. pipe, *h*, to the working places of the mine. The overflow water passes up through the pipe, *f*, 218 mm. diameter and 50 m. long, to the level *u*. The construction of the component parts of the apparatus is shown in the drawing. By the peculiar construction of the air inlet, which creates no compression of the water, and by the avoidance of sharp corners, the loss of head through resistance is reduced to a minimum.

The average flow of water through the system was found to be 3 cu.m. per min., which, falling through the distance 99.3 m., between the intake and the discharge levels, yielded 3000 kg. x 99.3 m., ÷ 4500 kilogram-meters per min., or 66.2 h.p. In order to test the efficiency of the installation, at full capacity, a test was made during which the flow of water was measured by a weir, and the amount of compressed air was measured by the filling of a receiver of known capacity. It was found that 3.2 cu.m. of water per min., falling the 99.3 m., afforded 10 cu.m. of air per min., at an effective pressure of 5.1 atmospheres (90 lb. per sq.in.). The work required to compress 1 cu.m. of air, adiabatically, to 5.1 effective atmospheres is approximately 24,300 kilogram-meters, so that, under the above conditions, the compressor was performing 10 × 24,300 ÷ 4500, or 54 h.p. The theoretical power of the water was 3200 × 99.3 ÷ 4500, or 70.5 h.p., showing an efficiency of 77 per cent.

The turbine wheel had an efficiency of about 75 per cent., including in the computation the water, 4 or 5 liters, used for cooling the compressor, and the compressor had an efficiency of 85 per cent., so that the combined efficiency of the installation that was displaced by the hydraulic apparatus was only 64 per cent., as against 77 per cent. efficiency of the new installation. Assuming the same conditions as in the above mentioned test, the older combination of machines would have yielded only 0.64 x 70.5 x 4500 ÷ 24,300, or 8.3 cu.m. of air per minute.

The superiority of the hydraulic installation is seen not alone in the greater capacity and efficiency. In the following tables are compared the cost of compressing air by three different means, viz., (1) by a piston compressor, belt-driven from a water turbine consuming the same amount of power as the hydraulic plant. (2) By an electric-driven compressor of the same capacity and using the same amount of power as the hydraulic plant. (3) By the hydraulic installation itself.

1. *Water-driven Plant—*

Investments:	
Belt-driven compressor	$1,250
Pelton wheel, complete	1,125
Building, foundations, etc	450
	$2,825
Interest and Depreciation:	
Interest on plant at 5 per cent	$ 141
Depreciation of machines at 10 per cent.	238
Depreciation of building at 3 per cent	15
Operating expenses:	
Wages (night and day shifts)	600
Lubricants, ½ pound per hour	75
Repairs and waste	75
Total annual expense	$1,144

Assuming 6000 working hours per year, and an output of 7.8 cu.m. per min., the year's output by the above arrangement would cost $0.38 per 1000 cu. meters.

2. *Electric-driven Plant* — Assuming the efficiency of the compressor to be 0.90, of the belt or gear drive, 0.95; of the motor, 0.90; and of the current transformer, 0.95, the total efficiency of the elcetric-driven plant would be 73 per cent., and for the exertion of 54 h.p. would require the purchase of 74 h.p. from the central generating station.

Investments:	
Belt-driven compressor	$1500
Electric motor, 70 h.p.	1,200
Buildings, foundations, etc	450
	$3,150
Interest and depreciation:	
Interest on plant at 5 per cent	$ 158
Depreciation of machines at 10 per cent.	315
Depreciation of building at 3 per cent	15
Operating expenses:	
Wages (day and night shift)	600
Lubricants	95
Repairs and waste	100
Electric power, 74 h.p. for 6000 hr. at ½c. per h.p.-hr	2,220
Total annual expense	$3,503

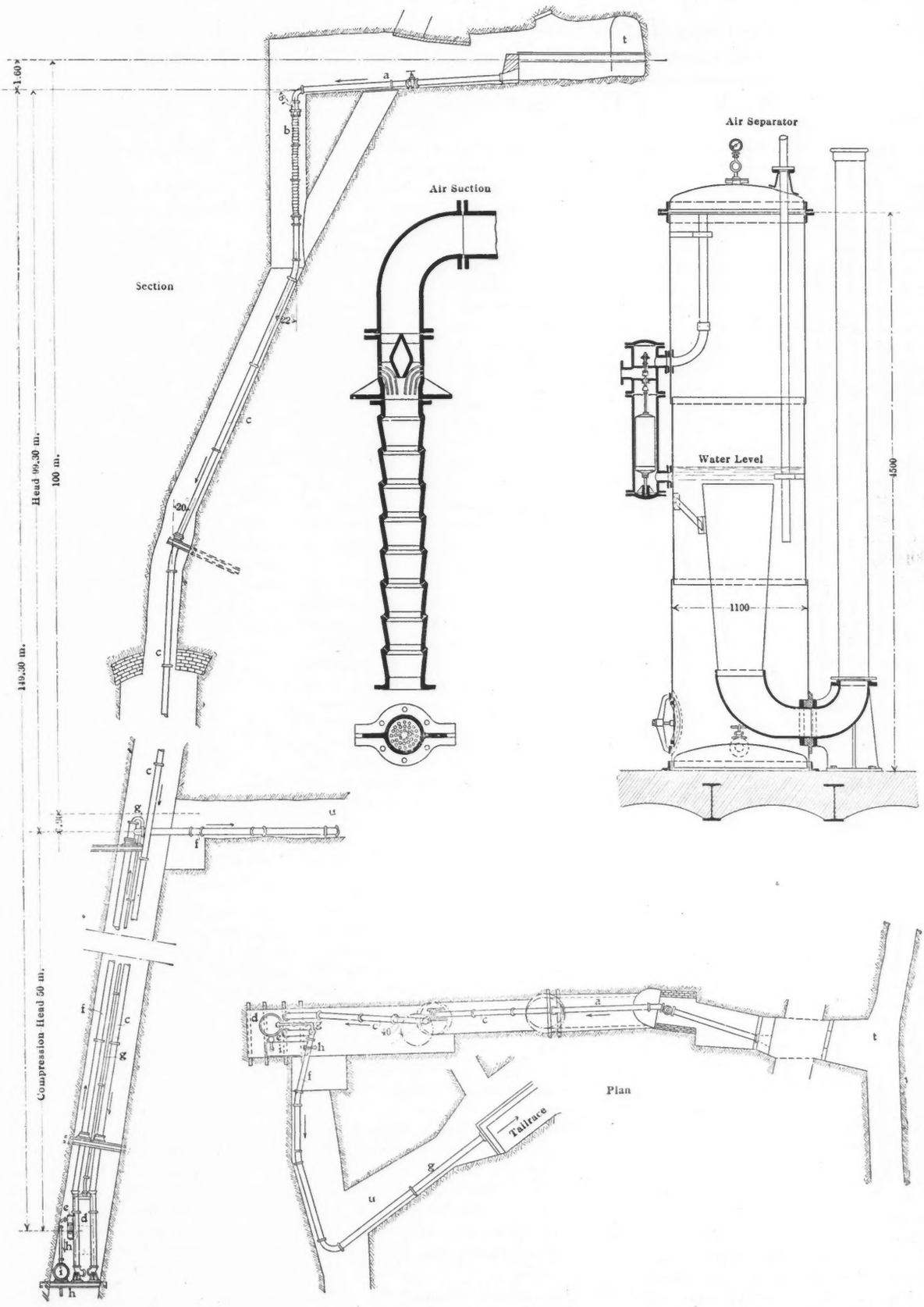
With an output of 10 cu. m. per min., the year's output by the above arrangement would cost $0.98 per 1000 cu. meters.

3. *Hydraulic Compressor—*

Investment:	
Compressor, installed	$3,750
Interest and depreciation:	
Interest at 5 per cent	$ 187
Depreciation at 5 per cent	188
Operating expenses;	
Lost wages during shutdowns	30
Repairs	20
Total annual expense	$ 425

With an output of 10 cu.m. per min., the year's output by the hydraulic compressor cost only $0.12 per 1000 cu.m. It may be added that 10 cu.m. of air at 5.1 effective atmospheres, is equivalent to 353 cu.ft. at a pressure of 90 lb. per sq. inch.

A writer on the brass and copper industries states that in muffle or crucible furnaces for brass melting, the joints between the firebricks should be as close as possible. Furnaces requiring high temperature, such as for refining copper, are best built of silica brick set in silica cement. The composition of the fireclay used should be as nearly as possible the same as the brick.



HYDRAULIC AIR COMPRESSOR

A Discussion of Mine Curve Problems

The Output of a Coal Mine Is Often Limited by Haulage Roads Having Steep Grades and Abrupt Turns. Approved Methods of Alinement

BY J. E. TIFFANY*

The most frequent demand made upon mine officials is for an ever increasing output. Although a coal mine may be provided with a number of electric-haulage motors, which ought to insure a large production, their work will be hampered unless the haulage roads are in first-class condition and free from abrupt turns, which latter are a common cause of wrecks and consequent delays.

It is often impracticable to make the main haulage road perfectly straight, but it is always possible to drive this haulway on sights in a given direction, until the necessity arises to make a change in its course. When such occasion arises, it should be carefully determined what the new direction should be and the two tangents then connected by a curve of as long a radius as possible.

The more hastily you build a railroad by skipping the work, and neglecting good alinement, the slower will be the travel upon it. A principle is here involved which applies to the development of a mine, for if the laying out of a mine is not given proper consideration, and if the main haulage roads are not driven with curves of long radius, also if cross-headings are broken off square instead of being connected with the main haulage headings and cross-headings by a curve, a method has been adopted, which will cause a slow recovery of the coal. Having driven the headings, it is not so easy to improve their condition as it is to improve the alinement of a railroad; furthermore, such neglect will cause an undeterminable extra cost per ton on the coal production.

From a theoretical point of view all curves should be of as long a radius as possible, but a radius of more than 50 ft. is not often used in mine practice in turning off cross-headings. It is the object of this article to give drawings of a number of mine curves explaining the same and showing how these can be applied to suit particular conditions. From a careful study of these problems there should be no difficulty to select the curve most suited to individual needs.

General Method of Locating a Curve

The methods used all require the use of a transit. For accuracy in driving a curve there is no better method than by the use of chords 10 ft. long, whose extremities are located in the center of the track. The point of curve is located by marking it with a survey station. From the line of tangent of the main heading, a deflection angle for a chord of 10 ft. is turned and a point placed about 3 ft. from the survey station. The latter station and the point ahead of it constitute the sights by which to drive the heading.

When the heading has been driven in a distance of about 10 ft. there is then room for the transit to be set up at the end of the first chord. The transit, however, is again set up at the point of curve and the same deflection turned as before. A distance of 10 ft. is measured in the direction of the deflection turned and the second survey station is located and marked. The transit is now moved to this last point and a deflection angle turned from this chord equal to twice the first deflection angle, giving by this means the direction for the second set of sights. The process is continued until the curve is driven to the point of tangent.

This work requires considerable attention on the part of the engineer and is not a convenient method unless the transitman can give it daily attention. Under these circumstances it becomes necessary to devise some method by which the work of driving a mine curve can be performed without such close attention on the part of the engineer. The 10-ft. chord method is shown in Fig. 1, while in the succeeding figures, methods are shown which do not require the same amount of attention. Before taking up the consideration of these problems, it is advisable to look at the calculations necessary for the method illustrated in Fig. 1. Let:

Δ = The deflection of the cross-heading tangent from the main heading tangent, in this case = 90 deg.

R = The radius of curve along the center of the track, in this case = 50 ft.

C = The length of the chords, in this case = 10 ft.

C_l = The length of the last chord.

X = The number of chords equal to 10 ft.

d_1 = The first deflection from the line of tangent of the main heading, then the deflection angle which two chords make with one another is equal to $2\ d_1$.

d_{l-1} = The deflection which the last chord makes with the one preceding it.

d_l = The deflection which the cross-heading tangent makes with the last chord.

In this case the values C_l, X, d_1, d_{l-1}, and d_l have to be determined by calculation.

By referring to any book of tables on railroad curves, we find that:

$$Sin.\ d_1 = \frac{\frac{1}{2}\,C}{R}. \qquad (1)$$

Substituting the valves of C and R given for this case, we get:

$$Sin.\ d_1 = \frac{5}{50} = 0.1 = sin.\ 5^\circ\ 45';$$
$$d_1 = 5^\circ\ 45'.$$

The value of X is determined by

$$X = \frac{\Delta}{2\ d_1} \qquad (2)$$

$$\text{Substituting} = \frac{90^\circ}{11^\circ\ 30'} = 7 + 9^\circ\ 30'.$$

Thus we see that $X = 7$ chords, each having a length of 10 ft. Before reaching the point of tangent we have another chord subtended at the center of the curve by an angle of 9 deg. 30 sec., the length of which we have represented by C_l

d_l = Half the remainder, when Δ is divided by $2\ d_1$, which in this case = one-half of 9° 30′
= 4° 45′

$d_{l-1} = d_1 + d_l$
= 5° 45′ + 4° 45′, or by substitution = 10° 30′.

$C_l = 2\ R\ sin.\ d_l$,
= 100 *sin.* 4° 45′ = 8.28.

By the above calculations, we find that $C_l = 8.28$, $X = 7+$, $d_1 = 5^\circ\ 45'$, $d_{l-1} = 10^\circ\ 30'$ and $d_l = 4^\circ\ 45'$.

In the first case illustrated, it is not absolutely necessary to make a drawing of it, but in the cases about to be discussed a sketch is imperative. For this purpose I will first consider the location and direction of the two tangents to be connected by a curve. Having fixed these, we proceed to make a drawing on a large scale. The ordinary mine-plan scale of 1 in. = 100 ft. is too small a scale to use. A suitable scale is 1 in. = 8 ft. The foreman who has charge of driving a heading is rarely provided with an engineer's rule, but by using the scale mentioned above, the plan can be scaled with an ordinary measuring rule, marked in inches and eighthts of an inch. The necessary dimensions should, however, be stated in figures on the plan.

Conditions to be Observed

Should the deflection angle which the two tangents make with one another be less than 46 deg. 10 sec., then for a curve

*Civil and mining engineer, Berlin, Penn.

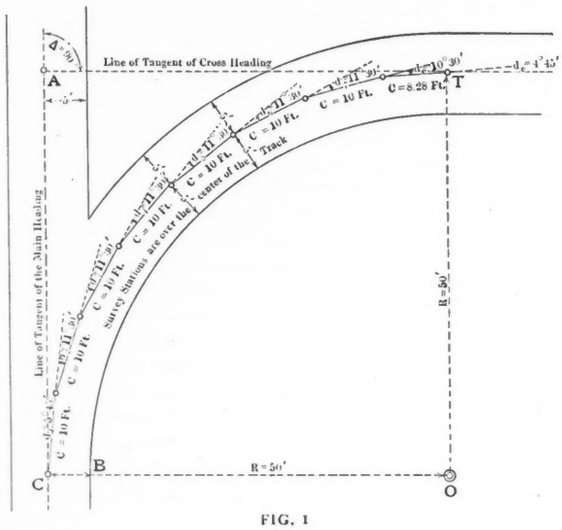


FIG. 1

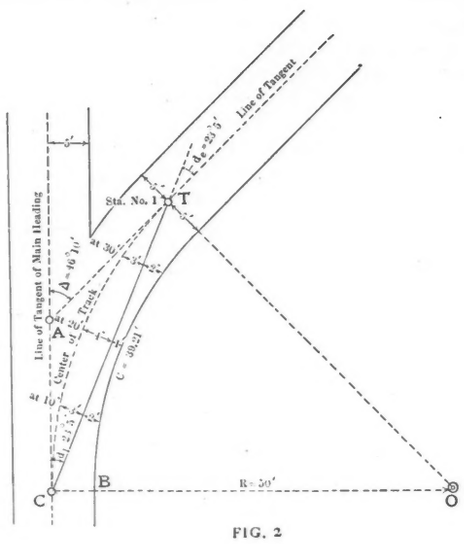


FIG. 2

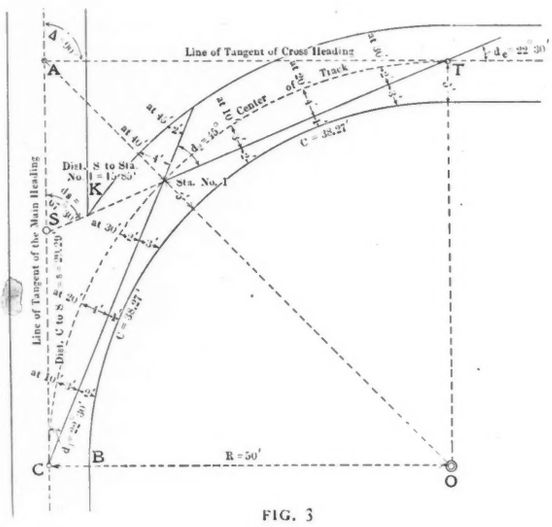


FIG. 3

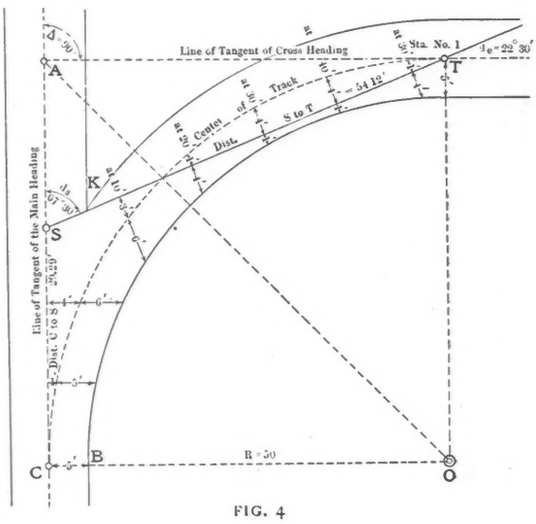


FIG. 4

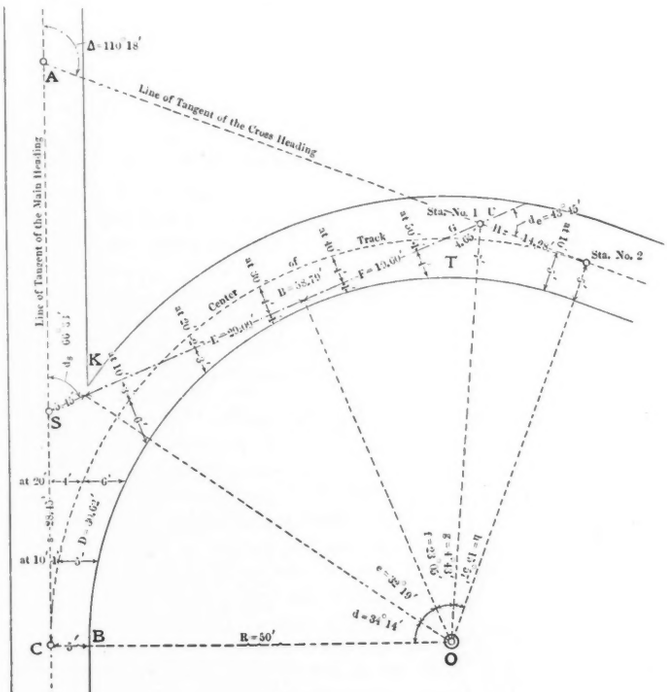


FIG. 5

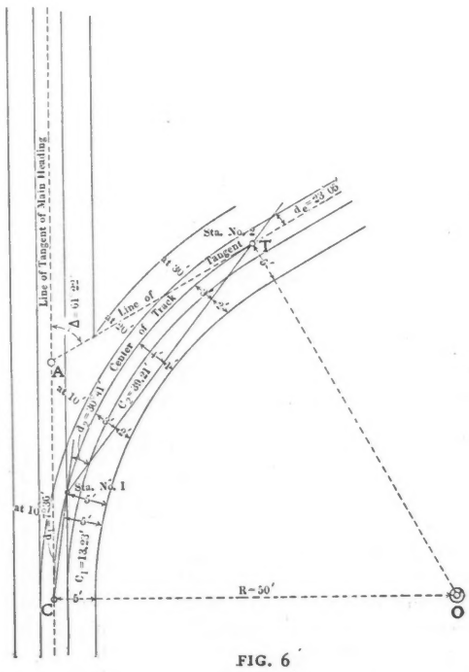


FIG. 6

PLANS FOR VARIOUS METHODS OF LOCATING CURVES IN COAL MINES

whose radius is 50 ft. one chord can be used from the point of curve to the point of tangent, so illustrated in Fig. 2. If we, however, increase the radius of the curve, the maximum for the deflection angle is decreased and also if the deflection angle should be greater than 46 deg. 10 sec. a radius can only be used which is correspondingly less than 50 ft. This method along with those illustrated in Figs. 4, 5 and 6 only requires one set of sights from the point of curve to where the sights are given for the tangent. Figs. 2 and 6 show what might be called a one-chord method, while those illustrated in Figs. 4, 5 and 7, although allowing a greater value of Δ cannot be described in the same way, because the lines used for bases are not chords to the curve used.

then the distance from the center of the curve to the center of the basal chord is the radius less 4 feet.

Let the symbols Δ, R, d and d_1 be the same as those used for Fig. 1 and have the same numerical value for R. The value of C will have to be calculated and stands for the length of the only chord.

The value of d_1 can be obtained by the equation.

$$cos.\ d_1 = \frac{R-4}{R} = \frac{46}{50} = 0\ 92 \quad (3)$$

$$= cos.\ 23^\circ\ 05', \text{ or } d_1 = 23^\circ\ 05';$$

but $d_1 = d_1 \therefore d_1 = 23^\circ\ 05'$,

and $\Delta = 2\ d_1 = 46^\circ\ 10'$.

By transposing equation (1), we get:

$$C = 2\ R\ sin.\ d_1$$

$$= 100\ sin.\ 23^\circ\ 05' = 39.21.$$

former. In Fig. 3 the main heading sights are carried in the center of the track from which the curve is turned and are also 5 ft. from the side of the heading.

Drawing the Plans

In making the drawing, first of all lay off the line of sight of the main heading and then that of the cross-heading and let the two lines intersect. The intersection in Figs. 3 and 4 takes place at A. The point of curve is a distance of 50 ft. from A and the point of tangent of the cross-heading is likewise 50 ft. from A.

By drawing lines from $P.C.$ and $P.T.$ respectively, at right angles to the lines of sight of the main heading and cross-heading they will intersect at O. The distances from O, the center of the curve, to

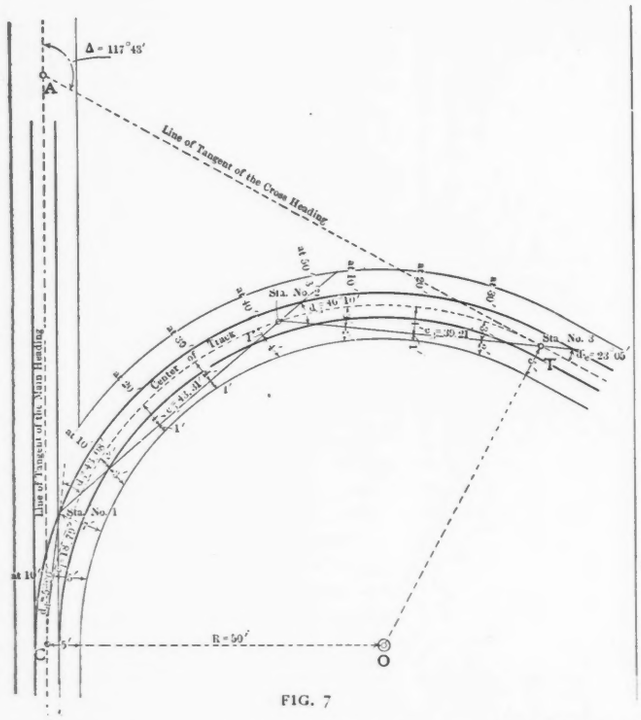


FIG. 7

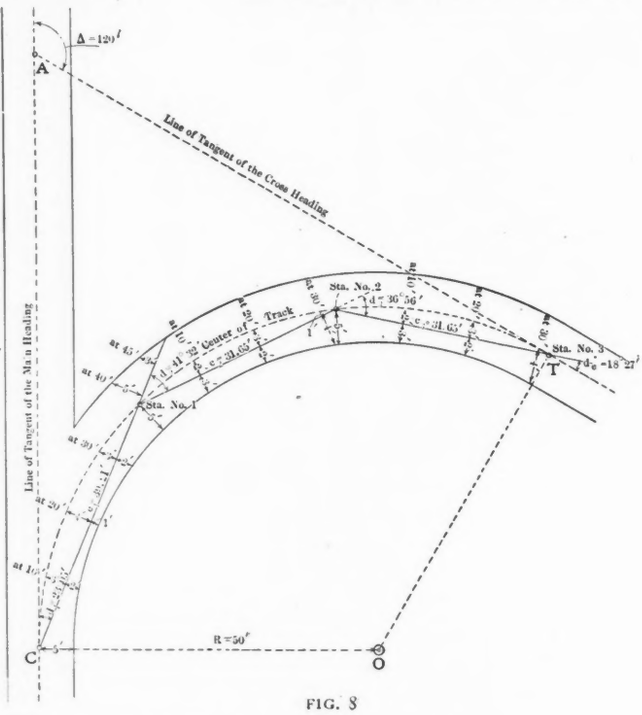


FIG. 8

GENERAL SCHEME FOR THE LOCATION OF ENTRY CURVES IN UNDERGROUND DEVELOPMENT

The calculations for the Fig. 2 type of curve depend on an assumed limiting principle that the nearest point on the basal chord to the side of the heading shall not be less than 1 ft. Supposing that the distance from the center of the track to the side of the heading is a distance $\frac{w}{2}$; then the distance from the center of the basal chord to the center of track will be $\frac{w}{2} - 1$, which expression, if $w = 10$ ft., will equal 4 ft. All the cross-headings drawn in figures which illustrate this article have a width of 10 ft., even where a greater width than 10 ft. is used in driving cross-headings, it is rarely advisable to use the full width until the curve has been driven to the point of tangency. If the distance from the center of the basal chord to the center of the track is 4 ft.,

With the exception of the methods shown by Figs. 4 and 7, all the survey stations used in driving the curve are located in the center of the curved track.

Applications of the methods shown in Figs. 2, 3, 6 and 8 are preferable to those shown in Figs. 4, 5 and 7, as there is a tendency, when points are set ahead of the point of curve, not to take the side off from the $P.C.$ to where the sights are set, but to commence immediately at the sights; of course under these circumstances it is impossible for the day-men to put down the track properly.

Figs. 3 and 4 show two different ways of making plans to drive the same curve; for reasons just enumerated above, I prefer the method illustrated by Fig. 3. Both plans are for curves connecting a main heading with a cross-heading, the latter having a direction at right angles to the

the $P.C$ and $P.T.$ should be equal to one another if the drawing has been made correctly.

We now describe the arc of the circle representing the curve along the center of the track between the $P.C.$ and the $P.T.$; this is done with the center at O and a radius of 50 ft. Other arcs are drawn, having the same center, and with radii of 45 and 55 ft. respectively. These latter curves represent the right- and left-hand sides of the heading. Join A—O by the line which intersects the curved line representing the center of the track, and divides it into two equal arcs, each having chords that are used as bases in the subsequent work. By the use of a scale where 1 in. equals 8 ft., commence at the $P.C.$ and measure off along the first chord successive distances of 10 ft. and continue the operation until the first chord pro-

duced intersects the arc representing the left-hand side of the heading. In Fig. 3 along the first chord produced are points marked off at 40 and 45 ft. from the *P. C.* Now make station No. 1 a new starting point and mark off points every 10 ft. until the *P. T.* is reached. Lines can now be drawn from these points at right angles to the chords.

By further use of the scale measure the offsets between the chords and the right-hand side of the heading and to the left of them measure the distance to the center of the track. The distances thus determined are shown on the plan.

By means of the offsets from the produced portion of the first chord, the heading can be driven a distance of 10 ft. ahead of station No. 1, thus giving the engineer a better chance to set his sights, and should he not be there by the time the miners have reached this point, the work can proceed.

The length of the chords can be scaled or calculated; the latter is the method advised and for this purpose most of the symbols used in Fig. 1 are employed with the same meaning. The same assumed numerical values for Δ and R are ascribed; these are 90 deg. and 50 ft. respectively. Considering that,

$x = 2$ chords of equal length c, the value of which has to be determined by calculation.

$$d_1 = \frac{\Delta}{4} = \frac{90^\circ}{4} = 22^\circ\ 30'.$$

d_2 = Deflection angle which the two chords make with one another and is equal to $2\,d_1$ which is $2 \times 22^\circ\ 30' = 45^\circ$, also,

$d_3 = d_1 = 22^\circ\ 30'$.

The length of C is calculated from the transposed form of equation (1).

$$C = 2\,R\ sin.\ d_1.$$
$$= 100\ sin.\ 22^\circ\ 30' = 38.27.$$

In making our calculation for the construction of Fig. 4 new symbols have to be introduced:

d = The distance from the *P. C.* to the supplementary point *S*.

Z = The distance from *S* to station No. 1.

T = Tangent distance; in this case = 50 ft.

t_1 = Distance from *P. T.* at *A* to the point *S*; this is equal to $T - s$.

The following equation is used to solve s:

$$s = \frac{2\,R\ sin.\ \frac{\Delta}{x}\ sin.\ \frac{\Delta}{2\,x}}{sin.\ \frac{3\,\Delta}{2\,x}}, \qquad (4)$$

$$= \frac{C\ sin.\ \frac{\Delta}{x}}{sin.\ \frac{3\,\Delta}{2\,x}}.$$

Substituting the numerical values given for Fig. 3, we have:

$$s = \frac{38.27\ sin.\ 45^\circ}{sin.\ 67^\circ\ 30'} = 29.29.$$

The solution of Z is as follows:

$$Z = \frac{2\,R\ sin.\ \frac{\Delta}{2\,x}\ sin.\ \frac{\Delta}{2\,x}}{sin.\ \frac{3\,\Delta}{2\,x}} \times \frac{2\,R}{2\,R},$$

$$= \frac{C^2}{2\,R\ sin.\ \frac{3\,\Delta}{2\,x}}. \qquad (5)$$

The above equation (5) is capable of general application, while in cases shown in Figs. 3 and 4, the following relation can be particularly applied:

$$\frac{Z}{sin.\ 22^\circ\ 30'} = \frac{c}{sin.\ 67^\circ\ 30'},$$

$$\therefore\ Z = \frac{c\ sin.\ 22^\circ\ 30'}{cos.\ 22^\circ\ 30'};$$

$$= c\ tan.\ 22^\circ\ 30', \text{ by substituting}$$

$$= 38.27\ tan.\ 22^\circ\ 30' = 15.85.$$

The values of c, s and Z are proportional to R when $\Delta = 90$ deg., thus the values for these, when $R = 50$ ft., which have been determined and stated above, can be calculated for other radii by direct proportion. For instance, if we want a curve with a radius of 45 ft., then:

$$C = \frac{45 \times 38.27}{50} = 34.44\ ft.$$

$$s = \frac{45 \times 29.29}{50} = 26.36\ ft.$$

$$Z = \frac{45 \times 15.85}{50} = 14.26\ ft.$$

The values for x, d_1, d_2, d_3 remain the same in Figs. 3 and 4 when Δ is 90 deg. and R is the only given quantity changed.

The value of the radius for the above case, Fig. 3, must not exceed 60 ft. There is only a clearance with this radius between the centers of the basal chords and the side of the heading of about 6 in. But if a radius of 52 ft. is used the clearance is increased to approximately 1 ft.

By referring above you will find that the symbol s is described as the distance from the *P. C.* to the supplementary point *S*. This point is so called because it embodies the same principle used in Fig. 4, but can also be used in the method used in Fig. 3 to great advantage. When the sights have been set at c, supplementary sights could have been set at s, it being a point on the main heading, where the second chord produced back intersects the line of sight of the main heading.

Plans similar to Fig. 3, where $\Delta = 90$ deg. can be used for curves of any radius less than 60 ft.; over 60 ft. the method shown in Fig. 8 can be applied.

Instrumental Work Underground

Having drawn the plan and made all necessary calculations, we now go underground, to set the sights and give the requisite instructions. The point of curve is first located by driving a spad, or whatever method is in use to establish underground survey stations.

The instrument is moved to the *P. C.* and a deflection from the line of sight of the main heading is turned; in this case, $d_1 = 22^\circ\ 30'$, which is the angle used in Fig. 3. A point is now set at a distance of about 3 ft. From these two points plumb-bobs are suspended to sight the direction of the basal chord.

When a distance of 10 ft. has been driven, it will be seen by the plan, Fig. 3, that the right-hand side of the heading should be 2 ft. from the line of sight; at 20 ft. the offset is 1 ft. and so on.

At a distance of 49 ft. from the *P. C.*, the line of sight intersects the left-hand side of the heading. When a distance of 45 ft. from the *P. C.* is reached, the engineer should be notified. The transit is again set up at the *P. C.* and deflection, $d = 22^\circ\ 30'$ is again turned. A distance of 38.27 ft. is measured off in this direction, giving the location of station No. 1. The transit is moved to station No. 1; a back sight taken on the *P. C.* and a deflection of 45 deg. is turned; this latter gives the direction for the new sights. The sights last put in are used until there is room for the point *T* to be located and a deflection of 22° 30′ turned to the right, giving the sights for the portion of the cross heading driven on tangency.

The supplementary point s above described can also be located and sights turned. But in using these sights a skip has to be taken off the corner *K*, just enough to enable a clear sight. The distance s has been calculated and shown for our given case to be equal to 29.29 ft. We therefore measure, from c along the line of sight of the main heading, the calculated distance. The angle for the sights is a deflection represented by d_s and equal to $d_1 + d_2 = 67^\circ\ 30'$. If we do not use the first basal chord in Fig. 3, but only the sights at *S* in Fig. 4, we commence by setting out first sights at s. By these sights the heading can be driven to the point *T*, a distance equal to $2 + c = 15.85 + 38.27 = 54.12$ ft. At *T* the deflection from the base line *S T* is 22 deg. 30 min. for the line of tangent.

Two equal basal chords similar to those shown in Fig. 3 can be used for any value of Δ up to 92 deg. 20 min., at which angle the basal will have a clearance of 1 ft., when $R = 50$ ft. Unfortunately the method shown by Fig. 4 is practically limited to 90 deg. as a maximum value for Δ, for above this value there is not sufficient clearance between the base line and the corner marked *K*, in fact a skip has to be taken off in both Figs. 3 and 4.

A Study of the Deflection Angle

Let us consider for a moment the greatest value of Δ that can be used with only one base line. In the first place we will assume that such a base line has a clearance of 1 ft. from the corner *K* (see Fig. 5), and that it has also the same clearance from where it approaches closest to the inside edge of the heading; furthermore

that the said base line terminates within 3 ft. of the other side of the heading, thus allowing ample room to set up the transit. In order to give the sights for the line of tangent as before, this curved heading has a width of 10 ft., and a radius R. The distance from the center of the curve to the corner K is $R+5$, and from the same point to B is $R-5$. The figure $K\,B\,O$ is a right-angled triangle and, therefore, $B\,K=\sqrt{20\,R}$.

In order that the line $S\,T\,U$ may clear the corner K by one foot, the intersection of said line with $B\,K$ will take place at a distance of $\sqrt{20\,R}-1$ from B, which we will represent by the letter D.

D subtends a central angle whose tangent is $\frac{\sqrt{20\,R-1}}{R-5}$, this we will say is equal to *tan. d*. Below are given equations, which are applicable for any value of R, and by adding together the values solved for the angles d, e, f, g and h we obtain the maximum value of Δ for any given value of R. Opposite the equations are given the values of angles, when R equals 50 ft.

$$D=\sqrt{20\,R}-1=30.62, \text{ when } R=50 \text{ ft.} \quad (6)$$

$$tan.\,d=\frac{D}{R-5}=\frac{30.62}{45}=tan.\,34^\circ\,14' \quad (7)$$

thtrefore,

$d=34^\circ\,14'$, when $R=50$ ft.

$$E=\sqrt{10-\sqrt{20\,R}+18\,R}=29.09 \text{ when } R=50 \text{ ft.} \quad (8)$$

$$tan.\,e=\frac{E}{R-4}=\frac{29.09}{46}=tan.\,32^\circ\,19' \quad (9)$$

therefore,

$e=32^\circ\,19'$, when $R=50$ ft.

$$F=2\sqrt{2R-4}=11.6, \text{ when } R=50 \text{ ft.} \quad (10)$$

$$tan.\,f=\frac{F}{R-4}=\frac{19.6}{46}=tan.\,23^\circ\,05'$$

therefore,

$f=23^\circ\,05'$, when $R=50$ ft. (11)

$$G=\sqrt{12\,(R-1)}-F=24.25-19.60=4.65 \quad (12)$$

$$tan.\,(f+g)=\frac{\sqrt{12\,(R-1)}}{R-4}=\frac{24.25}{46}=tan.\,27^\circ\,48'$$

whence

$f+g=27^\circ\,48'$, or

$g=27^\circ\,48'-23^\circ\,05'=4^\circ\,43'$, also

$$H=2\sqrt{R+1}=2\sqrt{51}=14.28, \text{ when } R=50 \text{ ft} \quad (13)$$

$$tan.\,h.=\frac{H}{R}=\frac{14.28}{50}\,tan.\,15^\circ\,75'. \quad (14)$$

therefore,

$h=15^\circ\,57'$.

Let B = The length of the base line $S\,T\,U$

$$=\frac{5}{sin.\,d_s}+E+F+G. \quad (15)$$

$=5.45+29.09+19.60+4.65=58.79$.

s = The distance from the $P.\,C.$ to the supplementary point s

$$=D-5\,cotan.\,d_s=30.62-2\,17=28.45, \quad (16)$$

when $R=50$ for both values.

d_s = The angle of deflection between the line of sight of the main heading and the base line $S\,T\,U$

$$=d+e=66^\circ\,33' \text{ when } R=50 \text{ ft.} \quad (17)$$

d_1 = The angle of deflection between the base line and the line of tangent of the cross heading,

$=A-d_s=43^\circ\,45'$, when $R=50$ ft., Δ having a maximum value of $110^\circ\,18'$; but when Δ is, say, 100 deg., d_1 is only 33 deg. 27 min.

The maximum value for Δ equals $d+e+f+g+h$, substituting the values determined above when $R=50$ ft., we get 110 deg. 18 min.

Let us now consider the calculation necessary to determine the value of G and H, when Δ is less than the maximum and greater than $d+e+f$, then,

$g+h=\Delta-(d+e+f)=10^\circ\,22'$ when $\Delta=100$ deg.

$$G=\frac{R\,[\,1-cos.\,(g+h)\,]}{sin.\,d_1} \quad (18)$$

$$=\frac{50\,(1-cos.\,10^\circ\,20'}{sin.\,33^\circ\,27'}=1.48$$

when $R=50$ and $\Delta=100$ deg.

$$H=R\left[\frac{sin.\,(g+h)-cot.\,d_1}{\{1-cos.\,(g+h)\}}\right] \quad (19)$$

$$=50\left[\frac{sin.\,10^\circ\,22'-cot.\,33^\circ\,27'}{\{1-cos.\,10^\circ\,22'\}}\right]$$

$=7.76$, when $R=50$ ft. and Δ 100 deg.

When Δ lies between $d+e+f$ and $2f$, with the latter value, we have the case illustrated in Fig. 2, and with any such value G and H vanish, and F and f have the same values as before, being solved by the same formulas:

$d_1=f$ and $d_s=\Delta-f$ when $\Delta=60$ deg. and $R=50$ ft.

$d_1=f=23^\circ\,05'$ and $d_s=60^\circ-23^\circ\,05'=36^\circ\,55'$.

$d+e=\Delta-2f=13^\circ\,50'$.

$$s=\frac{R\,sin.\,(d+e)-R\,cot.\,d_s}{(1-cos.\,(d+e)} \quad (20)$$

$=50\,sin.\,13^\circ\,50'-50\,cot.\,36^\circ\,55'$
$(1-cos.\,13^\circ\,50')$

$=10.03$ when $\Delta=60^\circ$ and $R=50$ ft.

$$B=\frac{R\,\{1-cos.\,(d+e)\}}{sin.\,d_s}+2F. \quad (21)$$

$=41.62$ when $\Delta=60$ deg. and $R=50$ ft.

With a reasonable allowance for clearance, we have seen by the methods illustrated, that for a given value of R, there is a maximum value for Δ, for example in Fig. 2, the maximum for Δ, with $R=50$ ft. is 46 deg. 10 min.; in Fig. 3, the maximum is 90 deg. 20 min., but by an application of the method shown in Fig. 6 these maximum values can be increased by 15 deg. 21 min., and a curve can be driven with one set of sights, under the following conditions, that the gage of the track shall be 3.5 ft., $R=50$ ft. and Δ not to exceed 61 deg. 21 min. The maximum value of Δ decreases as R increases, or g decreases. In this case the first station on the curve is set over the rail on the side, the cross heading is turned off the main heading, and in the center of the curved track.

The location of this point is determined as follows and depends on the gage of the track:

$$cos.\,2\,d_1=\frac{2R-g}{2R}=15^\circ\,12', \quad (22)$$

when $R=50$ ft.

also $g=3.5$ ft.; d_1 is the first deflection angle, and $g=$ the gage of the track.

Another good method, Fig. 7, which is similar to this one is to locate the position of the frog used in switching off the curve, and setting the sights for the first base line at this point. When this method is applied to the case given in Fig. 3, we have (with a radius of 50 ft.) a maximum value for Δ of 117 deg. 43 min.; the method can also be applied to Fig. 2 giving maximum $\Delta=71$ deg. 33 min. The former value of Δ is the largest thus far discussed for a radius of 50 ft.

By the use of three equal basal chords Δ can attain a maximum value of 138 deg. 30 min., and with four such chords

184 deg. 40 min. is the maximum, or we can use a chord like that used in Fig. 2 and two equal chords for the balance of the curve when Δ lies between 46 deg. 10 min. and 138 deg. 30 min., as illustrated in Fig. 8. By adding another base line to Fig. 5 we are able to use a value of Δ up to 165 deg. 54 min.

Curves of long radius, such as are used on main haulage roads should be driven with basal chords 10 ft. long, or equal chords can be selected, which will give an offset from the center of the chord to the center of track, which offset shall not exceed 1 ft. By not exceeding this, the curve can be driven with great accuracy.

If the latter course is adopted, the length of the chords used are calculated as follows:

$$C = 2\sqrt{2R - 1} = 44.74$$

for a 23-deg. curve,

and

$$\sin. d_1 = \frac{C}{2R} = 5° 07'. \quad (24)$$

Thus we see that for a 23-deg. curve, which has a radius of 250.8 ft., that chord fulfilling the required conditions would have a length of 44.74 ft. subtended at the center by an angle of 10 deg. 14 min.

The number of combinations of the methods shown above is limitless, however, I trust that the formulas and drawings may be found of some use in framing and suggesting this often neglected question of mine curves. As a general rule two or three standard drawings are usually all that is needed for the curves at any particular mine, because the conditions requiring such curves are nearly always the same.

Colliery Notes

In mines where compressed air is used the pipe lines can often be utilized to carry water in case of fire.

The soft-coal mines of the United States employ nearly half a million people, while the anthracite mines give work to about 170,000.

In the last fifteen years, 25,000,000 tons of small sized coal has been reclaimed from the anthracite culm piles of the United States.

Even when firing with electricity which is without doubt the safest method, the miner should not return directly to the hole after a misfire.

The safety of mines where open lights are used will be increased if the driver who delivers cars to the heading faces is equipped with a safety lamp.

The rate at which air circulates through a coal heap has more to do with fires in storage piles than any other condition aside from the character of the coal itself.

Officials of coal companies in the Schuylkill region have recently discharged a number of mine bosses for drinking, and employees who indulge in intoxicants are also being put under the ban.

It is stated that in Ireland and Spain a seam of anthracite coal is found in rocks of the Devonian system, while in another part of Ireland, a seam of coal is found traversing rocks of the Silurian age.

The ordinary method of taking the temperature of a coal pile, by lowering a thermometer down pipes scattered through the pile, is not satisfactory as the heat of such piles is irregular, and the location of greatest heat may be missed altogether.

Handling coal on the Great Lakes is now accomplished with amazing rapidity; 54,273 tons of coal, 9000 anthracite, the remainder bituminous, were recently unloaded in one day at Superior, Wis. In 17 hours, 7152 tons were unloaded; this is at the rate of 140 tons per hour.

It has been estimated that a square foot of uncovered pipe, filled with steam at 100 lb. pressure, will radiate and dissipate in a year the heat obtained by the economic combustion of 398 lb. of coal. Ten square feet of bare pipe corresponds approximately to two tons of coal per annum.

The primary cause of creeps or squeezes when the thrust is in a vertical line, is the size of the pillars left standing; however, if the thrust comes from an angle of any great degree, look to the form of the pillars for the cause. The removal or splitting of pillars which should have been left standing is a fruitful cause of squeezes and creeps.

All water-pipe valves should be closed slowly; this precaution should be strictly observed when the diameter of the pipe is large. When silting anthracite culm into old workings, it has been found that if the momentum of the running slush is suddenly arrested, a great pressure against the pipe in all directions is created which often results in bursting the pipe line. All stop-gates should be closed by screws to avoid sudden shock.

Direct-acting steam pumps, both single and duplex, are extravagant in the consumption of fuel even under the best of conditions, and are liable to great additional losses from the use of leaky steam valves and pistons. Careful tests, under favorable conditions, and the data obtained from actual practice, shows the following consumption of steam or fuel per horse-power per hour. Triplex power pumps require 1½ to 5 lb. of coal per horse-power per hour; small steam pumps, 25 lb.; large steam pumps, compounded, 13 lb.; pulsometer pumps, 60 to 70 lb.; injectors and inspirators, 100 lb. per horse-power per hour.

Where it has been decided to sink a sump to its finished depth before driving the headings a short distance into the seam, especially heavy timbers should be provided for covering over the sump. These timbers must be arranged so that the water may be easily hoisted, or pumped if required; they should project well over the sump-shaft walling to get a good surface bearing on the strata and also to take any weight that may come on the timbers by falling rock. If light timbers are used for covering the sump, they are apt to be crushed by heavy falls of stone when blasting out the sides or roof. Holes about two or three inches square should be made in this timber covering to allow for the escape of any gases generated in the sump.

Shallow shafts with a wash of from 50 to 75 ft., should be lined with concrete from the top of the shaft to the floor of the seam. This lining should vary in thickness from 18 in. at the top to 2½ ft. at the bottom of the shaft. Such shafts should also be fitted out at the bottom with a concrete arch which acts as a roof support and as a protection against the surface water which often gives trouble in shallow seams. When opening such a seam, and it has been decided to put in the arch before the headings are driven out any distance, great care should be taken not to get the arch too high or too low to meet the haulage requirements and various road gradients. If placed in a wrong position in relation to the seam, it is apt to prove a costly annual expense; therefore, careful observations should be taken of the direction and rate of dips; the line of cleats should be found as accurately as possible.

Sand has been successfully used in England to fight culm-bank fires. Sand obtained as a waste product is loaded on tipping trucks, and hauled to the top of the heap by an endless rope. The distributing plant, which can be removed from place to place as required, consists of a metal scaffolding provided with an electrically-operated bucket elevator, which carries the sand up to a hight of about 20 ft. At this elevation it is discharged into a hopper and mixed with a strong flushing current of water; the mixture is then carried down a delivery pipe about 100 yd. in length, to that part of the heap which is to be covered with sand. The space in question should have been previously surrounded by a low bank of earth to compel the water to run down into the heap and leave the sand on the surface. This method has given remarkable results. At the Dudroeider colliery, in England, a culm pile 12 acres in extent has been covered and now gives off only slight traces of smoke. The cost of the plant was $1750, and during 18 months, the 12 acres were covered at an expense of $1000 per acre for labor and water, the sand having been obtained for nothing.

THE ENGINEERING AND MINING JOURNAL.
Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres and Treas. ROBERT MCKEAN, Sec'y.
505 Pearl Street, New York.
London Office: 6 Bouverie Street, London, E. C., Eng.
CABLE ADDRESS "ENGMINJOUR, N. Y."

Subscription, payable in advance, $5.00 a year of 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii or the Philippines. $6.50 in Canada.

To Foreign Countries, including postage, $8.00 or its equivalent, 33 shillings; 33 marks; or 40 francs.

Notice to discontinue should be written to the New York office in every instance.

Advertising copy should reach New York office by Thursday, a week before date of issue.

For sale by all newsdealers generally.

Entered at New York Post Office as mail matter of the second class.

CIRCULATION STATEMENT

During 1907 *we printed and circulated* 507,500 *copies of* THE ENGINEERING AND MINING JOURNAL.

Our circulation for July, 1908, *was* 44,500 *copies.*

August 1..... 12,000

None sent free regularly, no back numbers. Figures are live, net circulation.

Contents

The Protection of Coal Miners

The attention of all engaged in coal mining, and of the general public as well, has recently been directed with especial concentration upon the loss of life and limb in this industry. The sad disasters of 1907 were the inspiration of renewed agitation respecting this important subject, which, of course, has been prominent in the minds of colliery engineers ever since coal mining has been an industry. That the latter is the case is apt to be forgotten. We have read many essays and discussions upon the subject which convey the idea that Americans in particular have but little knowledge respecting the principles of safety in coal mining. Such an idea is of course absurd.

It is not to be doubted that our present methods of mining coal can be greatly improved. Also it is not to be doubted that better knowledge respecting the properties of coal dust and explosive gases, and the correct methods of shot-firing, and many other details of practice, will lead to a reduction in the number of colliery accidents. But the most effective and at the same time the simplest means for increasing safety in coal mining, as we have repeatedly pointed out, is a faithful observance of the laws governing mining operations that are already on the statute books of the coal-mining States. If the coal-mining companies would do this and would carefully investigate local conditions at their mines and would formulate strict rules of their own to be observed in each operation, there would be fewer accidents. There are some companies which act on this principle of self-help, which is far more commendable than the shedding of crocodile-tears over the frightful loss of life and imploring the Federal Government to protect them (against themselves).

Among others, the United States Coal and Oil Company, of West Virginia is an admirable example of the rational system of operating with care and caution. The methods of this company as summed up by Mr. Beebe, its general manager, are as follows:

1. Vigilant supervision of ignorant labor.

2. Tamping with clay.

3. Prohibition of any needles except copper.

3. Prohibition of any needles except cept copper-tipped.

5. Compulsory snubbing of coal before shooting.

6. Employment of patrol, or shooting bosses, not shot-firers.

7. All breakthroughs cut the same size as air courses.

8. Sprinkling of roadways and rooms.

9. Compulsory removal of all dust from coal-cutting machines before shots are fired.

10. Particular attention to position of holes, and the amount of powder used.

11. Strict enforcement of mining laws enacted by the State of West Virginia.

12. Area of overcasts in all cases the same as all entries.

13. All parts of mine workings, whether old or new, visited by the mine foreman, or his assistants, every day, and a personal visit by the mine foreman himself to every working place, at least once a week.

14. Prohibition of the use of coal dust for ballasting mine tracks.

15. Requirement of 20 min. between shots in any working place.

16. We check all men in and out of the mines under all circumstances, from the general manager down to the trapper.

17. Haulageways and air courses kept absolutely clear of rubbish.

18. The glad hand always extended to the mine inspector.

As a result of the enforcement of the above simple and rational rules, the United States Coal and Oil Company has had but three fatal accidents in its mines since shipments were commenced in January, 1905.

Although the rules suitable for one mine will not thoroughly cover conditions at all other properties, those prescribed by the United States Coal and Oil Company, with certain additions and modifications, would afford greater safety at all bituminous coal mines. It is doubtful if even a copper-tipped tamping bar is perfectly safe. A rule that might well be included in those enumerated is, "the observance of atmospheric conditions through careful barometric readings, and the exercise of special precautions upon a sharply falling barometer." By an observance of barometric conditions, the dangers due to outflows of gas during periods of atmospheric depression can be greatly reduced through exercising greater caution and the regulation of the speed of the fan.

The many mine disasters that have occurred are not due to an absence of

knowledge respecting the dangers of dust, gases or explosives; nor have such accidents resulted because we are ignorant concerning proper methods of ventilation and timbering; the chief difficulty exists in the mine management neglecting to follow well-known common-sense rules, and the carelessness about obeying strictly the mine laws already in force. When mine operators awaken to their own deficiency and then rigidly enforce the methods and rules they know to be safe and proper, the list of fatalities now occurring each year will dwindle to figures much inferior to those at present recorded.

High and Low Prices—A Contrast

An example of the effect of practical and half-way reductions in prices is found in the bar and structural steel markets in recent weeks. A reduction in steel bars was made, nominally from $1.60 to $1.40 per 100 lb. to meet the competition of iron bars, in which the market is practically an open one, and in which bars had sold down to $1.25 or even $1.20. The nominal reduction was not by any means the real limit, as it is understood that large contracts for steel bars were made at $1.25 and $1.30, Pittsburg, to meet the urgent competition that existed. Large contracts were thereupon closed, the chief buyers being found in the important agricultural implement industry, in which manufacturers are apparently confident that they can sell their goods to the farmers, if the price is made attractive. In the short period since the reduction was made, good authorities estimate that the contracts placed for iron and steel bars exceed 650,000 tons, a figure quite satisfactory to the mills.

On the other hand, the reduction made in structural steel was only $2 per ton; a figure not at all commensurate with the previous drop in pig iron, but sufficient to arouse expectations of a further concession. There is no lack of building projects and plenty of money to back them, provided the advantages of cheap material can be secured. Erecting firms have even closed contracts conditioned on getting lower prices on steel. But the structural market is practically dead, and the amount of new orders placed in recent weeks is trifling, compared with the capacity of the mills.

Would not all conditions be vastly better if the structural orders had been on a parity with those for bars? And no one can really doubt that they would have been large, had builders been encouraged by substantial reductions.

The Proposed Mexican Legislation

Our correspondent in the City of Mexico in his letter under date of July 20 presents a new view respecting the proposed legislation in Mexico affecting the ownership of property by foreign corporations. It has appeared that the proposed legislation is unwise, but without doubt its probable effect has been greatly misrepresented. According to later despatches, it has been officially announced that the cabinet has decided to refer the proposed law to President Diaz with power to act. As we have previously expressed ourselves and as our correspondent reiterates in this issue, President Diaz "has always treated capital with great consideration and fairness, and will in all probability continue to do so." We feel that the present case may safely be left to his hands.

Iron and Steel Depression in Europe

The iron and steel markets in Europe, like our own, are in a depressed condition, and the decrease of business is noted everywhere. The British markets are in better condition than those of Germany, but production this year so far has been considerably below that of 1907 with no present sign of improvement. Manufacturers are uncertain as to the future, and are not inclined to put in stocks or to work ahead of orders, so that their contracts with producers for future delivery are unusually small. The export trade up to the end of May had fallen off about 20 per cent.; an important item to British iron-masters, who depend much more on foreign sales than our own. An effort to maintain prices on certain finished materials failed, and there has been a considerable reduction; ship-plates and structural forms, for instance, selling at 25 per cent. less than a year ago.

In Germany conditions are even worse. The syndicates, which control the pig iron and steel output to a considerable extent, have supported home prices, but do not succeed in securing orders. The greater part of the new business coming in is for export, and much of this is taken at prices which barely cover cost, and sometimes fall below it. There is dissension in the pig-iron syndicate, and negotiations for its renewal in 1909 have been unsuccessful so far. The general belief is that it will not be renewed, and that the pig-iron market next year will be an open one, with consequent heavy reductions in price.

The contraction in business abroad began a little earlier than here, but it was not so abrupt nor so great as in this country. It has continued to increase, however, and the prospects are for even a slower revival than our own.

The Copper Market

The strength in the copper market, which has been manifested increasingly during the last month, reflects an unquestionable improvement in the general business situation. The optimistic reports have not been confined to the copper market, but have come also from many other lines of business, and the improvement is evidenced, moreover, by the reduction in the number of idle freight cars. The encouraging feature in the copper market has been that the large sales effected recently have been to an important extent for domestic consumption and for early delivery.

However, it will not be safe to look for a quick return of the high prices for copper that prevailed in 1906 and 1907. There is a fairly large stock of refined copper still on hand and several new and important supplies are now being added to the market, especially the outputs of Ely and Cananea. At the beginning of 1907, the unsold stock of refined copper was about 120,000,000 lb. During the first half of 1908 there was a restriction of output and the withdrawal from the supply, for domestic consumption and for export, reduced the stock. Just how much was the reduction is uncertain, no statistics being available. However, it is believed that the unsold stock of refined copper on July 1, 1908, did not exceed 70,000,000 lb., and it may have been considerably smaller than that. The question that will determine the price in the near future is whether consumption will increase faster than the new production (including the restoration of old production). At present, the outlook in the race appears to be in favor of consumption, but production will doubtless make a good showing and the stock still on hand will be a restraining factor.

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

Machine Sampling

Mr. Church's article on "Conditions Necessary to Accurate Sampling by Machines" in the *Journal* of July 18, 1908, brings out clearly the fact that in sampling mills, as ordinarily arranged, there is a segregation of the coarse from the fine by which the latter travels faster than the former, so that in sampling we may, at one cut of the sampling scoop, take out a sample of the finer ore, and, at the next, some of the delayed coarser portion which should accompany it. In sampling an ore the aim is to have every part of the lot properly represented, and certainly the later portion is represented in the running stream equally with the more advanced portion. When such a stream of ore has been cut 13,200 times in 10 hours all parts of it should be properly represented, especially when the retained sample is 9 out of 60 lb. of the ore.

Henry A. Vezin, whom we older engineers took for an authority on sampling, used to emphasize the necessity of mixing after each crushing before the ore was again cut to a smaller bulk. To prevent the too impetuous flow of the ore, and to promote this mixing, he introduced between the crushing unit and its following automatic sampler a revolving drum like a trommel, having within it a set of blades set staggering, so that the ore was mixed, then passed on to the automatic sampler. Mr. Church's proposal for an improved method is somewhat along the same lines with the substitution of a feeding shoe for the revolving drum. To my mind the drum has an advantage that it not only slows down the flow but does some mixing of the arriving portion of the ore.

There is bound to be some irregularity in the stream of ore, but the automatic sampler acts indiscriminately, taking out, as it should, much from the full stream, less from the thinner ore, but in the case cited by Mr. Church always the required 15 per cent.

I may add that Vezin's practice was in many cases to let the automatic sample pile up and mix on the sampling floor. It was then for another reduction shoveled to the elevator leading to the same automatic sampler. It may be noted in the crushing and automatic sampling of ore that a shovelful put at once into the crusher, by the time it has arrived at the sampler, is strung out over several feet, so that for that shovelful, two cuts may be made by the machine. Now, where the ore is so frequently taken, can we not be sure of its proper representation throughout?

Mr. Church has much in favor of his contention that sampling can be better conducted by the use of feed shoes or similar appliances for mixing. One of the objections which has been urged against the Bridgeman sampler is that between the successive cuts there is no chance for this.

As regards the larger lumps flying down the chute, this is in part remedied both by covering it and by lessening the slope. It will also be well to give the ore-stream such a direction of flow that it will enter the sampler with little shock.

That a portion of ore sent to the final storage bin has been separated from its neighbor need not interfere with the fact that it has been represented in the sample. Indeed we may freely say that the sampling operation need not at all tend to making all parts of a lot alike in such a bin, even though properly sampled.

Mr. Church has cited the case of a number of samples made by Paul Johnson in 1902, and has shown that they vary from one another, but it can by no means be proved that this is due to segregation. I have known greater variations in automatic sampling which at the time I attributed to the salting of the lot by the preceding one due to some ore lodged from the earlier sample upon a beam and shaken down into the later one. Hence the importance of conscientious cleaning up between samples, remembering also that the more machinery, samplers and shoes we employ the more difficult it is to do this. Can we always trust the sampling man, and, if he neglects some detail of this kind, who is the wiser? Moreover, errors may easily creep into the finishing methods in which the personal equation counts when we come to the question of precision.

Variations in the gold determinations may easily arise from the coarseness of the screen used on the final assay sample.

At the mill of the Metallic Extraction Company, near Florence, Colo., Mr. Argall thoroughly tested out the automatic method, taking samples in duplicate until he had satisfied himself upon the reliability of such sampling and then threw the second sampler out of commission. In this case he had particularly difficult Cripple Creek gold ore to treat, where the fines carried twice the value of the coarser ore, and where the richer ore was spotty because of the presence of coarse gold. He was particular that the final sample should be ground to pass at least 120 mesh.

The greatest fault that I can find at the Great Cobar sampling mill is that but one carload out of five is sampled. In presence of such a practice why object to the slight irregularities which might creep into the sampling? The fifth car might be anything but representive of the four adjoining ones. L. S. AUSTIN.

Houghton, Mich., July 13, 1908.

The Origin of Coal

The article on the origin of coal by H. M. Chance, which appeared in the JOURNAL of July 4, calls attention to many points which are at variance with the generally accepted views on this subject. The impossibility of preserving fallen vegetation from decay, except it be covered by water, is so apparent that it is difficult to understand how it could accumulate on the land surface to the extent necessary to make thick coal seams. Logs and large stumps completely disappear in less than a century, and the finer material is consumed from year to year by the natural process of oxidation when exposed to the air. If, however, the vegetation is of such a character that it grows on the surface of water and at its death falls to the bottom, it is conceivable that it may accumulate to any thickness until some geological or geographical change causes it to be covered with a bed of slime or sediment which will be converted into slate.

The bottoms of all large bodies of water are much more even and have much fewer irregularities than the surface of the adjacent land. This is due to the eroding effect of surface drainage and the transportation of the eroded material to the water areas, where it tends to even up the irregularities. The same forces which tend to form irregularities of the land surface even up the bottom inequalities under all bodies of water other than flowing streams.

Any traveler on the tropical seas has the opportunity to observe the great quantity of sea weed which is growing upon the water, supported by small air cells attached to the stems. It continues to flourish and increase in extent until, torn to pieces by storms, it is swept out of its latitude and dies. The air cells decay and burst and the vegetable matter accumulates at the bottom of that part of the ocean to which the prevailing ocean currents sweep the storm-torn fragments. Such accumulations, protected from atmospheric decay, may attain to any thick-

ness and in the course of geological time be covered by sediments, and another accumulation of the same character be laid down on top. These changes from vegetable matter to sediment and back again, alternate as often as the burden of the ocean currents change.

It is not necessary, for the benefit of this theory of the origin of coal, to assume that the surface of the earth went up and down like the top of a blacksmith's bellows in order that it might be above water to allow vegetation to grow, below water to allow it to receive a covering of sediment, and these cycles repeated to suit the imagination of the theorist. It is highly probable that such an accumulation of sea weed on the ocean floor is taking place along the margin of the Gulf Stream, where the warm waters carrying the growing vegetable matter encounter the cold waters from the north Atlantic. All similar conditions would tend to produce like results and it is certainly interesting to know that the world's store of fuel is being added to probably as fast as it is being exhausted, even though it may not become available yet a while. This theory of the marine origin of coal is not new, as I am informed that it was proposed by Professor Mohr, of Bonn University, some 50 years ago. Professor Mohr was the inventor of the burette used in volumetric analysis and is sometimes spoken of as the father of volumetric analysis. He called attention to the presence of bromine and iodine in chimney soot as an evidence of the marine origin of the vegetable matter in coal.

HIRAM W. HIXON.
Mining Engineer and Metallurgist.
Worthington, Ont., July 22, 1908.

Tapping Mine Water Under Pressure

The work herein described was done in connection with the operations of the Whitman Mining Company, of St. Louis, Mo., the property of which is situated at Pearl, Idaho. The property is opened near the west end line by a crosscut tunnel, reaching a depth of 90 ft. From this point a drift has been run a distance of 1300 ft. on the vein; at a point 1030 ft. east of the crosscut tunnel, a raise was started to connect with an incline shaft, which had been sunk to a depth of 159 ft., including a 16-ft. sump, some time previously. This shaft was 4 ft. by 7 ft. 6 in. in the clear. From the bottom of the shaft a drift had been extended 136 ft. easterly, and another 84 ft. westerly; these drifts were 4x6 ft. Water stood at a hight of 56 ft. from the bottom of the sump; both drifts, of course, were full of water.

Where the raise was started the vein was found to be over 5 ft. in width, with only a slight dip from the horizontal. Knowing that the shaft was sunk on the vein, it was first necessary to cut into the footwall and square the timbers. When this was done, ore and timber chutes, and a good ladderway were put in, and raising commenced. When the raise had been extended a distance of 40 ft. quite a flow of water was encountered from the hanging-wall side. This necessitated changing the system of timbering from stulls and stringers to square sets, in order to carry a bridge on which to drive the roof lagging. Air drills of the George Leyner type were used. After reaching a point of 160 ft. from the drift a small chamber was cut out and securely timbered for the protection of men and the storage of machines in case the water should break through unexpectedly. The chamber was cut on the manway side and close to the ladder-way. Thereafter, similar chambers were cut every 20 ft. until the water was encountered, which was at a point 204 ft. from the drift.

After the first chamber was cut, one 9-ft. drill hole was kept ahead all of the time. In drilling the last round of holes before tapping the water, the point of the drill struck the end of the cap on the last set of timbers in the old sump. Owing to the amount of sediment and the number of decayed timbers which had accumulated in the sump it was necessary to blast the last hole a second time. In order to accomplish this, primers were made of an extra quality powder and the caps greased to keep them from getting damp. The holes were successfully blasted and this large body of water was liberated without a mishap of any kind. The tapping of this water served to establish an air course and the mine is now perfectly ventilated.

W. H. HUTCHINGS, Gen. Supt.,
Whitman Mining Company.
Pearl, Idaho, July 20, 1908.

Over-balance Weight for Single-drum Hoist

In the JOURNAL of May 2, S. A. Worcester described an over-counterbalance hoist for single-cage hoisting in shafts. The description was extremely interesting and the benefits from such a system are undoubted, but two points may with propriety be pointed out: (1) The addition of a separate drum for the counterbalance rope is not at all necessary, for the counterbalance rope can be wound on the hoisting drum, one-half of a wrap behind and opposite to the hoisting rope. It will then wind up when the hoisting rope unwinds and unwind when the hoisting rope winds up, staying always just out of the way of the hoisting rope. This is a matter of some importance for plants where there is no room for an auxiliary drum; (2) Mr. Worcester intimates that he has a patent or patents on the process of over-counterbalancing. Without having looked up the patent records, I do not believe that any valid patent can be obtained on this process. The different tricks about hoisting have nearly all been tried so long ago that the benefits of overbalancing for such service have almost certainly been known to those skilled in the art for more years than the life of a patent. In fact this system is almost obvious.

In extreme cases, where sufficient hight of travel for the counter weight is not obtainable, the counter-weight drum may be connected by gearing to the hoisting drum and the counterweight increased in proportion to the reduced travel. This is an undesirable system, but may occasionally be necessary. The writer knows of one case in which a self-acting plane with only one car was installed inside a mine, a geared counter weight being attached to the drum, which worked in a vertical raise cut just under the latter. This is only cited as an illustration of what may occasionally be necessary. This, however, is rather beside the mark of Mr. Worcester's article, which was so interesting that it is with great regret that the writer makes anything like a criticism upon it. At the same time it would be a pity to have any one debarred from using the system described because they thought that the scheme as a whole was patented.

JOHN J. SMITH.
Washington, D. C., July 24, 1908.

Aspen, in Pitkin county, Colo., began to produce a considerable quantity of lead ore in 1884, and for several years following made rather a large output, but the value of its ores being chiefly in silver, the mines to a large extent became unprofitable upon the drop in silver in 1893, since which time they have operated only on a small scale. The Aspen ores, which were chiefly of oxidized character and usually associated with lime and baryta, were found generally at the intersections of a series of vertical cross-faults with two bed-faults in carboniferous limestone and dolomite, but also in less important deposits, although in similar relations to faults, in strata both older and later. The Aspen ores were especially noteworthy because of their large percentage of barium sulphate, an objectionable constituent from the smelter's standpoint. Their tenor in lead was not high as a rule, and Aspen has always been essentially a silver camp, rather than a lead camp, although it has furnished much calcareous lead ore that has been desired by the smelters because of its fluxing qualities.

It is said that if a bearing begins to run hot it may be cooled, in many cases without stopping the engine, by oiling with good castor oil.

The First Six Months of 1908 in South Africa

The closure of the half year, with its imposing list of dividend declarations amounting to upward of $20,000,000, marks an opportune moment for a retrospective glance at the recent advancement of the Rand gold industry. Broadly reviewed, the first six months of 1908 appear to have been productive of results doubly gratifying in that very substantial progress has been made by the producing mines in spite of Chinese repatriation and without the assistance of fresh capital derived from foreign sources. Whether the unprecedentedly abundant supply of Kafir laborers can be regarded as a new feature in the economic situation of any permanence is a question too wide for discussion here. But the fact remains that for months past there have been more unskilled laborers available for service than there are positions for them to fill.

Owing to the increase in stamp duties, as well as in the number of stamps dropped, the gold yield for the half year shows a substantial advance in rate of production. Excluding the large amounts of gold held in reserve, the half year's production for the Rand alone may now be safely estimated at over $68,000,000, as against $129,000,000 for the year 1907. This aggregate is made up of the declarations of 66 mines, of which 41 have made dividend distributions exceeding $19,000,000.

Turning from the industry as a whole to its strongest factors, we find the Simmer & Jack, Robinson, and Robinson Deep easily maintaining their lead as the greatest producers and profit makers. The former two mines have for some time maintained a close rivalry for the premiership, but as soon as the Robinson has erected an extra 50 stamps, resolved upon as a result of the determination to extract large sections of Main Reef previously left in the footwall of Main Reef Leader stopes as unpayable, this mine will hold easy precedence among the gold mines, not only of South Africa, but of the world. The 1907 yields of the two leading mines were:

	Tons Milled.	Gold Produced.
Robinson	410,927	$6,320,000
Simmer and Jack	736,930	5,830,000

The monthly averages for this year have been 25,560 and 25,820 fine oz. respectively.

A fact not widely realized in connection with the changed conditions upon the Rand and which strikingly illustrates the growing tendency for magnitude in reduction plants appears in comparison between the analysis of production in 1898 (before the war) and in the half year under notice. The rate of output is now almost twice in value the "pre-war" record, and yet the number of contributors is less. The full significance of this circumstance may be shown clearly as follows:

Crushing Tons.	December, 1898.	May, 1908.
Over 50,000 tons	Nil	2
40,000—50,000	1	4
30,000—40,000	Nil	14
20,000—30,000	5	14
10,000—20,000	21	18
Under 10,000	42	14
	69	66

From this table it is to be seen that whereas only one mine in ten crushed over 20,000 tons of ore per month in 1898, today over one-half of the producers surpass that standard of capacity. The tendency of future advancement will be, of course, to still further increase the proportion of large capacity units.

Whatever may be its occasional abuse, the policy of working-cost reduction is beyond all doubt beneficially influencing the attitude of the European investor toward the Rand industry, though his favor can only return slowly after the disastrous term of instability, political and industrial, through which the field has passed. There is another feature, less manifest in financial circles, giving cause for considerable satisfaction. Although the market is moribund, money is still provided with surprising freedom for the prosecution of outside mining ventures, by speculators of the salary-earning class. Mine dividends, however, are now more the aim than Stock Exchange gambling profits and we find, notably in the last few weeks, many thousands of pounds being subscribed for the opening up of some new base-metal proposition or for the resuscitation of gold mines in the Klerksdorp, Barberton, and Lydenburg districts, closed down under company control.

Then again, the departure of practical men for Rhodesia, with a thousand dollars or so in hand, continues to indicate the steadfast faith of South Africans in the country's minerals, a confidence barely shaken by the enormous losses incurred in outside development in the last few years. To some extent the "rush" to Rhodesia has shown signs of abatement and several of the ultra-optimistic have returned to issue warnings to those contemplating the northern journey and to explain that all the promising blocks of ground have been taken up. It is not a little amusing to note the glib assumption of authority with which so many of the returning prospectors are able to condemn wholesale a territory of thousands of square miles in extent, as remarkable as western Australia for the wide distribution of its auriferous quartz veins. Rhodesia is a land of many hardships, but it offers very exceptional opportunities to the energetic prospector and miner, backed by a little capital, whose knowledge of new land exploitation has not been merely derived from running machines in a Rand deep level. The expansion of the country's gold industry, comprising in May 196 independent producers which recorded a yield of nearly $11,000,000, is more assured than that of its rivals in the world of gold production, Canada, New Zealand, Queensland and India.

Chronology of Mining in July

July 1—A new wage scale for the year in the sheet and tin-plate industry in adopted with slight reductions.

July 2—The steel syndicate in Germany withdraws from the price agreement. International Tube-makers Association is dissolved. An explosion of gas in the Rikovsky coal mine, Yusovo, European Russia, kills about 200 men. The courts of Venezuela decide that the New York & Bermudez Asphalt Company must pay its $15,000,000 fine.

July 11—The smelting plant of the Cananea Consolidated Copper Company resumes operations with numerous improvements.

July 15—Explosion in a coal mine of the Susquehanna Coal Company, at Williamstown, Penn., kills 12 men and seriously injures eight.

July 18—The Detroit wage scale involving a reduction of puddlers' wages is signed by the Republic Iron and Steel Company.

July 20—It is announced that on Sept. 1 the Mexican government will put into effect the advance in freight rates on ores authorized several months ago in spite of the protests of smelter and mining interests.

July 22—The De Beers Company decides to shut down the De Beers diamond mine, Kimberley, South Africa, on July 31.

July 23—The first cargo of 12,000 tons of iron ore arrives at the docks at Gary, Indiana, the new plant of the U. S. Steel Corporation.

July 25—The Mexican cabinet refers the proposed anti-foreign law to President Diaz with power to accept, enforce or reject the measure.

Southeastern Missouri and the Cœur d'Alene are the only lead-producing districts that have been developed in the United States, which have evidenced such permanence as render a study of their cost of production a matter of economic value. In most of the other lead-producing districts, the lead has been essentially a by-product, as at Joplin, or the ore has been obtained from bonanzas as at Alta, Frisco, Nicholia, and the greater ones at Eureka, Nev., and Leadville, Colo., which have been characterized by a rise and fall and extremely variable cost of production. Southeastern Missouri and the Cœur d' Alene, on the other hand, have developed very large bodies of low-grade ore, in the exploitation of which engineering has been a greater factor than in extracting the richer bounties of nature.

New Publications

SCIENTIFIC AMERICAN INDEX OF MANUFACTURERS. Pp. 55. 5½x8 in.; paper, 25c. New York, 1908: Scientific American.

PRACTICAL IRRIGATION, ITS VALUE AND COST. By Aug. J. Bowie. Pp. 232; illustrated. 6¼x9½ in.; cloth, $3. New York, 1908: McGraw Publishing Company.

AUSRICHTUNG, VORRICHTUNG UND ABBAU VON STEINKOHLENLAGERSTATTEN. By F. Freise. Pp. 151; illustrated. 7x10 in.; paper, 6 m. Freiberg, 1908: Craz & Gerlach.

TRANSACTIONS OF THE AMERICAN INSTITUTE OF MECHANICAL ENGINEERS. Vol. XXXVIII. Pp. 961; illustrated. 6¼x9½ in. paper. New York, 1908: Published by the Institute.

PEAT AND LIGNITE: THEIR MANUFACTURE AND USES IN EUROPE. By E. Nystrom. Canada Department of Mines. Pp. 247, illustrated. 6¼x9½ in.; paper. Ottawa, Canada, 1908.

CURVES FOR CALCULATING BEAMS, CHANNELS AND REACTIONS. By Sidney Diamant. Pp. 38; illustrated. 7¼x10¼ in.; cloth, $2. New York, 1908: McGraw Publishing Company.

HANDBOOK OF NEVADA MINING COMPANIES. Revised Edition. Compiled by Todd Information Bureau. Pp. 102. 6x9 in.; paper, $1. Goldfield, Nev., 1908: The Goldfield News.

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MINERAL RESOURCES OF ALASKA: REPORT ON PROGRESS OF INVESTIGATIONS IN 1907. By Alfred H. Brooks and Others. U. S. Geological Survey, Bulletin No. 345. Pp. 285; illustrated. 6x9 in.; paper. Washington, 1908: Government Printing Office.

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HENLEY'S ENCYCLOPEDIA OF PRACTICAL ENGINEERING AND ALLIED TRADES. Edited by Joseph Horner. Vol. I, A-Boi. Pp. 240, illustrated. Vol. II, Bol-Fil. Pp. 240, illustrated. 7½x10 in.; half leather, $6 per vol. New York, 1906: Norman W. Henley Publishing Company.

THE STRENGTH OF CONCRETE BEAMS. Results of Tests of 108 Beams (First Series) Made at the Structural-Materials Testing Laboratories. By Richard L. Humphrey. U. S. Geological Survey. Bull. No. 344. Pp. 58; illustrated. 6x9 in.; paper. Washington, 1908: Government Printing Office.

THE GOLD PLACERS OF PARTS OF SEWARD PENINSULA, ALASKA, INCLUDING THE NOME, COUNCIL, KOUGAROK, PORT CLARENCE, AND GOODHOPE PRECINCTS. By Arthur J. Collier, Frank L. Hess, Philip S. Smith, and Alfred H. Brooks. U. S. Geological Survey, Bull. No. 328. Pp. 343, illustrated, including maps. 5½x9 in.; paper. Washington, 1908: Government Printing Office.

REINFORCED CONCRETE: A MANUAL OF PRACTICE. By Ernest McCullough. Pp. 128; illustrated. 5x8 in., cloth. Chicago; *Cement Era* Publishing Company.

This book is what its sub-title indicates, a manual showing the latest practice in the design and construction of different classes of buildings from reinforced concrete. It contains formulas and directions for estimating the strength of beams, columns and other units of cement construction; directions for making forms and building up structures of different kinds; and, in short, much that an engineer should know when he is intrusted with the work of erecting a concrete building. Now that structures of this type are coming into extensive use, it will be a very useful book.

STOICHIOMETRY. By Sydney Young. Pp. 381. Illustrated. Cloth, 5x7½. Price, 7s. 6d. London and New York, Longmans, Green & Co., 1908.

This valuable work is one of a series of text-books of physical chemistry, edited by Sir William Ramsay, which alone is a sufficient guarantee of their authoritative character. Several books of the series have previously been published, but this one on stoichiometry is naturally the first, and consequently an elaborate essay entitled "An Introduction to the Study of Physical Chemistry," already published in one of the previous volumes is reprinted as the introduction to this.

The subject of physical chemistry is abstruse, and many of us who graduated from college before it was known as a special science, find it difficult to follow all of the reasoning and deduction of its exponents, although we recognize its immense importance and the fact that this is the science which holds the keys to future progress in chemistry and metallurgy.

Its branch called stoichiometry comprises the various methods employed to determine atomic and molecular weights, and the classification of compounds, including the properties of gases, liquids and solids. The treatment of this subject fell into competent hands when it was entrusted to Professor Young, who has produced a work which is an admirable introduction to the broad subject of physical chemistry.

THERMOCHEMISTRY. By Julius Thomsen. Translated from the Danish by Katherine A. Burke. Pp. 495. Illustrated. Cloth, 5x7½ in. Price, 9s. London and New York, Longmans, Green & Company, 1908.

This is another of the series of text-books of physical chemistry, edited by Sir William Ramsay. It is a condensation of Professor Thomsen's classic "Thermochemische Untersuchungen," published during the years 1882-1886. Every chemist is, of course, acquainted with that famous work as the source of most of the data existing as to the heats of formation, dissociation, etc., of chemical compounds. In this new work Professor Thomsen has reviewed the whole of the numerical and theoretical results without devoting much space to experimental details, which has made it possible to reduce the size of the work to about one-fifth of that of the original. It is not to be doubted that a host of chemists will be glad of the ability to obtain these data in a cheap and convenient form.

Yet this appreciation is tempered by some surprise at the inclusion of this work in Sir William Ramsay's new series inasmuch as from the standpoint of modern physical chemistry Thomsen's results are hopelessly out of date. We know now and accept the application of the laws of thermodynamics to chemical equilibrium and determine reactions rather by the free energy that is available than the balance of the heat of formation.

However, in spite of all the criticisms that may properly be directed to much of Thomsen's work, it has a great deal that is of permanent value and the present book is one that every chemist who studies his science will want to own. The translation has been admirably done.

The Cottrell Fume-condensing System at the Selby Smeltery

The troubles of the Selby Smelting Company, of San Francisco, whose smelting plant is at the entrance of Carquinez straits, are rather strenuous just at present. The board of supervisors of Solano county, on the opposite side of the straits, have finally ordered that any and all of the roasters of the company must be closed down until the Cottrell fume-condensing device is installed and proved to be effective. The people of Benicia complained that the smelter fumes were destroying vegetable and animal life in and near their town, and the judge of the superior court granted an injunction against the Selby company some time ago. By permission of the district attorney of the county, however, the works have continued operations, but on a reduced scale. The decree of injunction having been granted, the smelting company now has the opportunity to ask for a rehearing on the ground of "new evidence." If this hearing is not granted the company will have a legal right to appeal. The company still operates one roaster by permission of the district attorney, in order to complete its experiments with the Cottrell process of fume-condensing. The works cannot, of course, continue to operate with only one roaster, so it is now a case of "fight." The blast furnaces are in full operation as the "bag house" has proved successful. The first cotton bags used did not accomplish the purpose, so woolen bags were put in. These have proved entirely satisfactory.

It is interesting to note that in accordance with an agreement both the blast and roasting furnaces of the Selby works were closed down on May 28 last, and were not operated until June 4, so for seven days no sulphurous fumes escaped. On May 31, however, the people of Benicia claimed that the fumes were as bad and strong as ever. The company has already spent more than $100,000 to prevent the escape of fumes from stacks. At present the Cottrell process is used in the parting room; it precipitates all the sulphuric acid in suspension, and experiments are being continued with this to precipitate all the objectionable particles in the roaster gases. Orders have been placed for transformers and as soon as these are installed an actual diminution of the gases from the roasters will be shown.

Harry East Miller, the chemist of the Western Precipitation Company, which is handling the Cottrell system, assures a representative of the JOURNAL that the process is a complete success. He is confident that it will not only remedy all the difficulties at the Selby smelting works, but will also convince those opposed to the construction of the new Guggenheim smelter, at Point San Bruno, San Francisco bay, that the works may be constructed and operated without danger of any possible damage whatever from smelter fumes. Several minor changes have been made in the electrical appliances in use, and each time to the improvement of the system. As soon as completed, all the roasters there will be equipped with the Cottrell device.

Nova Scotia Steel and Coal Company

This company owns blast furnaces and steel works at Trenton and New Glasgow, N. S., iron ore and coal mines in Nova Scotia and iron ore mines in Newfoundland. The report for the year 1907 gives production as follows: Coal mined, 692,970 long tons; coke made, 90,749; iron ore mined, 346,505; limestone quarried, 74,557; pig iron made, 57,618; open-hearth steel made 70,222; billets rolled, 54,661; finished steel and iron products, 120,797 tons.

The net earnings for the year were $994,791. Interest and sinking-fund charges were $364,411; depreciation and renewals, $158,905; balance, $421,475. From this dividends of 8 per cent. on the preferred and 6 on the common stock were paid, amounting to $381,656, and leaving a surplus of $39,819. Adding the balance from 1906, gave a total surplus of $1,202,604 at the end of the year. The capital account shows $1,030,000 preferred stock, $4,987,600 common stock and $3,752,000 bonds.

President R. E. Harris says, in his report: "The mines and plant of the company were kept busy throughout the year, except the works at Trenton, which were closed during a part of December. The output of iron and steel was the largest in the history of the company, and exceeded that of the previous year by about 25 per cent.

"On the ground that working double-shifts increased the cost of mining, the board decided to single-shift No. 3 colliery, and to cut off certain unprofitable contracts, feeling that if the same, or a larger profit, could be obtained by mining a smaller quantity, it was better to reduce the output and leave the balance of the coal in the ground. A decrease in quantity of coal mined was, therefore, in pursuance of a deliberate policy. During the year work was carried on in opening up No. 4 colliery; it was also decided to reopen No. 2 colliery, and the work of pumping has since been carried on. We hope to have both of these collieries producing about May 1, 1908. With five collieries in operation, we expect that our output during 1908 will be larger than that of any previous year. Practically the whole of the estimated output of our mines has been disposed of.

"The work of driving slopes to our submarine iron-ore areas at Wabana, Newfoundland, was carried on throughout the year most successfully; these slopes are working in ore at a distance of over 2200 ft. from the shore. A new air-compressor plant has been installed and we expect to have three shifts at work, each of eight hours. It now looks as if we should be able to mine ore from these submarine areas early in 1909. I have frequently expressed my opinion as to the enormous value of these areas and the work done during the past year goes far to confirm this opinion.

"The sum of $378,386 was expended during the year on capital account in equipping the new colliery at Sydney mines, new forge buildings at New Glasgow, the purchase of iron-ore properties, the development of the submarine iron ore areas at Wabana, and for plant improvements."

Magnesite in California

All the magnesite produced in the United States comes from California, and virtually all in the State is derived from the mines at Porterville, in Tulare county. There are numbers of known deposits in Napa, Sonoma, Placer, Santa Clara, Alameda, Tulare, and a few other counties but none are utilized on any scale except those worked by W. P. Bartlett, of Porterville. These deposits are extensive; but what is more to the purpose from an economic point of view, they are close by the line of a railroad, so that there is little haulage from the mine.

A traction engine hauls the crude ore to the kilns where it is calcined and thence shipped to the coast manufacturers of wood pulp, and a few hundred tons of the crude mineral are used annually by the manufacturers of carbonic acid gas, who also sell their material after calcination to the paper makers. The new mine on South Tule opened by Mr. Bartlett for the paper men, will soon be shipping mineral. Meantime his kilns at Porterville are run on mineral which has previously not been utilized. This is the dark-colored rock, carrying more or less iron which has not been held of much account. Some that was roasted and calcined, however, was sent to the paper mills to be tested, with such satisfactory results that this rock is now being run through the furnaces instead of the white rock usually utilized. The first regular run on this material is now being made.

Little or no magnesite is now coming from any other mines in California. The consumption of this substance on the Pacific Coast is limited and does not run above 5000 tons a year, but a much larger product could be made were there sale for it. It is impossible to ship the material East from California owing to high freight rates. There is a movement on foot in the State to ask Congress to put a duty on foreign magnesite in the interest of the miners of California.

The production of sulphur in the United States in 1907 was 307,806 long tons.

Personal

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

O. N. Posey, of Los Angeles, is examining mines in southern Mexico.

W. C. Greene, of Cananea and Chihuahua, Mexico, is in Japan for his health.

James M. Kercel, of Salt Lake City, is in southern Mexico on professional business.

John Hayes Hammond is spending the summer at his residence at Magnolia, Mass.

J. H. Lang, of the American Metal Company, visited Joplin during the past week.

J. R. Finlay, mining engineer, of New York, is examining mines in the Joplin district.

F. B. Irvine, of New York, has been examining mining properties in Jalisco, Mexico.

J. Kirby, a British mining engineer, has joined the staff of the Dominion Coal Company.

W. N. Smith, of Wisconsin, has been studying mining and milling operations in the Joplin district.

Henry P. Lowe, of Denver, has left for Europe, visiting London and Paris, on mining business.

Prof. Arthur L. Walker, of Columbia University, has just returned from a professional trip in the West.

Juan R. Carey has been appointed superintendent of the Refugio mine near Parral, Chihuahua, Mexico.

Robert T. Hill, mining geologist, of New York, returned last week from a professional trip in Mexico.

R. L. Lloyd is now in charge of the blast furnaces of the Garfield Smelting Company, near Salt Lake City, Utah.

Robert Linton, who has been in Sonora and Durango, Mexico, for the last six months, is now in Los Angeles, California.

A. L. Queneau, metallurgical engineer of Philadelphia, has returned from Europe, where he has been engaged on professional business.

E. H. Crabtree, a Tonopah, Nev., operator, has been looking over property in Clear Creek, Boulder and Gilpin counties, Colorado.

H. W. Pring, formerly of Cripple Creek, Colo., has been appointed superintendent of the Aduddell property near Central City, Colo.

A. F. Holden, managing director of the United States Smelting, Refining and Mining Company, is visiting New York and Boston.

Allen Hazen, of New York, is in Toronto, engaged in the preparation of plans for the filtration plant to be established there.

J. C. Hutchinson, of Philadelphia, Penn., has been looking after mining interests in Gilpin county, Colo., during the last week.

Lafayette Hanchett, manager of the Newhouse interests, has returned to Salt Lake City, after a business trip to New York and Boston.

O. B. Thompson, manager of the Fifty Gold Mines Corporation, operating in Gilpin county, Colo., is making a business visit to New York City.

Geo. W. Bryant, vice-president of the Guanajuato Development Company, has returned to Mexico after several weeks in New York on business.

Philip S. Smith, of the United States Geological Survey is engaged in geological work in the Seward Peninsula, Alaska, for the department.

H. W. Hardinge left New York on July 22 for a professional trip to the West, covering a week or ten days, and will visit Cobalt before he returns.

W. F. Jennison has been commissioned by the Canadian government to prepare a monograph on the gypsum deposits of Nova Scotia and New Brunswick.

J. Parke Channing, consulting mining engineer, of New York, is at present at Globe, Ariz. He is expected to return to New York in about a week or ten days.

Horace V. Winchell has resigned his position as Chief Geologist for the Great Northern Railway and will take up consulting engineering at Minneapolis, Minn.

John Leggett Pultz, mining engineer, of New York, has gone to Birmingham, Ala., to take charge of some coal-mining operations. He expects to reside at Birmingham for a year or more.

Arthur S. Dwight, consulting mining engineer, of New York, has gone to the West upon business in connection with his new roasting and sintering process. He expects to be absent several months.

Henry D. Boddington, mining engineer, El Paso, Texas, and managing director of the Uruachic Mining and Smelting Company, Chihuahua, Mexico, is in England, and will return in September.

George S. Rice, of Chicago, consulting colliery engineer of the U. S. Geological Survey, sailed for Europe, July 25, to investigate foreign methods of mining, having in view the prevention of waste of coal and the loss of life in mining.

John S. Smith, chief engineer for S. Pearson & Son, London, Eng., who are extensively engaged in construction work in Mexico, is in Toronto. For several months he has been at Minitiblan, on the Isthmus of Tehuantepec, where the firm has established a large oil refinery.

Joseph A. Holmes, chief of the technologic branch of the U. S. Geological Survey, has gone to Europe to make investigations in connection with the coal-mining experiments which are to be conducted by the U. S. Geological Survey. Upon his return, in August, Doctor Holmes will be accompanied by representatives of the British, Belgium and German governments, who have been invited by the U. S. Government to participate in the tests to be conducted by the U. S. Geological Survey.

Obituary

Frederick S. Harris died, July 17, of typhoid fever, in the Agnew hospital, San Diego, Cal., after an 18-weeks' illness. Mr. Harris was born in Chicago, Oct. 22, 1859, and was well known in mining circles throughout the United States and Mexico, devoting the latter part of his life to consulting engineering, with offices at Goldfield, Nev. He joined the American Institute of Mining Engineers in 1897. He is survived by a widow.

Captain John Wilkes, the eldest son of Admiral Charles Wilkes, U. S. N., and Jane Renwick, New York City, died on July 6, 1908, aged 81 years. He was born March 31, 1827, and was graduated from the United States Naval Academy in 1847. In 1853 he was interested in gold mines in North Carolina and later made his home near Charlotte, N. C. In 1861 he and his brother Edmund built the railroad between Greensboro, N. C., and Danville, Va., for the Confederate government. For 40 years Captain Wilkes was manager of the Mecklenburg Iron Works, at Charlotte, N. C., and built up the business from a wayside repair shop to the present high-class foundry, machine, carpentry and sheet-metal shops. During the Civil war these works were seized for war purposes. Mrs. Wilkes, four children and 10 grandchildren survive him.

Societies and Technical Schools

Toronto University—Work is to be started immediately upon the new thermodynamics and hydraulics building. Only the main portion of the building will be erected at present. The cost will be about $100,000, leaving two wings to be added in the future. The building is expected to be completed in November.

Missouri School of Mines—The summer field work in mining and geology for the junior class was carried on in southeast Missouri. Part of the time was given to geology, part to ore dressing, and part to mining and mine surveying. The class was accompanied by L. S. Griswold, professor of geology; H. B. Litchman, professor of mine engineering; E. G. Harris, professor of civil engineering; Durward Copeland, professor of metallurgy, and Director L. E. Young.

The class visited Iron Mountain, Flat River, and other towns in the adjacent district. The work in mine surveying was done in the mine of the Madison Land and Lead Company, at Fredericktown.

Special Correspondence from Mining Centers

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

REVIEWS OF IMPORTANT EVENTS

San Francisco

July 22—Calaveras county is coming to the front as a dredging field. Some dredgers are at work at Jenny Lind and others are contemplated. At Chili gulch two or three dredgers are contemplated. This gulch has been the dumping ground for half a century for nearly all the rich gravel mines of the Mokelumne hill region. The drift-mine tailings of the early-day miners, who are not supposed to have saved 75 per cent. of the gold, were first deposited and concentrated and subsequently covered by hydraulic-mine tailings which have also been concentrating for many years. The Green Mountain Company, recently organized, has about 300 acres in a tract having two gravel channels and also much of the Chili gulch tailings. Chicago men have an option on the Moser tailings in Spring gulch, and intend using a dredge. Mr. Bedford, of Oakland, owning the adjoining ground, also expects to have a dredge. This will make three dredges on the Chili and Spring gulches. So large is the extent of ground and tailings in Chili gulch that years ago a company was formed to run a long tunnel to the Mokelumne river and sluice the tailings, but the anti-débris law came into effect and stopped the enterprise. Dredges can, however, be used without violating any laws, and there is a large amount of ground on which they may be worked.

The Chicago Copper Refining Company, through its attorneys, has finally leased the Tom Head copper properties in Tehama county from the California & Massachusetts Copper Refining Company, which has been developing them for the past year or two. The mines have not as yet made any production. The new leasing company binds itself to continue tunnel No. 3 and other levels and block out sufficient ore for smelting purposes until it is assured that 250 tons daily may be delivered to a smelter. When that time arrives the leasing company is to erect a smelter adapted to reduce chalcopyrite ores. The process may be modified, to suit the ore mined and extracted.

Supervisor Morrison, of Yuba county, who is at present going "hot-foot" after alleged violators of the Caminetti law, devised the plan now being tried of enjoining the mine instead of the owners or managers. He is of the opinion that the case of the "People vs. the Gold Run Ditch and Mining Company," 66 California, page 149, settles the matter. In that the Supreme court after deciding that all who contribute to a nuisance are properly joined jointly as defendants, it is the nuisance itself which if destructive of public or private rights or property, may be enjoined.

In the case of "Yuba County vs. the North America Consolidation Gold Mining Company," which is now pending, the anti-débris men have asked in the complaint that the North American mine be enjoined and restrained from being worked or operated by said defendants, their agents, servants, employees, successors and grantees in interest, in such a way or manner that the tailings, débris, etc., from the same will be dumped, discharged or deposited in the Yuba river or any of its forks, branches or tributaries. The preliminary injunction granted in the case runs against the North America mine from being worked. In addition to enjoining the mine they have enjoined the persons. When the injunction is filed with the recorder of the county where the property is situated that is enjoined, that is notice to the successors in interest of the injunction granted. Supervisor Morrison says this has not heretofore been done. By this method they cite the successors and grantees in interest to the property enjoined to show cause why they should not be punished if they violate the injunction. The plaintiff is not by this method required to prove his complaint or bring witnesses to prove injury, but all he has to do is to show that the injunction has been violated. It is highly probable that the hydraulic miners will find some legal way to get around this new move of the anti-débris men, as represented by Supervisor Morrison.

A factory has been established in Sonora, Tuolumne county, in the heart of the Mother Lode gold-mining region, for the manufacture of dental gold. The place is provided with rolls, wire-drawing apparatus, punching and stamping machinery, retorts, assaying outfit, and everything to refine and prepare the crude gold for its ultimate use.

Northern Sierra county showed more activity last spring in gravel mining than has been the case for a long time. At Gibsonville, Table Rock, Howland Flat, and other small towns more or less hydraulic mining has been going on, and spies of the Anti Débris Association have been visiting the scenes of operations and inspecting the dams. As these dams have been built under supervision of the Government engineers of the California Débris Association, the miners are indignant that they cannot be left unmolested in their work, which, at best, is only being done in a small way and a long distance from any navigable streams.

So much silicious ore is now coming from the Utah mines to the Mammoth Copper Company's furnaces in Shasta county, that 50 or more men have been laid off at the Quartz Hill mine, at Whitehouse, not far from the smelter, which has been shipping heretofore 3000 to 4000 tons of ore monthly. For the present the mine will only ship what is taken out in development work. Not being able to smelt its gold-bearing ores, carrying sulphur, in Utah, the present corporation of the Mammoth Copper Company is shipping these ores to California for treatment, pending the settlement of an injunction suit in Utah concerning the smelter fume question.

A large amount of prospecting is now being done in the region around Randsburg and Johannesburg in Kern county, this local activity being largely due to the expected advent of Southern Pacific's Owens Valley railway, which will pass through the center of the Rand district. Better arrangements than ever are also being made for suitable water supply for the mines and mills, lack of water having always been a drawback in that region. Several water companies are now looking up the development of water. Numerous discoveries of low-grade ore have lately been made, but these will only be available when there is abundant water supply for milling purposes. The Yellow Aster mine, the most productive in southern California, already has a 100-stamp mill, but such large bodies of low-grade ore have been developed that one of 500 stamps is to be erected and this is now being planned. To bring this new machinery the Santa Fe railroad will build a spur from Johannesburg, 1½ miles to the proposed mill-site.

The Board of Underwriters of the Pacific, which fixes insurance rates for the coast, has announced a reduction of 25 per cent. in premiums to effect all policies written since May 1 on smelting and mining plants. Rebates may be obtained by all who have paid their premiums. This brings insurance in these plants back to the rate it was before the great fire in San Francisco. Just after that catastrophe, rates were increased on mills, smelters, etc., in the interior counties of this and neighboring States. The mining companies and smelters are all large patrons of the insurance companies.

Goldfield, Nevada

July 21—Postmaster Collins has completed his annual report for the fiscal year ending June 30. It shows some interesting figures regarding Goldfield business conditions. The volume of business was little less than the previous year when the promotion companies were sending out mail matter by the cartload.

High-grading, which has reached greater hights of impudence and greater extent in amount in Goldfield than any other gold camp known, is still a prolific industry here. Two men were caught in the Mohawk in old lease workings one night this week and failing to comply with the order to throw up their hands, were shot by the deputies in waiting. One man was fatally wounded and the other is in jail.

That high-graders were at work in that particular neighborhood was known for some time, but despite careful watching the deputies were unable to find where the thieves made their entrance owing to the numerous openings and the network of old leasers' workings underground.

Two swindlers and bogus mining stock brokers, of Los Angeles and Chicago, who used Goldfield stocks as a lure, have been caught in the toils and are now under Federal arrest. Such procedure will help dispel the distrust of Nevada securities against which Goldfield has been struggling for a year.

The new oilfields' excitement still lasts. The Nevada Bay State Oil Company is shipping supplies to its camp, 15 miles northwest of Goldfield where it has 12 men already at work. Drilling apparatus is on the way from Los Angeles. A 1500-ft. hole will be sunk as fast as possible.

Checks were mailed on Wednesday last to the Florence-Goldfield stockholders for the third dividend since last fall, this one amounting to $105,000. This company is a lease-made property, for little underground work has been done for some time on company account. The new mill, which was the illegitimate offspring of a would-be engineering concern, is being remodelled and reconstructed before it has been finished. Much of the concrete work has been dynamited and the whole mill is undergoing a remodelling. Parsimony and ignorance on the part of the management is the primary reason for this trouble. Yet, thanks to the royalties from the leases, the company is paying regular 10-c. dividends amounting to $105,000 quarterly.

Aside from the Wingfield and the Reilly leases of early days, the Engineers' lease has in the past 30 days shipped $300,000: the Annex during its brief career took out $165,339. The Gem and Baby have just begun producing but already have a credit of $15,000. The Mohawk-Florence which was in ore only a short time and in trouble a much greater time took out $488,232: The Little Florence despite injunctions, fighting miners and high-grading officials took out $1,215,558 and the Rogers Syndicate has taken out $675,000 worth of ore and still has ore on the dump awaiting shipment.

Salt Lake City

July 22—Three furnaces of the United States lead smelter at Bingham Junction are in operation on an oxidized charge, and just as soon as the roasters are finished, which will be about August 10, three more will be running on sulphide ores.

An event of importance to the Utah mining industry is the blowing-in on July 24 of the new smelter, built at a cost of approximately $300,000, in the Tintic mining district by the Tintic Smelting Company, of which Jesse Knight, of Provo, Utah, is president. A smelter right in the district is hailed with much satisfaction by producers for the reason that, although freight rates to the Salt Lake valley plants are eminently fair, at the same time there is a vast tonnage in the camp which is of hardly high enough grade to ship out, but is profitable to treat on the ground.

There has been a marked improvement in general mining conditions at Park City and Alta during the past month. In the former camp, aside from the increased energy being displayed by the larger producers, many of the smaller mines are giving employment to more men. Properties that were closed when the panic of last year came on are being started up again. The plans of the Daly-West Mining Company, outlined several years ago and so important to its well-being, are being carried out after the three years' delay occasioned by the caving-in of the Ontario drain adit. This work consists of opening the orebodies of the Daly-West mine on an even level with the drainage avenue. The drift has but a short distance yet to go before reaching the vertical side line between the Daly-West and Daly mines; hence it ought to be a matter of only a few weeks until the ore reserves at depth will have been penetrated. The Daly-West company is operating its concentrator on ore from the upper portion of the mine.

The Utah Copper Company's copper production in June is estimated at 4,500,000 lb., which is a substantial increase over May. An official statement will be forthcoming in a few days showing the result of the operation of its properties during the second quarter of the year.

From an official high in authority in the Harriman system it has been ascertained that plans are practically complete for the construction of a railroad into the Yerington copper district in Nevada. Harriman surveyors located a route for the proposed line last year, the total length of which, from Wabuska on the main line of the Nevada & California railway to the Nevada Douglas and other mines of the camp is a little more than 30 miles, and would take it through the rich Mason and into the upper end of Smith valleys which are immensely productive, agriculturally speaking. Whether the road will be constructed by the Harriman system outright, or by three of the principal mining corporations operating in the Yerington district has not been definitely stated. However, it is known that the road will be built soon. Representatives of the Nevada Douglas, Mason Valley and Bluestone mining companies recently held a conference at which railroad matters were discussed and the prevailing sentiment was that if necessary, the trio would form a railroad corporation, finance it, and operate it independently. Again, it is stated, officials of the Western Pacific, the new Gould transcontinental line now building from Salt Lake City to the coast, appreciate the importance of the western Nevada camp and have expressed a desire to penetrate that territory. Salt Lake is the headquarters of nearly all the principal mining companies of Yerington, and for that reason much local interest is attached to the movements now being made.

Denver

July 24—Three different firms of building contractors have gone from Denver to Steamboat Springs, in Routt county, to look up the deposits of white sandstone for building purposes, and the onyx, so-called, which is found there. The sandstone for purity and hardness is pronounced by stone experts to be the finest discovered in the entire West.

Notwithstanding the steam and electric roads which encircle the Cripple Creek gold-producing area, and reach nearly every mine above and below them, it may be interesting to know that the first aërial tram in the district has been completed and is successfully running at the Cresson mine. It has a capacity of 10 tons an hour, and is stated to be transporting ore at a cost of 5c. per ton. At the same time there are still from 20 to 30 operators loading ore on teams today from mines which are not reached by the railways.

J. F. Manning and John J. Hoban, connected with the Gold Leaf Consolidated Mining Company, have been re-indicted by the Federal grand jury on the old charge (which had been quashed) of fraudulently using the United States mails.

It is reported that a sorting mill is to be built by Denver men at the old Caribou and Poorman mines, to treat the dumps of 25 years ago, which were mined by Hollanders, who bought the mine in 1873 and lost it through sheriff's sale in 1876.

Indianapolis

July 27—James Epperson, chief of the Indiana department of mine inspection,

has prepared a bill which he will ask the next Legislature to enact into law providing for a small tax on each ton of coal mined in Indiana, and a certain tax on each dollar earned by miners for the purpose of creating a fund from which the State may pay benefits to miners injured while at work and to families of miners killed while at work in the mines. "Both operators and miners are in favor of such a law," said Mr. Epperson, "and I believe that miners or their families should have damages without having to go through the courts for four or five years fighting for them." Mr. Epperson said he had not determined just how much of a tax should be provided, but it will be a very small percentage, and he thinks the money should be paid into the State treasury through the counties and paid out by the State. He says he will also ask that a section be placed in the law providing a small pension for miners who pass the age at which they are able to work.

Toronto

July 24—The Canadian government has appropriated the sum of $35,000 to be expended in boring for coal, oil, gas, etc. Hon. W. Templeman, minister of mines, stated that it was intended to devote this sum, or the greater part of it, to boring for coal on Prince Edward island, where the geological indications are favorable, although no deposit is known to exist.

Officials of the Canadian Pacific Railway announce the discovery of extensive deposits of iron ore in Laurentian mountains within 100 miles of Montreal. The exact locality is kept secret. It is claimed that the ore shows 60 per cent. iron. The St. Maurice forges, which produce a limited quantity of high-grade iron, are in the same range.

Mexico City

July 20—The all-absorbing topic of conversation—in the papers—is the proposed new mining legislation. Everyone is interviewed. A visiting Englishman was given a column to say that any legislation which made English capital timid would probably frighten English capital and prevent its investment in the mines of Mexico, when, as a matter of fact, there is no English capital here.

Other mine owners won't play, are going right home if this law passes. No one seems to remember that several of the good United States will not allow a foreigner to own property, much less a foreign company, yet foreign money seems to have little fear. The point about the whole thing is that really the mining companies should be entirely under the jurisdiction of Mexican courts, and most of the promoters do not want to comply with the Mexican corporation laws. If English promotors could, by raising a newspaper flurry, accomplish the repeal of some of the strict regulations governing company promotions, it certainly would be done.

This newspaper talk is rather funny in Mexico as it is not for the purpose of creating public opinion, but merely to influence the few who have the influence necessary to stop or pass the bill, and it would seem that inasmuch as capital has a better chance here than in most of the civilized countries, it might be well to leave the decision to those who have made the preceding laws. The older Mexicans will frankly tell you that when Diaz granted concessions to American companies for railroads, the outcry was great from the Mexicans, who said with one accord that these precious privileges should be given to Mexicans. They realize the wisdom of his action now. There is no Mexican money with which to build railroads.

The President has always treated capital with great consideration and fairness, and will, in all probability, continue to do so.

In the meantime, the papers distort everything to the one end of proving that capital has become timid and charge it all to this proposed legislation, forgetting that money is scarce in other lines as well. Mining enterprises which have been for sale for years without buyers and propositions which have been dead as long, are stood up, given a new coat of capitalization and then knocked down with this bludgeon of adverse legislation, so-called.

London

July 17—The prospectus of a new mining company, called the Lena Goldfields Ltd., has been issued. The company has been formed to acquire from the Russian Mining Corporation, Ltd., the benefit of a contract to purchase shares equal to 70 per cent. of the total issued capital of a Russian company, called the Lena Gold Mining Company, and to acquire such portion of the remaining capital not secured under such contract as can be purchased with a view to the acquisition of the entire capital stock of that company. The new company will also acquire from the Russian Mining Corporation the benefit of a contract to purchase the Bodaibo railway by which access to the mines is obtained.

The share capital of the new company is £1,405,000 in £1 shares, of which 1,251,100 shares are to be now issued. Of these, 954,600 fully paid shares will satisfy the consideration payable to the Lena Gold Mining Company if all the shares in that company are acquired, 60,000 fully paid shares will be paid to the Russian Mining Corporation, the vendors, and 236,500 shares are now offered for subscription. There will be consequently 153,900 shares unissued or in reserve. The new company, which is in the nature of a trust company, will be entitled to nominate the board of the Lena Gold Mining Company, and the prospectus states that three of the present directors of that company will be nominated. The public who subscribe for the 236,500 shares now offered will with the Russian Mining Corporation, which receives 60,000 fully paid shares, acquire in round figures a quarter interest in the property of the Lena Gold Mining Company. The Lena Goldfields or English company has as stated above, the right to nominate the board of the Russian company. It will, however, only represent a quarter of the capital and it is not explained what the position will be if the shareholders in the Lena Gold Mining Company, who retain a three-quarter interest, seek to acquire control of the property.

The property acquired consists of extensive gravel deposits, situated about 1100 miles northeast of the town of Irkutsh on the Trans-Siberian railway. The Lena Gold Mining Company was established in 1863 and to October, 1906, had obtained 2,392,021 oz. gold of a value of £9,000,000. For the year ending October, 1907, the output was valued at £843,000, which is stated to be approximately one-fifth of the total gold production of the Russian Empire. The property has been favorably reported on by Charles M. Rolker, who spent two months in examining the mines. There are four groups of mines, and from one alone, the Bodaibo, a working profit of £1,389,110 is expected. The Lena Gold Mining Companys equipment for the purposes of carrying on its mining operations, in addition to the ordinary appliances for gravel mining and sluicing, consists of an electric power plant of 1660 h.p. and pumping plant of 1,200,000 gal. per hour capacity. The company employs 3000 miners and workmen, for whose use hospitals, schools, churches and bath houses have been provided. For the year ending October 13, 1906, the gold production was £742,000, giving a working profit of £164,034 for the year 1906-7, gold production £843,000, working profit £232,490, and for the year 1907-8 a profit of £250,000 is anticipated. The directorate of the Lena Goldfields, Ltd., includes the names of Lord Harris, Chairman of the Consolidated Goldfields of South Africa, Ltd., and of R. T. Fresheville, director of the Consolidated Mines Selection Company, Ltd., the well known mining engineer.

The gold deposits occurring in the properties consist of gold-bearing gravels in ancient river-beds, and are worked for the most part as drift mines, the development and extraction of gravel continuing during the whole year, the actual production of the gold by washing being carried on from the middle of May to October. The average value of the gravel worked for the three years ending October, 1906, has been approximately 36s. per cu.yd. and for the year ending October, 1907, it was 39s. per cubic yard.

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

Copper Queen—A third air compressor, which was formerly in the old Czar power house, is now being installed in the new power plant. This completes the new plant. The prospect and development work at the mines progresses steadily, and the showing for the past month has been satisfactory, particularly in the deeper levels of the Lowell mine. Nearly all the drifts on the 1300-ft. level are being pushed ahead, and during the past week one of them encountered a body of good sulphide ore, the extent of which is yet unknown. On the 1000-ft. level a body of good sulphide has been found in the new crosscut between the Lowell and Gardner, and a second is now being developed on the south side of the Lowell. The 1400-ft. station of the Lowell shaft has been cut and a new drift started to explore the country west of the Del Norte claim of the Hoatson mine where good ore is known to exist. A pump station is also being cut on the 1400-ft. level. The Uncle Sam shaft in the western part of the property has been sunk to a depth of 650 ft. Work on this shaft will probably be stopped in about two weeks when it reaches the main 200-ft. level 50 ft. farther down.

Superior & Pittsburg—In the Hoatson shaft a strike of oxide ore has recently been made on the 1300 level. The ore was found in a crosscut about 550 ft. from the shaft. A raise, up about 20 ft., is still in ore which averages 15 per cent. copper. The Hoatson shaft is shipping 300 tons of ore daily, and will ship a larger tonnage in a few months when the orebodies recently discovered can be mined to advantage. In the Junction shaft a depth of 1500 ft. has been reached. Some high-grade orebodies have been opened up on the 1300-ft. level. The Cole shaft is furnishing about 250 tons of ore daily. A strike of ore carrying 10 per cent. copper on the 1100-ft. level has recently been made.

Calumet & Arizona—The copper production at the smelter in Douglas for the month of June was approximately 4,200,000 pounds.

Shattuck & Arizona—The drift on the 600-ft. level passed through about 40 ft. of ore in the recently discovered orebody and is now being driven in ledge material of favorable appearance.

Imperial Copper Company—The strike recently made on the 400-ft. level of the Mammoth claim is proving to be the largest body of high-grade ore yet encountered in that mine. The smelting plant owned by this company at Sasco has been running with success since it was blown in. The plant is producing from 650,000 to 700,000 lb. of copper a month, all of which is being sold in New York, assaying 99.3 per cent. copper, with a fairly good proportion of the precious metals. The second unit, which will double this output, should be in operation before the end of July, and at about the same time the 300-ton concentrating plant should start up.

Tombstone—Both of the large Corliss cross-compound pumping engines, recently installed on the 1000-ft. level, were successfully started on June 25, and have since been running without a hitch. They pump from the 1000-ft. level to the surface, and the management has been able to cut out the relay pumps on the 700-ft. level and one of the Dow pumps on the 1000-ft. level. This has resulted in a saving of fuel of about $56 daily. The miners have started crosscutting west from the pump shaft in the limestone toward the contact between the limestone and the Contention dike 400 to 500 ft. distant from the shaft. Crosscutting east from the 1000-ft. level to get under the large leached orebody encountered on the 800-ft. level has also begun.

SANTA CRUZ COUNTY

Four Metals—The copper strike at the Red Hill tunnel is showing up larger with every day's work. The tunnel has cut 50 ft. into the vein of concentrating sulphide ore, without encountering the hanging wall. The tunnel is now in about 500 ft. with a depth of more than 400 ft. The directors announce their intention to put in a concentrator.

National Consolidated—The shaft is down 200 ft., and crosscutting has been begun. The new hoist is in place and sinking will be continued to the 400-ft. level.

YAVAPAI COUNTY

Wilson Group—This group of mines, 12 miles south of Prescott, has been bonded to H. J. Beemer, of New York City. It adjoins the Storm Cloud group, now the property of Mr. Beemer. Development on the Storm Cloud has exposed large bodies of high-grade gold-copper ore, and the same ledges run through the Wilson property.

Bullwhacker—Lessees working this mine have about 100 tons of $150 ore on the dump, taken out during the past six months. Large bodies of this kind of ore are exposed in the mine, four miles east of Prescott.

Monica—The company has added 10 stamps to its mill near Kirkland, making a total of 20 stamps. The output should be about doubled. The average value of the ore being milled is reported to be about $18.

Penn-Arizona Copper Company—This company is sinking a shaft on its properties in Copper Basin, seven miles west of Prescott. At a depth of 65 ft., a body of copper-bearing sulphides was broken into. The body cut is about 3 ft. wide, and assays 4 per cent. copper besides some gold and silver. The extent of the find has not been determined; neither wall has been reached.

United Verde—This company will start its new No. 5 furnace in a few days. The new furnace is 4x20 ft. and is said to be one of the largest blast furnaces in the southwest.

United Verde Extension—This property lies just east of the famous United Verde. A crosscut on the 300 level is in about 45 ft., and is showing ore in the face.

California

AMADOR COUNTY

Defender—At this property, F. B. Joyce, superintendent, the clean-up of the 10 stamps last month showed an average yield of $6 per ton exclusive of metal in the sulphurets.

South Eureka—The 20-stamp mill running day and night is crushing an average of 90 tons per day; 20 stamps will soon be added. The main shaft is to be sunk to the 2700 level. W. H. Finehley is superintendent.

BUTTE COUNTY

Gunn Drift—This mine near Paradise, in the Magalia Channel region, is being examined by Los Angeles men with a view to purchase.

Pentz—At this old gravel-mining camp considerable work is being done, and some prospecting is being done by means of drills.

CALAVERAS COUNTY

Paragon—L. J. Hutchinson and others have relocated this placer claim in the Angels district, near the Kentucky placer mine.

San Antone—This quartz mine at West

Point has been bonded by Phillips & Macher to H. W. Norman, of the Ritter mine. The property is equipped with a hoisting and pumping outfit.

Blue Bell—This mine near Glencoe has been bonded by the Golden Era Mining Company, of San José, Cal., and a 40-stamp mill is to be put up this year.

Horswell—The gravel mine operated a few years ago by Mr. Horswell on the Haupt place, near San Andreas, is about to be reopened.

Ritter—At this mine, Mountain Ranch, a 6-ft. vein of good milling ore has been cut on the north drift on the 200 level.

INYO COUNTY

Britain—Some very high-grade gold ore is coming out of this mine in Beveridge district, owned by Spear Brothers, of Lone Pine. Rich silver ore has also been found in this ground.

Ella—This mine adjoining the old Union at Cerro Gordo and owned by C. Krohn, has been bonded to Thomas Varden and T. W. Parker for $25,000. It is a silver-lead property and has been worked for years.

Four Metals Mining Company—The five-mile tramway being built will be ready for operation in September. The company's furnace will be able to handle 250 tons of ore daily.

KERN COUNTY

Kern County Consolidated Gold Mining Company—At this property on Piute mountain, F. W. Gwynne, superintendent, the veins are at present producing very high-grade quartz.

Pine Tree—A fine body of gold ore is reported found in this mine at Tehachapi. A new incline has been sunk on the ledge above the water tunnel.

MARIPOSA COUNTY

Mariposa—At this mine, Mount Bullion, a five-stamp mill is to be erected and leases will then be let on the property.

NEVADA COUNTY

Delhi—At this mine, owned by the Champion Mining Company, the chlorination works have been started up on accumulated sulphurets.

Gray Eagle—This mine at Maybert is being reopened under superintendence of C. A. Marriner.

Ancho—At this property, Graniteville, Harry Overman, manager, a 15-ft. vein has been intersected in the lower tunnel.

PLUMAS COUNTY

Nugget—A cucumber-shaped nugget valued at $625 has been found in one of the hydraulic mines in Onion valley.

Gruss—At this mine, Genesee, five stamps are now dropping on ore from the old shaft.

SHASTA COUNTY

Evening Star—James Sallee has purchased this mine at Old Diggings and put a force of men at work under C. Lanyan.

SAN BERNARDINO COUNTY

Dry Washers—The Italie Company at Twenty-Nine Palms district is experimenting with dry washers. The Westerfield separators recently set at work, are reported satisfactory, but larger ones will be built.

SIERRA COUNTY

Twenty One—Crary, Armstrong and the Courtney Brothers, who hold the bond on this mine at Alleghany, have made an important strike at depth. The ore is of very high grade.

TRINITY COUNTY

Mountain Boomer—R. L. Skinner, C. F. Meckel and D. B. Fields, of Weaverville, have bonded this property at New River. The mine has been a producer for some years.

TUOLUMNE COUNTY

Little Bonanza—This mine, near Sonora (formerly Last Chance) has been pumped out and mining operations have been begun by four leasers.

Colorado

BOULDER COUNTY

Cashier Mining Company—This company, operating at Camp Albion on low-grade ores, is having its 25-ton mill thoroughly tested and the successful treatment of the ores will mean the erection of a mill capable of handling several hundred tons daily. Thomas L. Wood, Boulder, Colo., is manager.

Livingstone Leasing and Holding Company—New York men have become interested in this property at Sugar Loaf and propose extensive developments, with W. R. Doty, Boulder, as general manager.

United States Gold Corporation—Plans are being drawn for this company's proposed cyanide plant of 100 tons initial capacity at Sugar Loaf. The contract is to be let at the stockholders meeting in Boulder on August 1.

Longfellow Mining Company—R. G. Mann, of Boulder, manager of this company, is going to purchase new machinery for the property at Jamestown.

Alton—Ore carrying as high as $4000 per ton has been found in the tunnel workings of this property near Caribou.

CLEAR CREEK COUNTY

Gold Leaf—This property is reported purchased by Dr. Barber, of Tamaroa, Ill., and a new plant of machinery is to be installed, with the intention of erecting a mill at a later date. The property is in the Gold Dirt district.

Waldorf Consolidated Mining Company—It is reported that the extensive holdings of this company in the Argentine district have been leased for ten years to a Kansas City., Mo., syndicate.

GILPIN COUNTY

Druid Mining Company—Arrangements are being made for the installation of a larger hoisting plant on the Searle mine, and the Gilpin Tramway Company will build a switch for handling the ores. C. M. Anderson, Central City, is manager.

Decatur Mining Company—Decatur, Ill., men are interested and are figuring on increasing the capacity of the mill in Moon gulch. Good mill and smelting ores are being taken out. G. M. Ashmore, Rollinsville, is manager.

Mackey—It is reported that Eastern men are arranging to pay off the indebtedness on this property in the Pine Creek district and for the early resumption of operations.

Champion—The company is planning the installation of an air compressor at the Lone Star mine, near Rollinsville. A regular product is being taken out of the Champion mine and milled, giving an average of about $10 per ton.

Aduddell—Colorado Springs and Eastern capitalists have secured the Aduddell group under lease and bond and are carrying on extensive shipments, under the management of H. W. Pring, of Central City. The company is arranging for the purchase of a mill to treat the heavy tonnage of low-grade ores.

Bezant Gold Mining Company—Iowa and Colorado capital is interested in the purchase of the Quartz Mill mining group in Leavenworth gulch, and J. H. Bawdem, Central City, has been placed in charge.

Senator Mines Company—A good strike is reported in the 300-west level of the Senator mine near Black Hawk.

East Notaway—A shipment of smelting ores from the 555-ft. level carried 27.98 oz. gold, 9.18 oz. silver, and 4.80 per cent. copper, or a value of $554 per ton. The property is owned by the Town Topics Gold Mining Company.

Amethyst—Central City and Denver men have organized and will work the New Brunswick property in Russell district. Forbes Rickard, Central City, will have charge of the operations.

LAKE COUNTY—LEADVILLE

New Monarch—Two carloads of high-grade gold ore are shipped daily to the Salida smeltery, the average production of the mine being about 50 tons per day. Work on this property for several months has been confined to the old region; a large acreage of unexplored ground remains to be gone over.

Huckleberry—Two carloads of gold ore were recently shipped from this property in the St. Kevin district, that netted nearly $20 per ton. A highly mineralized body has been encountered from which extensive shipments will be made.

Margaret—Steady shipments of high-grade ore which averages about 12 oz. gold to a ton, are made from the property to the local smelters. The ore also carries a fair percentage of lead.

Ibex—Between 300 and 400 tons of sulphide ore are produced daily by the company and are shipped to the Arkansas Valley plant.

Favorite—The lessees on this property in South Evans gulch are producing good-grade ore and have a large body exposed in the workings. The ore is particularly acceptable at the Arkansas Valley smelter, as it carries from 30 to 50 per cent. lead and from 1 to 1½ oz. gold, also from 5 to 10 oz. silver. More than 700 tons of this material have been shipped during the past two months and the shoot is still strong and maintaining its grade.

Starr Placer—Operations on this property in California gulch show that while some of the ground has previously been washed out, there still remains sufficient gold to make the work pay.

Idaho

Bonner County

Idaho Smelting and Refining Company—This company, which owns one of the finest smelter sites in the Northwest, and which has a 200-ton plant on the shores of lake Pend d'Oreille, has just secured deposits and guarantees of funds amounting to $200,000 with which to begin operations at once. For many months the management has been trying to get money to pay off $217,000 in debts and provide an operating fund. S. W. Gebo, of Montana, has deposited a large proportion of the amount, and repairing and enlarging work is now in full swing again. Two roasters and a blast furnace are to be installed, and when the plant is ready for operation it will be able to handle 250 tons of ore a day. Contracts are already made for ore and coke. Much of the ore will come from independent shippers in Montana and the Cœur d'Alene.

Shoshone County

Monitor—The old equipment will be replaced by one 60- and one 50-h.p. boiler, a compressor and other minor pieces of machinery. The mine has been cleaned up by a small crew and now 25 men are at work. Sinking from the 400-ft. level will commence at once. The company will not ship till a large ore reserve is developed.

Midnight—Rich galena has been struck in this property, near Mullan and the Morning mine. The strike was made in an adit at a depth of 700 ft. and revealed 18 in. of galena. At 1000 ft., where the Morning No. 5 tunnel crossed the lead, the vein was found to contain about 10 ft. of concentrating ore, and its dip was throwing it close to the Midnight endlines. The upper adit was driven to determine the dip of the vein, and with the present strike it is found to apex on Midnight land. Work will be continued for some time on this level. The property is under bond to eastern capitalists for whom William Q. Ranft, of Missoula, Mont., is agent.

Silver Mountain Mining Company—A contract for 100 ft. of tunnel has been let and the work is now in progress. The tunnel is in 400 ft. and it is thought that 100 ft. will tap the lead. This will give a depth of 300 feet.

Cañon Creek Fraction—Two stringers of galena have just been discovered in this property, which is near the Hercules mine. The full width of the ledge has not yet been determined.

Park Copper—An assessment of three mills a share has been levied on the stock of this company for development purposes.

Golden Chest—This mine, near Murray, will resume operations at once. Superintendent Auerbach has just returned from a trip to New York, where he attended a meeting of the directors.

Sonora—Ore has just been encountered on this property near Mullan; conditions are reported to be improving as the work progresses. The drift has been run 70 ft. from the crosscut. At a recent meeting of stockholders, an assessment of 2½ mills was levied for carrying on the development.

Interstate—Work will be started in a few days on a long crosscut tunnel which is designed to cut three leads at a depth of 1200 ft., or 800 ft. lower than the present workings. The crosscut will be 2800 ft. in length, and will be started at water level. Work has been carried on in the third level and this will continue. The crew will be increased materially.

Granite-Allie—Commercial galena one foot wide has been opened up in the bottom of an 85-ft. shaft. At 60 ft. the bottom of the shaft was all in ore and this continues to the bottom. After 15 or 20 ft. more of sinking, a crosscut will be run to the wall. This property is said to have the only contact vein in the Murray district.

Rex—Resumption of work is indefinitely delayed owing to financial difficulties. Until a few weeks ago development work was being done and some excellent bodies of galena had been developed.

Paymaster—Galena, high in silver, has been encountered, and drifting is said to show an increasing quantity. The streak is 2 ft. wide, and is carried in a vein 5 ft. in width. Drifting has been carried 100 ft., the entire distance in ore.

Indiana

Greene County

Summit—This mine, near Linton, claims the State record for work during the last year, having worked 260 full days out of a possible 308, and it would have operated 10 days longer but for strikes. The mine also claims one of the best records for tonnage in the State. During the past year the tonnage of coal was 241,000.

Parke County

The question as to whether underground coal ought to be assessed for taxation as real estate or personal property when the mining company owns no surface ground, came up before the State Tax Board on an appeal by Vandalia Coal Company, the Parke County Coal Company and the Divian Coal Company. The coal land was assessed at $30 an acre as personal property, but the State board held that it should have been assessed as real estate, and the price, $20 per acre, for which it was assessed last year, must stand for four years.

Pike County

Frederick—Fire on July 18 destroyed the engine house and tipple at this coal mine, nine miles south of Petersburg. Operations have been suspended at the mine until new machinery can be installed, a work requiring several weeks.

Michigan

Copper

Copper Range—The shaft on the Globe tract, which is held under option and is being developed by the Copper Range Consolidated, is bottomed at a depth of 1000 ft. A station has been cut at this point, and as soon as the shaft can be put in shape to accommodate regular hoisting, drifting will be started. At the above depth the shaft, which is vertical, encountered the formation, and in cutting out for the level some copper-bearing rock was exposed. This will be opened up extensively, as a thorough search is being made to locate the Baltic lode. Diamond drill cores exposed the lode on this tract and it was calculated that the shaft would cut the formation at a depth of between 800 and 900 ft. In cutting the station at the sixth level, a distance of 856 ft. from surface, the lode was encountered, but it carried no copper, and sinking was again resumed. All developments for the present will be confined to opening the ground tributary to the 1000-ft. level.

Adventure—The diamond drill which tapped the copper-bearing formation from the crosscut of No. 3 shaft has been pulled and a second hole will be put down from there to cut the formation at another point. Should the drill core from this proposed point prove as rich as the first, the company will, in all probability, take some action in regard to sinking a new shaft to open up this new strike.

Superior—At this property preparations are being made to crosscut to the lode at the 10th level. The openings in the upper levels are satisfactory and are being increased to supply between 400 and 500

tons of rock daily, as soon as everything is in shape to begin regular shipments to the mill. Work of grading the railroad is progressing and the framework for the temporary shaft house is being assembled and will soon be delivered to the shaft. During development a stock pile of approximately 25,000 tons of stamp rock has been accumulated; this, together with the rock coming from the openings, will amply supply the two heads which this company has leased from the Atlantic company.

Michigan—Diamond drill operations have been started by this company in an attempt to disclose the same favorable formation that has been exposed in the Adventure drill cores.

Missouri

JOPLIN—ZINC-LEAD DISTRICT

Catherine—Frank Nicholson is overhauling his mill preparatory to reopening the mine.

Porto Rico Milling Company—This company has been incorporated with a capital stock of $25,000, with L. Gilbreath, E. M. Gilbreath, J. W. McCullough, E. McCullough and E. J. Cooper, of Joplin, as stockholders.

Old Dominion—The Whitsett mine of this company at Porto Rico has reopened and is producing.

Red Fox—This mine at Midway is to be reopened.

Evans Mining Company—This company has taken a lease on seven acres, and a 100-ton mill upon the Weyman land, and will reopen the mine at once.

White Star—This company has taken a 20-acre lease on the Luscombe land at Cave Springs, and has already started to open up the ground.

Montana

BUTTE DISTRICT

Boston & Montana—During the past week work has been stopped on the Greenleaf and the pumps have been withdrawn. It is reported that the results of the development work done thus far have failed to meet the expectations of the management and that no further work will be done on the claim. The shaft is down over 1000 ft. Much interest was taken in the work at the Greenleaf inasmuch as it was the deepest shaft on any property east of the known copper zone. It was hoped that the work would determine the presence of copper in that locality.

Pilot-Butte—The property lies between Senator Clark's Elm Orlu and the claims of the Butte & Superior. The shaft is down 500 ft. From the station on the 500-ft. level one crosscut has been driven 300 ft. to the southwest, and another 350 ft. to the northeast. The property was shut down last February, but work was resumed the latter part of June when the shaft was unwatered. An electric compressor has been installed and it is also planned to put in a new electric hoist.

Reins Copper Company—The board of directors, at a meeting held the latter part of June, issued a call for a special meeting of stockholders to be held Aug. 12. It is proposed to place before the stockholders the question of issuing $600,000 of company bonds for the purpose of paying off the company's present indebtedness and to provide for its future operations.

FERGUS COUNTY

Barnes-King—The June report of Manager McGee states that the bullion shipments for the month amounted to $28,000. The operating expenses were $20,000, leaving a net profit of $8000. This showing is considered rather encouraging by the stockholders in view of the setbacks occasioned by excessive rains during the month. The company was reorganized and the mine placed under new management a little less than a year ago.

Nevada

ESMERALDA COUNTY—GOLDFIELD

Production—Tonnage for the week just passed amounted to 2159, with a total valuation of $198,785. The Combination mill treated 595 tons of Consolidated ores. The Western Ore Purchasing Company handled from the Gem Florence, 12 tons; Baby Florence, 50 tons; Eisen dump, 161 tons; Rogers Syndicate, 154 tons; Engineers Lease, 236 tons; Victor, 24 tons; Van Riper dump, 43 tons. The Nevada-Goldfield Reduction Works handled from the Combination Fraction 535 tons; Sandstorm No. 5, five tons; Little Florence, 25 tons; Baby Florence, 25 tons; Mohawk Combination, 95 tons; Black Butte, 20 tons; Curtis Jumbo, 118 tons; Commonwealth, 35 tons; Hayes-Turner Mohawk dump, 41 tons; Hayes Oddie dump, 20 tons; from the old Western mill, 25 tons.

Rogers Syndicate—The syndicate's lease on the Florence ended without any sensation on July 11 at midnight. This lease had ore only about five months of its existence, but during that time it shipped about $600,000 worth of ore; $245,000 have been paid in dividends, and it is expected that the final disbursement will bring this amount to or above $300,000. A royalty of 25 per cent. on all ore extracted was paid to the lessors.

Baby Florence—This lease has at last encountered the rich Florence vein and has entered the list of shippers.

Little Florence—The dump of the lease was purchased by A. C. Eisen, who put expert sorters to work culling it for shipment. A lot of high-grade was encountered, about a ton being secured that averaged $3 per lb. High-graders in the mine are supposed to have sent it to surface as waste for the benefit of outside confederates. When the Florence mill begins running this whole dump will probably be treated.

Consolidated Jumbo—Norrington & Campbell have been granted a lease on the southerly 400 ft. of the Grizzly Bear claim. They are installing an electric hoist.

Diamondfield Black Butte—Another lease has been let on this property adjoining the Baumgartner lease which recently shipped six tons assaying $1090 per ton.

Commonwealth—The Wilber & Peck lease, known as the Tokop, has made its fourth shipment of ore averaging about $40. The pay portion of the vein is about 4 ft. wide and the ore is being taken from a depth of only 50 ft. The work of finding the vein and ore-shoot from the workings of the old shaft will be begun at once.

Victor—The Victor Mining and Leasing Company has begun breaking ore on the 250-ft. level in the upraise.

Engineers' Lease—This lease on the Florence is the big thing of the camp at present. It is owned by Messrs. Taylor, Price, and Niven, all local mining engineers, and is a close corporation. The first shipment was made in June and in the following 30 days the output amounted to $300,000. One lot settled for last week averaged more than $1000 per ton.

Milltown Fraction—The Milltown Fraction will purchase a more powerful hoist and will sink the shaft an additional 150 feet.

Laguna—The Hazel Goldfield lease on the Laguna has let a contract for sinking the shaft from the 450- to the 550-ft. level. The contract price is $38.50 per ft., with a bonus of $3.50 per ft. if the work is completed within 30 days.

ESMERALDA COUNTY—CUPRITE

Sulphur—Los Angeles and Boston men have acquired title to the sulphur claims near Cuprite and are carrying on systematic tests of the product mined with very satisfactory results thus far. The sulphur is 93 per cent. pure as it is mined, and the deposits are very large and situated very near the two railroads.

HUMBOLDT COUNTY—SEVEN TROUGHS

Reagan Hayes Lease—This lease has just made a 30-ton shipment to the smelter so rich that Mr. Reagan accompanied the shipment to Salt Lake; 60 sacks will average $2500 per ton.

Prior Chadbourne Lease—This lease adjoining the Reagan Hayes lease is installing a hoist.

NYE COUNTY—TONOPAH

Shipments—Ore shipments from the Tonopah mines for the past week were: Tonopah mining, 2950 tons; Belmont, 450 tons; Montana-Tonopah, 1000 tons;

North Star, 80 tons; Midway, 100 tons; MacNamara, 150 tons; West End, 45 tons; a total of 4775 tons.

Tonopah Mining—This company's 100-stamp mill at Millers treated almost 14,000 tons of ore during the 30 days of June and made a metallurgical recovery of between 88 and 90 per cent. Development work to the amount of 392 ft. was accomplished the past week in addition to stoping 3460 tons of ore.

MacNamara—The motors and transformers have arrived and have been installed, and from now on the compressor and fans will be run by electric current. The Tonopah mines show an increase in temperature of one deg. F. for every 36 ft. in depth in some mines and for every 56 ft. in others.

Belmont—Prospecting on the 1000-ft. level north of the Mizpah fault is being pushed ahead, the crosscut being in now more than 100 ft. Stringers of quartz ore from 2 to 10 in. in width have been cut continually. One 10-in. stringer about 50 ft. north of the fault is being drifted on. The finding of a pay orebody on this side of the Mizpah fault would be of inestimable value to the camp.

NYE COUNTY—BULLFROG

Montgomery-Shoshone—J. G. Kirchen, who is manager of the Tonopah Extension, has taken hold of the Montgomery-Shoshone in addition to his other work, and is directing the development of the mine. Walter Techow has been made mill superintendent.

NYE COUNTY—CACTUS PEAK

Cactus Range Gold Mining Company—This company operating about 22 miles east of Goldfield is installing an air compressor and a Cameron pump. Ore was found on the 100-ft. level, but water interfered with further development. The shaft will now be sunk 250 ft. deeper.

New Mexico

GRANT COUNTY

Comanche Mining and Smelting Company—The interest of this company has passed into the hands of H. B. Hovland and Hovar A. Smith, of Bisbee, Ariz., and capitalists from Duluth, Minn., who are in control of the Copper Gulf Mining Company. A new company has been formed with a capitalization of $2,000,000, to work the property.

South Dakota

CUSTER COUNTY

Mariposa—The main ledge for which the company has been working for many months, has been struck 90 ft. from the main tunnel. The ore shows well in free gold.

LAWRENCE COUNTY

Pluma—Secretary Harding, of Des Moines, is financing a sale of stock or mortgage bonds to raise money for a 500-ton mill and deeper development of the property.

Minnesota Mines Company—The first cleanup after two months of irregular operation is highly pleasing. The one shift in the mill has been increased to three and cleanups will now be regular.

Safe Investment—The property will be reopened within a few days and the 40-stamp mill will be run to full capacity.

Portland—The rich gold ledge struck some months ago is supplying regular shipments of ore.

Imperial—Crosscuts are being driven east and west from the shaft at the 600-ft. level and the ore is steadily looking better. More than 150 tons daily are shipped to the mill.

PENNINGTON COUNTY

Ama Queen—The mill will soon be in shape for operation and the unwatering of the shaft is about to commence. The old Tremain mill has been supplanted with gravity stamps and water power is used instead of steam.

Golden Summit—In connection with the operation of the Golden Medal property near Keystone, this ground is also to be worked. New machinery has been put in and a new shaft house.

Ivanhoe—If the test runs now being made are satisfactory, only the high-grade ore from the small veins will be run until the 50-ton mill is ready, when the lower-grade ledges will be tapped for a supply.

George—The owners of this placer ground near Rockerville are preparing to start operations. New machinery has been installed and the work will continue until late in the fall.

Arundel—New machinery is going in on the property and Superintendent Truax is preparing to ship tungsten ore east regularly.

Golden West—Work with the diamond drill is prosecuted in several locations to find the supposed higher-grade orebodies at greater depth. The mill will not be operated until the drill completes its work.

Wisconsin

ZINC-LEAD DISTRICT

Platteville—The Empire and Acme mines resumed this week with light forces and full crews will be added next week. The Cruson started development again and is hand-cobbing its ore dump. The Forest City company is preparing to continue prospecting. The St. Rose, the only producer in the Platteville camp since June 1, is turning out green concentrates assaying 55 per cent. metallic zinc, which is higher than the average milled product in this district. The West Main street company is drilling on the mining school campus; some jack and lead have been encountered in two holes; a shaft will be sunk if the drillings warrant it.

Highland—In this district the Highland Mining Company is working a full crew of men and is operating both its concentrators, one turning out lead and jack and the other drybone or zinc carbonate. The Franklin and St. Anthony have resumed with light forces, and are milling. The Milwaukee-Highland has been reorganized under the name of the Milwaukee Mineral Company; the lease covers a good run of lead ore, which can be worked independently of the zinc deposit. The Wallace is taking out jack and will haul its ore to the Milwaukee-Highland mill for treatment. Shaffra & Girman, on the old Section 4 range, and John Kreuhl, on the land just east of the Highland Mining Company, are running drybone.

Linden—In this district the Ross, Glanville, Dark Horse, Stevens, Rajah and Pollard mines are producing, and a little prospecting is in progress; in all about 100 men are employed, practically all of the mines working light forces. The Ross is holding its ore, and has 1600 tons of zinc concentrates on hand; it has always been the policy of this company to hold its ore in periods of low prices.

Mifflin—The Sunrise, Gruno, Slack and Peacock mines, in this district continue producing. The new Peni mill shipped its first car of jack this week. The D. D. C. mill is practically completed and will soon be put in operation. The Big Tom is installing the pumping equipment obtained from the Ebenezer.

Canada

Mineral Production of Ontario—Returns made to the Ontario Bureau of Mines show the output of the mines and metalliferous works of the Province, for the first three months of 1908, as follows:

	Quantity.	Value.
Silver, oz	3,673,047	$1,938,840
Gold, oz	129	2,686
Cobalt, tons (estimated)	325	32,974
Copper, tons	1,999	284,451
Nickel, tons	2,328	458,120
Iron ore, tons	24,572	66,423
Pig iron, tons	90,826	1,467,779

ONTARIO—COBALT DISTRICT

Ore Shipments, Cobalt—Shipments of ore for the week ending July 18 were as follows: Cobalt Lake, 95,228 lb.; Crown Reserve, 44,000; La Rose, 362,610; Nipissing, 253,600; Nova Scotia, 40,230; O'Brien, 63,870; Right of Way, 60,050; Trethewey, 121,640, total 1,011,000 pounds.

Chambers—Ferland—Rich ore is being extracted at the 100-ft. level on the main vein. This is an extension of the O'Brien main vein, which crosses the property. At the O'Brien at a depth of 300 ft., rich ore was also found. The wall rock is heavily shot with silver on each side. A plant will be installed as soon as buildings are ready.

Crown Reserve—This mine, which is held from the Ontario government subject to a royalty of 10 per cent., has made its

initial payment of $4000 to the public treasury.

Nipissing—The shaft on vein No. 49 is down to a depth of 105 ft., at which point the mineralized portion of the vein is 4 in. wide and assays 3000 oz. silver per ton. This is the vein which caused such a sensation in the camp in December, 1906, when the silver gave out at a point higher up.

O'Brien—The Ontario government has received $38,264 from the O'Brien mine, as royalties for the three months ending June 30. The royalty consists of 25 per cent. of the value of the output.

Right of Way—Rich ore has been struck on a continuation of the La Rose vein on the second or 145-ft. level. The vein at this point is about 8 in. wide. This is the first high-grade ore found on Right of Way at the lower level.

Silver Queen—Owing to the damage by fire to the compressor plant the company has arranged to secure power from the Cleveland-Cobalt company, and is operating the regular number of drills until the burned plant can be restored.

ONTARIO—HASTINGS COUNTY

Deloro Smelter—A number of additions and alterations have been made to this plant since it started about the first of the year; these have more than doubled its capacity. Shipments to Deloro from Cobalt have steadily increased and the daily output of silver amounts to about three-quarters of a ton.

SASKATCHEWAN—LAC LA ROUGE DISTRICT

New Discoveries—Samples of ore taken from the north of Prince Albert, Sask., where there has recently been a rush of prospectors, have been brought to Winnipeg by George Moorehouse, Secretary of the Board of Trade. They include gold quartz, silver and copper. The Pinche brothers of Winnipeg and J. Sinclair have located a nickel deposit on an island in Lac La Rouge, the seam being 30 ft. wide and two miles long. There is an iron cap on the vein. Samples are being sent to Sudbury for analysis.

ONTARIO—PORT ARTHUR DISTRICT

Loon Lake—A number of test pits have recently been sunk and hundreds of tons of iron ore have been exposed. The ore is red hematite associated with "taconite," similar in character to that of the Mesabi range. D. D. Lewis, superintendent of the Algoma Steel Works, Sault Ste. Marie, inspected the properties recently.

Mexico

It is officially announced that at a meeting of the Cabinet on July 25 it was decided to refer the proposed new mining law to President Diaz with power to act. A brief of the arguments for and against the measure will be submitted to the president. With this as a basis President Diaz will decide either to enforce the law at once by presidential decree or to refer the whole matter to the session of Congress which convenes on September 16.

CHIHUAHUA

Parral Production—The production of the camp for the week ending July 11 amounted to 7350 tons, of which 3510 tons were shipped to smelters and 3840 locally treated. This is a slight falling off, as compared with the preceding week.

Grand Central—High-grade silver ore is being developed at this new property, situated on the Sabinal district along the Rio Grande, Sierra Madre & Pacific. W. F. Thompson is the owning operator.

Santo Domingo—This old mine in the San Pedro district is being extensively worked by an El Paso, Texas, company, of which Capt. Britton Davis is president and E. H. Wells manager.

Greene Gold-Silver—Rumors affecting this company's affairs have been varied and frequent of late, and it is now the general opinion that operations may be shortly suspended at the Ocampo properties. One of the late reports is to the effect that there is in process of organization a new and well-financed company which will acquire and operate jointly the properties of the Greene Gold-Silver Mining Company and of the Belen Mining Company in the Ocampo camp. Included in the latter company's holdings is the famous Matulera mine, which has been for a number of years and now is a regular producer.

Republica—The report of the May operations of this company, with property, has been issued by the United States & Mexican Trust Company, of Kansas City, Mo. It contains the following items: 500 tons of ore milled, yielding 38 tons of concentrates of gross value of 48,347 oz. silver; silver bullion amounting to 20,137 fine oz. produced in cyanide plant; total value of output, 64,356.06 pesos; operating costs, 26,001.26 pesos; net profit, 38,354.80 pesos.

La Fortuna—This company is reported to be carrying on very encouraging development operations in the San Joaquin district, 25 miles from Nueva Casas Grandes. A force of 100 Mexicans under the direction of Supt. L. E. McBane is employed. The main shaft is down 600 ft. and a considerable tonnage of milling-grade silver ore is exposed.

Dolores—This company is adding two batteries of five stamps each to its milling plant, making a total of 25 stamps, in addition to several Huntington mills. The company is also treating a large tonnage of slimes in its cyanide plant. The monthly output is now about $40,000.

Rosario Mining and Smelting Company—This company has in progress of erection at its property in the Urique section a 10-ton reverberatory furnace. It is also the plan to erect during the year a 25-ton wood-fired reverberatory, on the completion of which the smaller furnace will be utilized for bullion melting. The manager is G. B. Jacobs and the assistant manager L. H. Skeels.

Choreras—Messrs. J. D. Evans and Charles Heflin, of Texas, are developing a promising copper property in the Choreras mountains east of Chihuahua, along the Orient railroad.

DURANGO

Lustre Mining and Smelting Company—This company has, according to reports, its pyritic smeltery in satisfactory operation. It is also stated that plans have been perfected for the building of a 65-mile narrow-gage railroad from Rosario, the westerly terminal of the Parral branch of the Mexican Central railway, to the company's mines and reduction works. The Baring Brothers' banking house, owning properties in the same section, is said to be interested in the railroad enterprise.

Inde District—The State government has approved of the plans for the proposed railroad line from Rosario, the terminal of the Parral branch of the Mexican Central to the camp of the Gold Mining Company. It is also the plan to extend this line to Tepehuanes and Magistral, as well as other sections of the Inde and Santiago Papasquiro districts.

GUANAJUATO

The week ending July 11 was an active one, there having been an increase in shipments of concentrates, their total value being $137,000. This amount exceeds the previous week's shipments by $37,000. The shipments of bullion amounted to $154,000, making a total for the week of $291,000. The amount of freight received at the new station of the Mexican Central is about twice as much as when the road centered at Marfil. The amount of machinery consigned to the different mining companies here has increased greatly. Quantities of machinery have arrived awaiting transportation to the Guanajuato Development Company.

Guanajuato Reduction and Mining Company—An aërial tram is being constructed from the Tepeyac mine to the Bustos mill for the conveyance of ore from the mine to the mill.

TEPIC

Rosa Morada—At the Frontal mine, owned by the Cambio Gold Mining Company, of Cincinnati, and situated in the Rosa Morada district of Tepic, the 35-ton concentrating mill has been completed, but the installation of the cyanide plant will be delayed until fall.

VERA CRUZ

Dos Bocas—An oil gusher of S. Pearson & Son, at Dos Bocas, near Ozuluama, has been burning for several weeks, and it is estimated that more than 10,000 bbl. of oil per day are being consumed.

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, July 29—Trade throughout the country continues dull and not even temporary activity is noticed. Eastern dealers have been looking to the West to improve conditions, but no results have followed. Large accumulations of coal are reported at the lower Lake ports and this condition will continue until grain and ore shipments arrive from upper Lake ports. There is an optimistic feeling in the trade that business will soon become better, but no specific reasons are noted.

The coal trade in the South is nearly at a standstill and the strike among the miners has seriously curtailed production in Alabama. The disturbance has spread to the coke ovens, but the manufacturers of iron do not expect to curtail production inasmuch as arrangements have been made to receive coke from West Virginia. The operators have organized an association with the intention of running their mines on the open-shop plan.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to July 18, short tons:

	1907.	1908.	Changes.
Anthracite.....	3,106,737	2,859,672	D. 247,065
Bituminous.....	20,829,195	17,535,290	D. 3,293,905
Coke.....	7,734,995	3,670,466	D. 4,064,529
Total.....	31,670,927	24,065,428	D. 7,605,499

According to official reports the shipments of coal from the mines on the Norfolk & Western Railway for the month of June were 919,964 tons, of which 800,343 tons were commercial and 119,621 tons were company coal.

Shipments of coal and coke by the Pittsburg Coal Company for the six months ending June 30 were as follows, in tons:

Coal:	1907.	1908.	Changes.
Pittsburg district..	8,374,965	5,033,901	D. 3,341,064
Hocking (Ohio) dis.	607,271	388,151	D. 219,120
Total.....	8,982,236	5,422,052	D. 3,560,184
Coke:			
Pittsburg district..	244,198	4,146	D. 240,052

The gross earnings of the company were $2,525,109 in the first half of 1907 and $868,069 in the same period of 1908. The net earnings in the first half of 1907 were $1,128,012 and the net loss in 1908 was $393,630.

New York

Anthracite

July 29—In the hard-coal market No. 1 buckwheat continues scarce with a brisk demand; pea coal is inclined to be short, but the other small sizes are in abundant supply. There are no features in the market, and dealers seem reconciled to the prevailing dull times. Circular prices are as follows: Broken, $4.55; egg, stove and chestnut, $4.80; 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.

Bituminous

The demand for soft coal is very light, and no improvement is evident except at a few points in the far East. Consumers of fuel for manufacturing purposes are working principally on their stocks of manufactured goods and are not manufacturing now. It is, therefore, to be expected that until the stocks are disposed of, these consumers will not come actively into the market. New York harbor seems to be duller than almost any other consuming territory and good grades of steam coal go begging at $2.45@2.50 per ton. Slack is quoted at 50c. per ton at the mines, run-of-mine gas coal at 65c. and ¾-in. coal at 90c. per ton.

Transportation from mines to tide is slow. In the coastwise-vessel trade there seems to be a slight improvement, and freight rates are firmer. The rates from Philadelphia are as follows: Boston, Salem and Portland, 55c.; Lynn, 60@65c.; Newburyport, Gardiner and Bangor, 70@75c.; Portsmouth, 55@60c.; Saco, 90@$1; Bath, 65@75c.; to the Sound, 45@50 cents.

Birmingham

July 27—The coal production in Alabama is down to its lowest mark at present, caused by the strike. A large number of strike breakers are being brought in and the mining fields are still under martial law. A State organization has been perfected among the coal producers here; representatives of all but about 10 per cent. of the production were at the first meeting held in Birmingham last week. H. L. Badham was appointed temporary executive officer of the organization. An agreement is said to have been entered into to operate the mines on the open-shop plan.

As a consequence of the miners' strike, the coke supply of Alabama has been interfered with. A number of coke pullers joined a union and as soon as the company officials heard of this the men were discharged.

The strike breakers are in the main men who have worked in coal mines before and, while some are quitting when they hear that a strike is on, many are remaining at work.

Chicago

July 28—The only demand for coal is for the harvesting trade. For steam purposes the demand has not nearly come up to the hopes of the trade and domestic coals are lifeless.

The best grades of western and smokeless lump profit from the demand by the harvester manufacturers and this has made smokeless, large sizes, hard to obtain. Illinois and Indiana lump sells for $1.75@2 in carload lots, run-of-mine brings $1.60@1.75 and screenings are strong at $1.45@1.65.

Eastern prices are under circular quotations, smokeless run-of-mine bringing $3@3.30, Youghiogheny $3.15 for steam and $3.25 for ¾-in. gas; and Hocking fetches $3@3.15 for standard products.

Anthracite is very dull and probably will be so to the end of the summer. Lake receipts do not come up to anything like a normal movement and graduated discounts do not stir the consumer to lay in stock. There is much demurrage coal constantly on tracks, from Eastern and Western mines.

Pittsburg

July 28—Conditions in the coal trade remain practically the same as a week ago. About 75 per cent. of the railroad coal mines are running, but they are not being operated in full. Prices remain on a basis of $1.15 per ton for mine-run coal at the mine, but for what little current business is going, a slightly higher price is asked. Slack is down to 50c. and sales have been made at a lower rate. Indications pointed to a rise in the rivers yesterday and coal was brought down from the pools to the harbor, where fully 6,000,000 bushels are now ready for shipment. The rivers stopped rising last night when within a foot of being navigable and indications are that shipments will have to be postponed for the present.

Connellsville Coke—Production of coke is being greatly increased and before the end of the week it is expected that over one-half of the ovens in the Connellsville fields will be in operation. The H. C. Frick Coke Company has been compelled to start many idle ovens owing to the increase of pig-iron production at plants of the United States Steel Corporation. Preparations are being made to put more works in operation next week. Prices remain firm on contract coke, but for spot

shipment low prices prevail. Furnace coke on contract remains at $1.65@1.75 and foundry $2.10@2.25. The *Courier* in its summary for the week gives the production in both fields at 185,093 tons. The shipments were 6846 cars as follows: To Pittsburg, 2688; to points west of Connellsville, 3734; to points east of Connellsville, 424 cars.

Iron Trade Review

New York, July 29—The pig-iron market has broadened slightly especially for basic iron. Buying orders developed during the week but only on a small scale and at moderate prices. Sales of 200 tons of bessemer were made at $15.75 Valley furnaces and it was also reported that 200 tons of basic and malleable were sold at $15.25. This last price is questioned because these grades have been offered recently at $15 Valley with no takers.

Within the last few days contracts have aggregated 10,000 to 12,000 tons of basic iron for delivery during the third quarter at $15.25@15.50 Eastern furnaces. This brings the total during the last two weeks up to nearly 50,000 tons of basic iron.

New interest is shown in finished steel products. The principal feature is the increase in specifications on suspended contracts which include some railroad work. A number of contracts for steel for buildings developed this week. The contract for heavy rails for the Mexican Central railroad was increased from 10,000 to 11,000 tons. There was also an order for seven miles of 6-in. and smaller gas pipe for Ohio and an inquiry for 10 miles of 3-, 4- and 5-in. pipe from the same district.

The National Tube Company put additional blast furnaces on blast at Loraine and McKeesport and is now operating 55 per cent. of its capacity. The port of Gary, Ind., was opened this week by the arrival of 12,000 tons of iron ore from Lake Superior. This inaugurates the first step in the operation of this new plant of the United States Steel Corporation.

The Zanesville, Ohio, plant of the American Rolling Mills Company, started work with a force of 200 men and 100 more men will be given employment within a week. The plant has been closed since November.

Baltimore

July 27—Exports for the week included 927 short tons of copper in ingots, cakes and bars to Holland and England; 1127 short tons of steel billets to England; 528 tons of steel rails to Costa Rica and 443 tons of tin scrap to Holland. There was imported 5800 tons of iron ore from Cuba.

Birmingham

July 27—Despite the strike of the union coal miners in Alabama the Southern pig-iron production is holding up well and the furnacemen assert that there will be no shutting down of furnaces. The furnaces in blast in this State are doing well and the production is being shipped out about as rapidly as it is made. Quotations are $11.50@12.50 per ton, No. 2 foundry; the average is $12 per ton, No. 2 foundry. The foundries and machine shops in the Birmingham district report better conditions with orders coming in steadily, though not in great volume.

There is some inquiry for iron for delivery during the last quarter of 1908. Some of the largest consumers of pig iron in the country are also sounding the market and making inquiry as to the probable production in the future. There are three furnaces about to be blown in in the immediate Birmingham district and two other iron makers can soon be in a position to produce.

The operations at the steel plant at Ensley and the rolling mills at Bessemer, in this district, are being increased. The output at both places is most satisfactory just now. There is a fair demand for steel rails and the product is being shipped from Ensley as quickly as it can be loaded.

Chicago

July 28—The iron market continues dull. Sales of pig iron are confined to small lots of Southern at $11.50@12 Birmingham ($15.85@16.35 Chicago) and $17 @17.50 for Northern. There is little difference in prices between early and late delivery within the last half of the year. Contracts generally are almost non-existant, sales being confined to the next 60 days. Southern gets most of this business and efforts are being made to hold up the price to $12 without general success.

Iron and steel products continue dull. Structural materials are faintly active and in a few products, such as sheets and bars, there is slow progress upward.

Coke is moving slowly at $4.90 for the best Connellsville and $4.15@4.75 for West Virginia grades.

Philadelphia

July 29—There are a number of inquiries for foundry, forge and pipe iron. Bids have been made, but as our people have to bid against outside makers, it is impossible to tell how much of the new business will come to eastern Pennsylvania furnaces. Some pipe iron is needed for immediate delivery. The bids made here do not show any shading. Most of the iron called for is wanted for September and later melting. The situation is gradually clearing and consumption requirements are enlarging. The demand for basic is more promising than for a long time, and some business is being done under close cover at $15. No. 2 leads all other and is held closely to $16. Bessemer pig continues dull.

Steel Billets—More business has been arranged for than for many weeks and billets are once more on the move.

Bar Iron—Retailers and jobbers, who have been running very scant of stock, are now showing some interest in bars. Large consumers have been urged not to delay placing their orders for the remainder of the year.

Sheet Iron—An undertone of improvement has manifested itself during the week. Quite a good week's business has been done.

Pipes and Tubes—Some of the large mills have gathered in business for oil-pipe-line extensions, and more business of this character is on the way. Prices remain low, and consumers are acting accordingly.

Merchant Steel—Negotiations have been opened for larger fall supplies among some Eastern jobbers who want to have stocks on hand.

Plates—The shipyards are gathering in enough new work of small dimensions to send them to the mills for supplies. Construction requirements are very light.

Structural Material—There is a little new business. The railroads are not ordering much in the East. Our manufacturers are anxious concerning the prosecution of a lot of railroad-bridge work that is still held up.

Steel Rails—It is given out that several railway systems will order rails in September. At present there are no orders on the market.

Scrap—Eastern railway systems have more good steel scrap on hand than they have had for years.

Pittsburg

July 28—Satisfactory conditions in the iron and steel trade continue. All of the plants of the Republic Iron and Steel Company are running this week and at the general offices of the company in this city it was stated that enough new business had been booked yesterday and today to warrant the operation of all the mills, except, possibly, the steel works at Youngstown, all of next week. No large orders are being received, indicating that buyers are taking only enough material for actual needs; this is considered encouraging, as it shows that everything bought is going into consumption, and there will be no big stocks anywhere when an active buying movement begins. The Carnegie Steel Company has more business than at any time since the opening of the year. Its Homestead, Duquesne and Ohio works are running practically full and Clairton and other plants are in partial operation. The company put on two more blast furnaces during the week, increasing the number to 29, which is more than 60 per cent. of its pig-iron capacity, as the furnaces that are running are the largest producers. The steel-rail

trade continues to be disappointing and the company is not operating its Edgar Thomson rail plant to more than 25 per cent. of its capacity. The Pittsburg Steel Company expects to start four of its new open-hearth steel furnaces at Monessen next week. It will receive its basic pig iron from the Midland furnace, the contract for which was mentioned recently. The other four open-hearth furnaces are likely to be started before the end of August and more pig iron will have to be bought. Other iron and steel plants in the Pittsburg district are operating more fully than last week and altogether the situation is very satisfactory.

Pig Iron—The pig-iron market is in a remarkable condition. Despite the fact that the demand is improving, there is a softening in prices for all grades. Large furnace interests have been endeavoring to keep up old prices, but it is impossible to stop shading. This was noticed when a steel interest entered the market for 100 tons of bessemer for August delivery and 300 tons for later shipment. Several interests quoted the minimum price of $15.75 at furnace, but this rate was shaded until it is reported today that the contract likely will be placed at $15.50. Another steel interest closed today for 300 tons of standard bessemer at a shade under $15.75. One dealer closed several contracts for different grades of pig iron aggregating nearly 1500 tons and all at the regular rates, which are as follows: Bessemer, $15.75; malleable bessemer and basic, $15; No. 2 foundry and gray forge, $14.75, all at Valley furnaces. There also are a number of good inquiries in the market that will develop into contracts shortly. Among them is that of the Standard Sanitary Manufacturing Company, a large buyer of foundry iron. It wants 8000 tons, about one-half Northern and one-half Southern, with a small tonnage of Virginia iron. The iron is for September and October deliveries, and it is expected that with the strong competition for the business, a low price will be obtained by the company. The contract will be closed this week.

Steel—Some business was done this week in bessemer and open-hearth billets, but no large tonnages were placed. The price of $25, Pittsburg, is strictly maintained. Sheet bars continue firm at $27.50, Pittsburg; plates at 1.60c., and steel bars at 1.40c.

Sheets—The sheet market shows a slight improvement and prices are firm. Some idle mills have been started by the leading producer and also by independents. Black sheets are quoted at 2.50c., and galvanized at 3.55c., for No. 28 gage.

Ferro-Manganese—The market remains unchanged and for prompt and future delivery prices continue at $46@47 per ton, Pittsburg.

Metal Market

Gold and Silver Exports and Imports

NEW YORK, July 29.
At all U. S. Ports in June and year.

Metal.	Exports.	Imports.	Excess.
Gold:			
June 1908..	$ 8,626,718	$ 3,409,885	Exp. $ 5,216,833
" 1907..	23,872,140	2,165,342	" 21,706,798
Year 1908..	53,507,975	26,368,198	" 27,139,777
" 1907..	36,300,732	21,468,647	" 14,832,085
Silver:			
June 1908..	4,437,360	3,366,182	Exp. 1,071,178
" 1907..	5,360,599	3,476,546	" 1,884,053
Year 1908..	25,514,545	21,054,332	" 4,460,213
" 1907..	29,219,209	22,395,611	" 6,823,598

Exports of specie from New York, week ending July 25: Silver, $1,317,300 to London and Paris. Imports: Gold, $112,948 from Central and South America, Mexico, West Indies, France and England; silver, $108,842 from West Indies, Europe, South America and Mexico.

Specie holdings of the leading banks of the world July 25, are reported, as below, in dollars:

	Gold.	Silver.	Total.
Ass'd New York	.....	.....	$316,610,900
England.....	$188,857,340	.....	188,857,340
France..... ..	636,385,100	$182,535,160	818,920,260
Germany.....	196,925,000	81,605,000	278,530,000
Spain.....	78,310,000	134,385,000	212,695,000
Netherlands....	38,522,000	21,154,000	59,676,000
Belgium.....	20,323,335	10,161,665	30,485,000
Italy.....	18,137,000	21,500,000	39,637,000
Russia.....	580,265,000	39,375,000	619,640,000
Aust.-Hungary.	234,810,000	67,065,000	301,875,000
Sweden.....	19,640,000	.....	19,640,000
Norway.....	8,400,000	.....	8,400,000
Switzerland....	18,940,000	.....	18,940,000

The New York banks do not separate gold and silver. The foreign statements are from the *Commercial and Financial Chronicle* of New York.

Silver Market

SILVER AND STERLING EXCHANGE.

July.	Sterling Exchange.	Silver. New York, Cents.	Silver. London, Pence.	July.	Sterling Exchange.	Silver.. New York, Cents.	Silver.. London, Pence.
23	4.8680	52½	24 3/16	27	4.8690	52⅜	24 3/16
24	4.8675	52⅜	24 3/16	28	4.8690	52½	24¼
25	4.8675	52½	24¼	29	4.8690	52⅜	24⅜

New York quotations are for fine silver, per ounce Troy. London prices are for sterling silver, 0.925 fine.

Messrs. Pixley & Abell report silver shipments from London to the East for the year to July 16:

	1907.	1908.	Changes.
India.....	£6,736,174	£4,317,908	D. £2,418,266
China.....	.....	516,400	I. 516,400
Straits.....	544,012	90,510	D. 453,502
Total.....	£7,280,186	£4,924,818	D. £2,355,268

Receipts for the week were £177,300 from New York and £5200 from Mexico; total, £182,500. Exports were £2615 to Egypt and £117,750 to India; £120,365 in all.

The price of silver has remained fairly steady at 24 3/16d. until July 29, when it was advanced to 24⅜d. upon the reopening of the Bombay market, which has been closed the past week.

Copper, Tin, Lead and Zinc

DAILY PRICES OF METALS.

July.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. Cts. per lb.	Spelter. New York, Cts. per lb.	Spelter. St. Louis, Cts. per lb.
23	12⅞ @13	12⅝ @12⅞	58⅜	30¾	4.45 @4.50	4.45 @4.50	4.30 @4.35
24	12⅞ @13⅛	12¾ @12⅞	59	30½	4.45 @4.50	4.50 @4.55	4.35 @4.40
25	13 @13⅛	12¾ @12⅞	....	30½	4.45 @4.50	4.50 @4.55	4.35 @4.40
27	13⅛ @13¼	12¾ @13	59¼	30¼	4.47½ @4.50	4.52½ @4.57½	4.37½ @4.42½
28	13⅛ @13¾	12⅞ @13	59	30½	4.47½ @4 50	4.57½ @4.62½	4.42½ @4 47½
29	13⅛ @13¼	12⅞ @13⅛	59¼	30¾	4.47½ @4.52½	4.62½ @4 67½	4.47½ @4.52½

London quotations are per long ton (2240 lb.) standard copper, which is now the equivalent of the former g.m.b's. The New York quotations for electroytic copper are for cakes, ingots or wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is 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.

Copper—Under a steady demand from domestic consumers, some of whom have placed large orders, the price for copper has risen further. The strength of the situation has been enhanced by a good business from abroad, along with the improvement in domestic business. The total sales for the week, July 23-29, amount to many millions of pounds, including large transactions both in Lake and in electrolytic copper. The supply of copper is sufficient to meet all present demands, but at the close of the week several producers are holding for higher prices. However, sellers in general have refrained from any attempt to put up the market too quickly, the policy being rather to advance quotations gradually as business develops.

The market closes firm at 13⅛@13¼c. for Lake and 12⅞@13⅛c. for electrolytic in ingots, cakes and wirebars. Business in casting copper during the week has been done at an average of 12⅝@12¾c., the closing prices being 12¾@12⅞c.

The London standard market has advanced in sympathy with refined copper, and closes firm at £59¼ for spot and £59⅞ for three months.

Refined and manufactured sorts we quote: English tough, £61½@62½; best selected, £61½@62½; strong sheets, £73½@74½.

Tin—The London market has shown renewed strength, heavy transactions in futures taking place from day to day. The close is cabled at £137½ for spot, and £138⅝ for three months.

Business in the domestic market has been on a moderate scale, traders and consumers not being very anxious to take hold of the metal at present figures. The main transactions were made in spot tin, which is still rather scarce and for which

a premium is still exacted. The close is quoted at about 30¾c.

Manufactured Copper—Sheets, cold-rolled, 17½c.; hot-rolled, 16½c. Wire, 14¼c. base.

Lead—Business in this metal has been on a larger scale at advancing prices. The market closes at 4.47½@4.52½c., New York.

London also reports a firmer market, a scarcity of sellers, and quotations at the close of £13 3s. 9d. for Spanish lead, £13 0s. 3d. for English lead.

Spelter—A much more active demand than for sometime past has made itself manifest in this market, and the unwillingness of holders to part with their metal at the lower prices has brought about a gradual advance. The market closes firm at 4.47½@4.52½c., St. Louis, 4.62½@4.67½c., New York.

The London market has been quiet, but maintained its firm undertone, and the close is cabled at £19⅛ for good ordinaries, and £19⅜ for specials.

Other Metals

Antimony—No sales of importance took place this week, and prices are only nominal. Quotations are 8½c. for Cookson's, 8⅜c. for Hallett's and 8@8¼c. for ordinary brands.

Aluminum—Ingots, American No. 1, in large quantities, 33c. per lb. Rods and wire, 38c base; sheets, 40c. base.

Cadmium—In 100-lb. lots, $1.25 per lb., at Cleveland, Ohio.

Quicksilver—New York price is $44 per flask for large lots; $45 for jobbing orders. San Francisco, large lots nominal at $43.50, domestic and $42, export; small orders, $45@46. London is £8 per flask, with £7 17s. 6d. quoted by second hands.

Zinc Sheets—Base price is 7c., f.o.b. La Salle-Peru, Ill., less 8 per cent.

Platinum—Prices remain unchanged at $22.50 per oz for hard platinum, $20 for ordinary and $15 for scrap.

Foreign Coal Trade

Welsh Coal Trade—Messrs. Hull, Blythe & Co., London and Cardiff, report current prices at Welsh ports as follows, under date of July 18: Best Welsh steam, $3.96; seconds, $3.72; thirds, $3.54; dry coals, $3.84; best Monmouthshire, $3.54; seconds, $3.30; best small steam, $2.22; seconds, $1.98. All per long ton, f.o.b. shipping port.

Mexican Imports of Coke—Importations of coke into Mexico, according to the Mexican Treasury department were 400,464 tons in 1907 and 424,441 tons in 1906. In these years the United States supplied 323,279 tons and 358,251 tons respectively.

Missouri Ore Market

Joplin, Mo., July 25—The high price of the week for zinc ore was $38 per ton; the assay base price was $34.50 for 60-per cent. zinc, the base ranging down to $32 per ton, and averaging, all grades, $31.72 per ton. The high price for lead ore remained at $60 per ton, but a much larger quantity was sold at this figure than in the previous week, the market being strong at the week-end. Medium grades brought $58@59 per ton, and all grades averaged $59.20.

Shipments of zinc ore decreased 715 tons from the previous week, being only 4068 tons; with an output approximating 4400 tons, stock is rapidly accumulating in the bins, even with the restricted output.

Following are the shipments of zinc and lead from the district for the week ending July 25:

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	2,074,100	599,520	$51,170
Joplin	1,852,000	314,320	39,819
Galena	699,030	155,330	15,765
Duenweg	517,140	73,190	10,460
Alba-Neck	485,860	.....	8,459
Oronogo	424,720	.....	7,522
Prosperity	378,880	20,740	6,683
Granby	345,120	33,000	6,175
Spurgeon	166,560	133,270	5,595
Aurora	340,220	12,280	4,415
Carthage	193,710	.....	3,292
Badger	95,290	28,700	2,416
Miami	181,890	.....	2,304
Carl Junction	120,000	2,660	2,058
Zincite	105,540	.....	1,688
Sarcoxie	62,500	.....	1,000
Peoria	58,070	.....	464
Wentworth	34,560	.....	426
Totals	8,135,180	1,373,020	$169,719
Seven months	274,804,350	43,085,670	$5,809,867
Zinc value, the week, $129,061;		7 mos.,	$4,640,117
Lead value, the week, 40,658;		7 mos.,	1,169,750

Average ore prices in the Joplin market were, by months:

ZINC ORE AT JOPLIN.			LEAD ORE AT JOPLIN.		
Month.	1907.	1908.	Month.	1907.	1908.
January	45.84	35.56	January	83.58	46.88
February	47.11	34.92	February	84.58	49.72
March	48.66	34.19	March	82.75	49.90
April	48.24	34.08	April	79.76	52.47
May	45.98	33.39	May	79.56	56.05
June	44.82	32.07	June	73.66	60.48
July	45.79	.....	July	58.18	.....
August	43.22	.....	August	59.54	.....
September	40.11	.....	September	53.52	.....
October	39.83	.....	October	51.40	.....
November	35.19	.....	November	43.40	.....
December	30.87	.....	December	37.71	.....
Year	43.68	.....	Year	68.90	.....

Wisconsin Ore Market

Platteville, Wis., July, 25—The base price for 60 per cent. zinc ore this week was $33@35 per ton. No premium is reported to have been paid. The best grade of lead ore sold at $58@60 per ton, the same as last week. The tonnage of zinc ore shipped from this district comprises more carbonate ore than for some months. A number of "jack" mines have resumed within the last two weeks, but most of them have as yet put on only light forces.

Shipments, week ended July 25:

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	400,270	.....	156,100
Highland	314,900	.....	.....
Days Siding	264,000	.....	.....
Hazel Green	250,200	80,000	.....
Mineral Point	198,560	.....	.....
Linden	195,020	.....	.....
Harker	152,630	.....	.....
Benton	134,440	.....	.....
Dodgeville	120,000	.....	.....
Livingston	120,000	.....	.....
Cuba City	.....	124,100	.....
Total	2,150,020	204,100	156,100
Year to July 25	51,228,541	6,190,805	781,165

In addition to the above there was shipped to the electrostatic separator at Platteville, from Linden, 66,500 lb.; from Highland, 58,200 lb.; from Rewey, 124,910 lb.; from Benton, 425,960 lb. Shipped to the Joplin separator works at Galena, from Benton 75,070 lb.; from Linden, 48,000 lb. Shipper to the Enterprise roaster at Platteville, from Strawbridge, 150,000 lb. all zinc ore.

Chemicals

New York, July 29—The market continues dull and little new business is reported. The trade does not look for any improvement until fall buying begins. In all industries consuming chemicals the demand continues for immediate consumption only and few orders for futures have been booked.

Copper Sulphate—There is no activity in the market and the few offers of goods by independent makers at $4.50 have not had a ready market. Standard copper sulphate remains at $4.65 per 100 lb. for carloads and up to $4.90 for smaller quantities.

Nitrate of Soda—There is a little better demand and prices are firm. Quotations remain at 2.30@2.32½c. for spot and 2.25 @ 2.35 for other positions of 1908.

Mining Stocks

New York, July 29—The week has been one of strength for the mining stocks on the Exchange, and sales have been heavy. Amalgamated Copper rose to $74¼ and closed at $73½. American Smelting common, touched $88½ and closed at $86⅞. United States Steel common showed great strength, rising to $45⅞ on heavy buying and closed at $44⅝; the preferred closed at $108¼. Utah Copper declared an initial quarterly dividend of 50c. per share and the stock rose a point to $39.

On the curb Standard Oil and Guggenheim Exploration were the features. The reversal of the decision by the United States Court of Appeals in the $29,000,000-fine case caused a sharp rally in Standard Oil stock, the price advancing to $665. Later it receded to $645 and closed at $649. Guggenheim Exploration closed at $160. Nevada and Cobalt stocks were moderately dealt in, but the range in price was narrow.

Boston

July 28—The market for mining shares is active and broad. Interest has been centered in the Lake stocks following activity in the Butte issues.

Calumet & Hecla is off to $669. Amalgamated has risen $3.50 to $74.25 ex-dividend. North Butte has been the leader this week, selling up over $7 to $81.75. Quite a spurt was recorded in the Lake properties. Adventure rose $3 to $8; Allouez, $3.50 to $34.50; Atlantic, $1 to $15.50; Centennial, $2.50 to $28.25; Elm River, $1.12½ to $2.62½; Franklin, $2.37½ to $12; Isle Royale, $1.75 to $22.50; Mass, $1 to $7; Michigan, $3.75 to $13.50; Mohawk, $3.50 to $62; Osceola, $3 to $105; Quincy, $7.25 to $96; Rhode Island, $1.12½ to $5; Tamarack, $11 to $77; Victoria, $1.62½ to $6.62½; Winona, $1 to $7; and Wolverine, $8 to $140. Utah Copper advanced over $3 to $39.62½ on the announcement of an initial quarterly dividend of 50c. per share. Utah Consolidated has been bought for New York account and is up $2.75 to $46.50 Persistent buying of Boston Consolidated put the stock up $1.50 to $14.25. Butte Coalition rose $1.25 to $26.75; Boston & Corbin, $1 to $18.25; Arizona Commercial, $2 to $21.50; Calumet & Arizona, $3 to $118; Old Dominion, $2.37½ to $39.37½ Parrot, $1.25 to $27; Shannon, $1.12½ to $15.12½; and United States Smelting, $3.62½ to $41.62½. The curb has responded to the better feeling, but it is only a question of time when the better class securities now traded in there will be listed on the Stock Exchange.

STOCK QUOTATIONS

NEW YORK July 28	
Name of Comp.	Clg.
Alaska Mine	½
Amalgamated	74
Anaconda	46
Balaklala	3½
British Col. Cop.	5
Butte & London	
Butte Coalition	26½
Colonial Silver	¼
Cum. Ely Mining	8¾
Davis Daly	2⅛
Dominion Cop	2 1/16
Douglas Copper	4¼
El Rayo	2 1/16
Florence	3 7/16
Foster Cobalt	38
Furnace Creek	.13
Giroux	3⅝
Gold Hill	⅛
Goldfield Con	5 13/16
Granby	‡101
Greene Gold	3/16
Greene G. & S	¼
Greenw'r & D.Val.	.75
Guanajuato	2
Gnggen. Exp.	175
Hanapah	‡.20
McKinley Dar.	74
Micmac	2 3/16
Mines Co. of Am.	1⅛
Mitchell Mining	⅛
Mont. Sho.C	1.00
Nev. Utah M. & S	3
Newhouse M. & S	6½
Nipissing Mines	7¼
Old Hundred	⅛
Silver Queen	1.09
Stewart	¾
Tennessee Cop'r.	36 7/16
Tri-Bullion	1/16
Union Copper	‡1 3/8
Utah Apex	4
Utah Copper	39½
Yukon Gold	4¼

BOSTON July 28	
Name of Comp.	Clg.
Adventure	7 7/8
Allouez	34½
Am. Zinc	‡28¼
Arcadian	4
Arizona Com	21¼
Atlantic	15⅛
Bingham	.35
Boston Con	14
Calumet & Ariz	118
Calumet & Hecla	669
Centennial	28½
Con. Mercur	.42
Copper Range	77
Daly West	11
Franklin	11½
Greene-Can	11
Isle Royal	22¼
La Salle	14¼
Mass	7
Michigan	13½
Mohawk	65
Nevada	14⅛
North Butte	81½
Old Colony	.40
Old Dominion	39⅜
Osceola	105
Parrot	27
Quincy	97
Rhode Island	5
Santa Fe	2¼
Shannon	15
Superior	19½
Tamarack	77
Trinity	14½
United Cop., com.	6¾
U. S. Oil	24
U. S. Smg. & Ref.	41¼
U.S.Sm. & Re.,pd.	46
Utah Con	46½
Victoria	6½
Winona	6⅞
Wolverine	139
Wyandotte	1⅞

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	24⅞
Am. Smelt. & Ref.	87⅞
Am. Sm. & Ref., pf.	‡107¼
Bethlehem Steel	19
Colo. Fuel & Iron	32⅜
Federal M. & S.,pf.	85
Inter. Salt	18½
National Lead	71
National Lead, pf.	103¾
Pittsburg Coal	‡12⅞
Republic I. & S.	21
Republic I. & S.,pf.	73¾
Sloss-Sheffield	62½
Standard Oil	649
U. S. Red. & Ref.	‡14
U. S. Steel	45½
U. S. Steel, pf	108¾
Va. Car. Chem	‡25¾

BOSTON CURB	
Ahmeek	‡76
Black Mt	‡3¼
East Butte	6⅞
Hancock Con	7
Keweenaw	9½
Majestic	.80
Raven	.96
Shawmut	.33
Superior & Pitts.	13
Troy Man	.45

ST. LOUIS July 25		
N. of Com.	High.	Low.
Adams	.30	.20
Am. Nettie.	.03	.02
Center Cr'k	1.75	1.50
Cent. C. & C.	68.00	66.00
C.C. & C. pd.	78.00	76.00
Cent. Oil	110.00	100.00
Columbia	4.00	3.00
Con. Coal	18.00	16.00
Doe Run	120.00	110.00
Gra. Bimet.	.20	.18
St. Joe	15.00	12.00

LONDON July 29	
Name of Com.	Clg.
Dolores	£1 10s 0d
Stratton's Ind.	0 0 7½
Camp Bird	0 12 9
Esperanza	3 0 0
Tomboy	1 2 6
El Oro	1 3 9
Oroville	0 9 0

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

NEVADA STOCKS. July 29.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.	Name of Comp.	Clg.
COMSTOCK STOCKS		Silver Pick	.22
Belcher	.25	St. Ives	.34
Best & Belcher	.50	Triangle	.06
Caledonia	.14	BULLFROG STOCKS	
Challar	.15	Bullfrog Mining	.04
Comstock	‡.26	Bullfrog Nat. B	.05
Con. Cal. & Va	.88	Gibraltar	.06
Crown Point	.30	Gold Bar	.05
Exchequer	.17	Homestake King.	.35
Gould & Curry	.15	Montgomery Mt.	.07
Hale & Norcross	.22	Mont. Shoshone C.	.93
Mexican	.79	Original Bullfrog.	.02
Ophir	2.35	Tramp Cons	.18
Overman	.08	MANHAT'N STOCKS	
Potosi	.12	Manhattan Cons.	.08
Savage	.24	Manhat'n Dexter.	.05
Sierra Nevada	.32	Jumping Jack	.02
Union	.31	Stray Dog	.03
Utah	.04	MISCELLANEOUS	
Yellow Jacket	.37	Golden Boulder	.08
TONOPAH STOCKS		Bonnie Clare	.07
Belmont	.98	Lee Gold Grotto	...
Extension	.88	Nevada Hills	1.62½
Golden Anchor	.02	Nevada Smelting.	.87½
Jim Butler	.30	Pittsburgh S. Pk.	1.13
MacNamara	.68	Round Mt. Sphinx	.21
Midway	.45		
Montana	1.48		
North Star	.10		
Tono'h Mine of N.	7.75		
West End Con	.66		
GOLDFI'D STOCKS			
Adams	.06		
Atlanta	.28		
Booth	.39		
Columbia Mt	.27		
Comb. Frac	1.57		
Cracker Jack	.06		
Dia'dfield B. B. C.	.20		
Goldfield Belmont	.15		
Goldfield Daisy	.78		
Great Bend	.37		
Jumbo Extension	.60		
Katherine	...		
Kendall	.16		
Lone Star	.10		
May Queen	.06		
Oro	.13		
Red Hill	.29		
Roanoke	...		
Sandstorm	.32		

COLO. SPRINGS July 25	
Name of Comp.	Clg.
Acacia	‡6
Black Bell	....
C. C. Con	3⅛
Dante	6
Doctor Jack Pot	5½
Elkton	58
El Paso	36
Findlay	25
Gold Dollar	‡6
Gold Sovereign	‡3
Isabella	30⅛
Index	....
Jennie Sample	‡2⅝
Jerry Johnson	‡4
Mary McKinney	‡25
Pharmacist	‡3
Portland	1.00
Un. Gold Mines	‡3¾
Vindicator	80
Work	8½

Assessments

Company.	Delinq.	Sale.	Amt.
Butler-Liberal, Utah	July 17	Aug. 6	$0.02
Caledonia, Nev	Aug. 12	Sept. 2	0.05
Challar, Nev	July 8	July 30	0.10
Exchequer, Nev	Aug. 11	Sept. 1	0.05
Helvetia, Ariz	.....	July 20	0.50
Ingot, Utah	July 17	Aug. 5	0.01
Iowa Copper, Utah	July 13	July 30	0.05
Lead King, Utah	July 1	July 28	0.01
Little Chief, Utah	Aug. 11	Sept. 1	0.01
Lucky Calumet, Ida	July 3	Aug. 13	0.01
Maxfield, Utah	July 18	Aug. 17	0.02
Mexican, Nev	July 17	Aug. 17	0.10
Missoula Copper, Ida	July 25	Aug. 25	0.01
Oro Cobre, Cal	July 16	Aug. 3	0.02
Sierra Nevada	July 14	Aug. 4	0.10
Signet	Aug. 8	Oct. 6	0.01
Talisman, Utah	Aug. 1	Aug. 18	0.02
Tomahawk, Nev	July 10	Aug. 12	0.01
Wabash, Utah	July 10	Aug. 1	0.10
Wheeler, Utah	July 16	Aug. 6	0.01½

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	68.673	55.678	31.769	25.738
February	68.835	56.000	31.852	25.855
March	67.519	55.365	31.325	25.570
April	65.462	54.505	30.253	25.133
May	65.971	52.795	30.471	24.377
June	67.090	53.663	30.893	24.760
July	68.144	.....	31.366	.....
August	68.745	.....	31.637	.....
September	67.792	.....	31.313	.....
October	62.435	.....	28.863	.....
November	58.677	.....	27.154	.....
December	54.565	.....	25.362	.....
Year	65.327	.....	30.188	.....

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

COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1907.	1908.	1907.	1908.	1907.	1908.
January	24.404	13.726	24.825	13 901	106.739	62 386
February	24.869	12.905	25.236	13.098	107.356	58.786
March	25.065	12.704	25.560	12 875	106.594	58.761
April	24.224	12.743	25.260	12.928	98.625	58.331
May	24.048	12.598	25.072	12.788	102.375	57.387
June	21.665	12.675	24.140	12.877	97.272	57.842
July	22.130	.....	21.923	.....	95.016	.....
August	18.356	.....	19.255	.....	79.679	.....
September	15.565	.....	16.047	.....	68.375	.....
October	13.169	.....	13.551	.....	60.717	.....
November	13.391	.....	13.870	.....	61.226	.....
December	13.163	.....	13.393	.....	60 113	.....
Year	20.004	.....	20.661	.....	87.007	.....

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

TIN AT NEW YORK

Month.	1907.	1908.	Month.	1907.	1908.
January	41.548	27.380	July	41.091	.....
February	42.102	28.978	August	37.667	.....
March	41.313	30.577	September	36.689	.....
April	40.938	31.702	October	32.620	.....
May	43.149	30.015	November	30 833	.....
June	42.120	28 024	December	27.925	.....
			Av. year.	38.166	.....

Prices are in cents per pound.

LEAD

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	6.000	3.691	19.828	14.469
February	6.000	3.725	19.531	14.250
March	6.000	3.838	19.703	13.975
April	6.000	3.993	19.975	13.469
May	6.000	4.253	19.688	12.938
June	5.760	4.466	20.188	12.600
July	5.288	.....	20.350	.....
August	5.250	.....	19.063	.....
September	4.813	.....	19.775	.....
October	4.750	.....	18.531	.....
November	4.376	.....	17.281	.....
December	3.658	.....	14.500	.....
Year	5.325	.....	19.034	.....

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

SPELTER

MONTH.	New York.		St. Louis.		London.	
	1907.	1908.	1907.	1908.	1907.	1908.
January	6.732	4.513	6.582	4.363	27.125	20 563
February	6.814	4.788	6.664	4.638	25.938	20.875
March	6.837	4.665	6.687	4.527	26.094	21.075
April	6.685	4.645	6.535	4.495	25.900	21.344
May	6.441	4.608	6.291	4.458	25.563	19.906
June	6.419	4.543	6.269	4.393	25.469	19.000
July	6.072	.....	5.922	.....	23.850	.....
August	5.701	.....	5.551	.....	21.969	.....
September	5.236	.....	5.086	.....	21.050	.....
October	5.430	.....	5.280	.....	21.781	.....
November	4.925	.....	4.775	.....	21.438	.....
December	4.254	.....	4.104	.....	20.075	.....
Year	5.962	.....	5.812	.....	23.771	.....

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

CHEMICALS, MINERALS, RARE EARTHS, ETC.—CURRENT WHOLESALE PRICES.

ABRASIVES—		
Bort, good drill quality, carat		$85.00
Carborundum, f.o.b. Niagara Falls, powd.	lb.	.08
Grains	"	.10@.17
Corundum	"	.07@.10
Crushed Steel, f.o.b. Pittsburg	"	.05¾@.06
Emery, in kegs: Turkish flour	"	.01¾@.02½
Grains	"	.03½@.04½
Naxos flour	"	.01¾@.02½
Grains	"	.03½@.04½
Chester flour		.01½
Grains	"	.03½@.04½
Peekskill, f.o.b. Easton, Pa., flour	"	.01½@.01½
Grains, in kegs	"	.02½@.02½
Garnet, per quality	ton	25.00@35.00
Pumice Stone, Am. Powd.	100 lb.	1.60@2.00
Italian, powdered	"	.01¼@.01½
Lump, per quality	"	.05@.20
Rottenstone, ground	"	.02½@.04½
Lump, per quality	"	.05@.25
Rouge, per quality	"	.05@.30
Steel Emery, f.o.b. Pittsburg	"	.07¼@.07¾
ACIDS—		
Acetic 28%	lb.	.026@.03
Boric	"	.08@.08¼
Hydrofluoric, 30%	"	.02¾@.03
" 48%	"	.06
" 60%	"	.10
Hydrochloric acid, 20°, per lb		1.25@1.50
Nitric acid, 38°	per lb.	4.25@4.62½c.
Sulphuric acid, 50°, bulk, per ton		$12 up.
60°, 100 lb. in carboys		.85@1.12½
60°, bulk, ton		16.00@18.00
66°, 100 lb. in carboys		1.00@1.25
66°, bulk, ton		18 00
Oxalic	"	.07@.07¼
ALCOHOL—Grain 95%	gal.	2.63
Denatured		.39@.45
Refined wood, 95@97%	"	.41@.47
ALUM—Lump	100 lb.	$1.75
Ground	"	1.85
Chrome Alum	lb.	.05¼@.05¾
ALUMINUM—Sulphate, com'l.	"	1.10@1.75
AMMONIA—24 deg.	lb.	.04½@.05½
" 26 " "		.04¾@.05¾
AMMONIUM—		
Bromide	lb.	.23
Carbonate	"	.07⅜@.08
Muriate grain	"	.05¾@.06¼
Lump	"	.09¼@.09½
Sulphate, 100 lb.		3.05@3.10
Sulphocyanide com.	"	.30
" " chem. pure	"	.40
ANTIMONY—needle, lump	lb.	.03⅝@ 04
ARSENIC—White	"	.03⅜@.03⅝
Red	"	.07½@.07¾
ASPHALTUM—		
Barbadoes	per ton	40.00@80.00
West Indies	"	20.00@60.00
Egyptian	lb.	.12@.14
Gilsonite, Utah ordinary	per ton.	33.00
Trinidad	"	28.00@30.00
California	"	21.00@27.00
BARIUM—		
Carb. Lump, 80@90%	lg. ton.	30.00@35.00
Precipitated 96@98%		31.50@35.00
Powdered, 80@90%	lb.	.02@.02½
Chloride com'l	ton.	38.00@40.00
Nitrate, powdered, in casks	lb.	.05½@.06
Blanc Fixe	per lb.	.02¾
BARYTES—		
Am. Ground	sh. ton.	14.00@21.00
Floated	"	22.00
Foreign floated	"	19.50@22.50
BISMUTH—Sub-nitrate	lb.	1.50
BLEACHING POWDER—35%, 100 lb		1.25@1.40
BLUE VITRIOL—(copper sulphate), carload, per 100 lb		4.65
BONE ASH	lb.	.02½@.04
BORAX	"	.04½@.05½
CALCIUM—Acetate, gray, 100 lb.		2.00@2.05
Acetate, brown	"	1.25@1.30
Carbide, ton lots f.o.b. Niagara Falls, N. Y., for Jersey City, N. J.	sh. ton.	65.00
Chloride, f.o.b. N. Y.	"	11.00@14.00
CEMENT—		
Portland, Am. 500 lb.	bbl.	1.55@1.60
Foreign	"	2.25@2.90
"Rosendale," 300 lb.	"	.85
(in sacks)		.65
Slag cement	"	.75@1.25
CHROME ORE—		
New Caledonia 50% ex. ship N. Y.	per lg. ton	17.50@20.00
Bricks, f.o.b. Pittsburg, M.	"	175.00
CLAY, CHINA—Am. common ex-dock, N. Y.	"	8.00@9.00
Foreign	"	10.00@17.50
COBALT—Oxide	lb.	1.45
COPPERAS—Bulk	100 lb.	$0.55
In bbls	"	.65@.75
In bags	"	.60@.70
CRYOLITE	lb.	.06½@.06¾
FELDSPAR—Ground best	sh. ton.	10.50@15.00
FIRE BRICK—		
American	per M.	30.00@40.00
Imported	"	30.00@45.00
St. Louis No. 1	"	18.00
" No. 2	"	15.00
Extra	"	20.00@23.00
FIRE CLAY—F. o. b. St. Louis.		
St. Louis, extra quality	per ton	5.00
" ordinary	"	2.50
FLUORSPAR—		
Domestic f.o.b. shipping port:		
Lump	lg. ton.	8.00@10.00
Ground	"	11.50@13.50
Foreign crude ex. dock		8.00@10.00
FULLER'S EARTH—Lump, 100 lb.		.75@.85
Powdered	"	.75@.85
GRAPHITE—Ceylon		
Flying dust, finest to best	lb.	.01@.04
Dust	"	.01¾@.05
Chip	"	.02¾@.07½
Lump	"	.04@ 10
Large lump	"	.07@.10
GYPSUM—		
Fertilizer	sh. ton.	5.00
Ground	sh. ton.	4.00@7.00
INFUSORIAL EARTH—		
Ground Am. best	lb.	.01¾
French	lg. ton.	56.00
German	lb.	.02½@.02⅝
LEAD—Acetate (sugar of) brown	lb	.07¾
Nitrate, com'l	"	.08¼@.08¾
MAGNESITE—Greece.		
Crude (95%)	lg. ton.	8.00@10.00
Calcined, powdered	sh. ton.	26.00@35.00
Bricks, domes, per qual. f.o.b. Pittsburg	M.	160@200
MAGNESIUM—		
Chloride, com'l	100 lb.	.80@1.00
Sulphate (Epsom salt)	100 lb.	.85@1.00
MANGANESE—		
Foreign, crude, powdered:		
70@75% binoxide	lb.	.01@.01¼
75@85% binoxide	"	.01¼@.01½
85@90% binoxide	"	.01½@.05
90@95% binoxide	"	.06½
Ore, 80%-85%	sh. ton.	18.00@40.00
MARBLE—Flour	sh. ton.	8.50@10.00
MINERAL WOOL—		
Slag, ordinary	"	19.00
Selected	"	25.00
Rock, ordinary	"	32.00
Selected	"	40.00
MONAZITE SAND—		
Guar. 97%, with 5% Thorium oxide, nominal	lb.	.08 and up.
NICKEL—		
Oxide, crude, lb. (77%) for fine metal contained		.47
Sulphate, single	lb.	.09@.11
" double	"	.06½@.08
NITRATE OF SODA—100 lb. 95% for '08		2.30
95% for 1909		2.30
95% for 1910		2.32½
96% is 5c higher per 100 lb.		
OZOKERITE—best	lb.	.14@.17
PAINTS AND COLORS—		
Litharge, Am. powdered	"	.06½@.06¾
English glassmakers'	"	.08½@.08¾
Lithopone	"	.03½@.07
Metallic, brown	sh. ton.	16.50@22.00
Red	"	14.00@18.00
Ocher, Am. common	"	8.50@9.00
Best	"	16.00
Dutch, washed	lb.	.02½@.03
French, washed	"	.01½@.02½
Paris green, pure, bulk	"	.26
Red lead, American	"	.06¼@.06¾
Foreign	"	.08½@.08¾
Turpentine, spirits bbl., per gal.		.42½
White lead, Am., dry	lb.	.05⅞@.06
American, in oil	"	.06¼@.06¾
Foreign, in oil	"	.10½@.10¾
Zinc white, Am. extra dry	"	.05½@.05¾
French, red seal, dry	"	.08½@.08¾
" Green seal, dry	"	.10½@.10¾
PHOSPHATES—Acid	60c per unit	
*Fla., hard rock		9.25@9.75
land pebble 68%		4.00@4.25
†Tenn., 78@80%		6.00@6.50
75%		4.50@5.00
68@72%		4.00@4.25
‡So. Car. land rock		6.75@7.00
" river rock		7.00@7.25
POTASSIUM—		
Bicarbonate crystal	lb.	$.08½@.09
Powdered or granulated	"	.09@.09½
Bichromate, Am.	"	.08⅝@.09
Scotch	"	.10½
Bromide	"	.15@.17
Carbonate (80@85%)	"	.03½@.04
Caustic, ordinary	"	.04½@.05½
Elect. (90%)	"	.05½@.06
Chloride (muriate), 100 lb.		1.90
Chlorate, powdered	"	.09½@.09¾
Crystals	"	09@09½
Cyanide (98@99%)		
Carloads (30,000 lb.)	"	18c.
5-ton lots	"	18½c.
Less than 5 tons	"	19c.
Kainite, long ton, bulk, 8.50; bags, 9.50.		
Permanganate	lb.	.09½@.10
Prussiate, yellow	"	.14@.14½
Red	"	.32@.36
Sulphate	100 lb.	2.18½@2.21½
PYRITE—		
Domestic, non-arsenical, furnace size, f.o.b. mines	per unit	11@11½c.
Domestic, non-arsenical, fines, per unit, f.o.b. mines		10@10½c.
Imported non-arsenical, furnace size, per unit		.12½@.13
Imported, arsenical, furnace size, per unit		.12@.12½
Imported fines, arsenical, per unit.		.08½@.09
" " non-arsenical, per unit		10½@11c.

Pyrite prices are per unit of sulphur. An allowance of 25c. per ton is made when delivered in lump form.

SALT—N. Y. com. fine 280 lb.	bbl.	.72@1.18
N. Y. agricultural	sh. ton.	3.80@4.50
SALTPETER—Crude	100 lb.	4.50@5.00
Refined, crystals	"	5.50@6.00
SILICA—		
Ground quartz, ord'ry	lg. ton	10.00@15.00
Silex	"	13.00@40.00
Lump Quartz	"	5.00@6.00
Glass sand	"	2.75
SILVER—Nitrate, crystals	oz.	.37½@.4
SODIUM—		
Acetate	lb.	.04½@.04¾
"Alkali," per 100 lb., 58/48		.80@.87½
Bicarb. soda, per 100 lb		1.10@1.40c.
Soda, caustic, per 100 lb., 76/60		1.75@1.85
" " powdered		.02¾@.06½
Salt cake, per 100 lb, bulk		.40
" " bbl		.65@.85
Soda, monohydrate, per lb		1.4@1.75c.
Bichromate	lb.	.07½@.07½
Bromide	"	.15@.17
Chlorate, com'l	"	.09@.09½
Cyanide ("100% KCN")		
Carloads (30,000 lb.)	"	18c.
5-ton lots	"	18½c.
Less than 5 tons	"	19c.
Hyposulphite, Am.		1.35 up
German	"	1.60@1.70
Phosphate	100 lb.	2.10@2.30
Prussiate	"	.08½@.09½
Sal soda, f.o.b. N. Y.	100 lb	.65@.70
Foreign, f.o.b. N. Y.	"	.80@1.00
Silicate, com'l	100 lb.	.80@1.15
Sulphate, com'l, (Glauber's salt)	100 lb.	.60@.75
" " calcined		.65@.85
STRONTIUM—Nitrate	lb.	.07¾@ 8½
SULPHUR—		
Louisiana (prime) to New York, Boston or Portland	lg. ton	22.00
To Philadelphia or Baltimore	"	22.00
Roll	100 lb.	1.85@2.15
Flour	" "	2.00@2.40
Flowers, sublimed	" "	2.20@2.60
TERRA ALBA—French & Eng.	100 lb.	.65@1.00
TALC—Domestic	sh. ton.	15.00@25.00
French	"	16.00@25.00
Italian, best	"	35.00@40.00
TIN—Bi-chloride, 50%	lb.	.09½ up
Crystals	"	.19¾ up
Oxide, lb		.33@.35
URANIUM—Oxide	"	3.50
ZINC—		
Chloride solution, com'l 20°	"	.02½
Chloride, granular	"	.04½@.05
Dust	"	.04½@.05½
Sulphate	"	.02@.02½

*F. o. b. Florida or Georgia ports. †F. o. b. Mt. Pleasant. ‡On vessel Ashley River, S. C.

NOTE—These quotations are for ordinary wholesale lots in New York unless otherwise specified, and are generally subject to the usual trade discounts. In the cases of some of the important minerals, such as phosphate rock, pyrites, and sulphur, in which there are well established markets, the quotations fully represent the latter. But in the cases of some of the minor mineral products, the quotations represent what dealers ask of consumers and not what producers can realize in selling their outputs as matters of private contract.

THE MINING INDEX.

The editors of this paper read all the important publications of the world that relate to mining and the treatment of minerals. This index is published as a reference for all interested and to make it impossible for readers of the ENGINEERING AND MINING JOURNAL to miss any important article published anywhere.

We will undertake to furnish a copy of any article (if in print) in the original language, for the price quoted. Where no price is quoted the cost is unknown. These papers are not kept in stock, but must be ordered from the publisher; hence there will be some delay for foreign papers.

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CALCIUM CARBIDE

6840—FURNACE—Ueber die Fortschritte in der Verwendung grosser elektrischer Oefen zur Fabrikation von Kalziumkarbid und Hochprozentigem Ferrosilizium. Walter Conrad. (Stahl u. Eisen, June 10, 1908; 10½ pp.) Describes the latest European improvements in furnaces for calcium carbide manufacture. 40c.

CEMENT

6841—CEMENT MILL—A 12,000 Barrel Cement Mill in California. (Eng. Rec., June 20, 1908; 5 pp.) A description of a cement mill in California which has a capacity of 12,000 bbl. per day. The construction of the plant together with the equipment and working are described. Illustrated. 20c.

6842—ELECTRIC POWER for Cement Plants. J. B. Porter. Eng. and Min. Journ., July 11, 1908; ¾ p.) Discusses the economy obtained from using electric power in the manufacture of cement. 20c.

6843—PORTLAND CEMENT—How Portland Cement is Made. T. B. Rennell. (Min. and Met. Journ., June 12, 1908; 2¾ pp.) A description of the steps involved in the manufacture of Portland cement as practiced in plants of recent construction. Methods in testing products. Illustrated. 20c.

6844—PORTLAND CEMENT PLANT—Maryland's First Portland Cement Plant. (Mfrs. Rec., June 18, 1908; 2 pp.) Describes the first Portland cement plant of importance to be erected in Maryland. Illustrated. 20c.

COAL AND COKE

6845—AERIAL ROPEWAY at Dinnington Main Colliery. (Coll. Guardian, June 12, 1908; 1 p.) Describes a rope haulage for conveying washed slack from the washery at the Dinnington Main Colliery to the storage bunker over the coke ovens. Illustrated. 40c.

6846—CANADA—The Mining Operations of the Dominion Coal Company. F. W. Gray. (Can. Min. Journ., July 1, 1908; 6 pp.) This is the second article and deals with the operation of the mines of the Glace Bay basin. Illustrated. To be continued. 20c.

6847—CHEMISTRY OF COAL. Myles Brown. (Sci. and Art of Min., June 27, 1908; 1½ pp.) The calorific power of coal and some useful notes on calorific units and elements, factors, etc., are given for various grades of coal. 20c.

6848—COAL HANDLING—The Storage and Handling of Coal and Ashes in Power Plants. Werner Boecklin. (Cassier's Mag., July, 1908; 22 pp.) Describes the economic handling and storage of coal and ashes in power plants. Illustrated. 40c.

6849—COAL HANDLING—Three Tramway Bridges on the Coal-Storage Dock of the Berwind-White Coal Mining Company, Superior, Wis. R. W. Wetherill. (Eng. News, June 18, 1908; 2¼ pp.) Describes a new dock at Superior, Wis., which is of the bridge-tramway type; each one of the bridges has a total length of 506 ft. and a span of 295 ft. at the center of the tower. Illustrated. 20c.

6850—COLLIERY DISASTERS. F. A. Hill. (Eng. and Min. Journ., July 4, 1908; 2/3 p.) It is pointed out that the laws are aimed at the operator rather than at the miner. It is suggested that all miners should carry a clearance card showing their ability as miners. 20c.

6851—COST OF HANDLING COAL, How to Compute the. C. L. Moore. (Black Diamond, July 11, 1908; 1 p.) Discusses systematic methods of keeping accounts so as to know accurately how much it costs per ton to handle coal. 20c.

6852—ELECTRICITY FOR COAL MINES—Stations Centrales D'Electricité pour Charbonnages. J. Kersten. (Rev. Univ. des Mines, April, 1908; 35 pp.) An outline of the principles governing the selection of electric appliances for given conditions, and a careful discussion of the economies secured by a centrally located plant.

6853—ELECTRIC POWER—Is the Electric Current Safe in Coal Mines? Rush N. Hosler. (Eng. and Min. Journ., July 4, 1908; 2½ pp.) The death rates in foreign countries has been reduced one-third as a result of investigations. Apparatus to prevent firedamp ignition. 20c.

6854—EXPLOSION — Facts Concerning Cardiff Mine Explosion. George S. Rice. (Eng. and Min. Journ., July 11, 1908; ½ p.) Calls attention to some errors in the communication of H. M. Dodge, concerning the explosion at Cardiff, Ill., several years ago. 20c.

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6861—KENTUCKY—Mining Coal in Big Stone Gap Field, Kentucky. John P. Shippen. (Eng. and Min. Journ., June 27, 1908; 3¾ pp.) Rotary dumps and coke drawing machines are successfully used. The coke-ovens carry a flue which connects with the boilers. Illustrated. 20c.

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COPPER

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6884—ALASKA—Notes on Copper Prospects of Prince William Sound. Fred H. Moffit. (U. S. Geol. Surv. Bull. 345, 1908; 3 pp.) The properties on Prince William sound are all within comparatively easy reach of tide water and their development is not dependent on expensive railroad construction or hindered in the same degree by the severity of the winter as in other districts of Alaska.

6885—ALASKA—The Copper River District, Alaska. Hermanu A. Keller. (Eng. and Min. Journ., June 27, 1908; 5¾ pp.) Describes the deposits of copper sulphide ore lying about 150 miles from the coast of Alaska, which will soon be reached by a railroad. Illustrated. 20c.

6886—ALASKA—The Mineral Resources of the Kotsina and Chitana Valleys, Copper River Region. Fred H. Moffit and A. G. Maddren. (U. S. Geol. Surv. Bull. 345, 1908; 51 pp.) This paper embodies the results of last season's work, and includes the copper deposits of the Kotsina and Chitina regions. Enough of the general geology is introduced to give a clear idea of the relation existing between the copper ores and the rock with which they are associated.

6887—ARIZONA—Changes in Equipment of Copper Queen Mine. G. H. Allen. (Min. Sci., July 9, 1908; 1½ pp.) Description of the new equipment lately installed at the property of the company at Bisbee, Ariz. Illustrated. 20c.

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6892—QUEENSLAND—Cloncurry Copper Mining District. L. C. Bail. (Queens Gov. Min. Journ., May 15, 1908; 7½ pp.) Conclusion of article previously mentioned in this Index, dealing with history, economics, geology, copper ore deposits and iron ore deposits. 60c.

6893—PRODUCTION—The World's Copper Supplies in 1907. John B. C. Kershaw. (Cassier's Mag., July, 1908; 8 pp.) Describes graphically the production of copper in the world and in various countries for a period of ten years. 40c.

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6895—SMELTING—Copper Smelting in Siberia. William A. Heywood. (Min. and Sci. Press, July 11, 1908; ¾ p.) A description of the ore and method of smelting at the Spassky Works in the Akmolinsk district of Siberia. 20c.

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GOLD AND SILVER

6898—ALASKA—Investigations of the Mineral Deposits of Seward Peninsula. Philip S. Smith. (U. S. Geol. Surv. Bull. 345, 1908; 47 pp.) In Seward Peninsula the year 1907 was marked by increased activity in prospecting for both placer and lode deposits, but no rich bonanzas like those found in 1905-6 were discovered.

6899—ALASKA—Occurrence of Gold in the Yukon-Tanana Region. L. M. Prindle. (U. S. Geol. Surv. Bull. 345, 1908; 9 pp.) The placer gold production of the Yukon-Tanana region up to 1907 inclusive, has been approximately one-third of the total gold production of Alaska.

6900—ALASKA—Prospecting and Mining Gold Placers in Alaska. John Power Hutchins. (U. S. Geol. Surv. Bull. 345, 1908; 24 pp.) Discusses the progress in prospecting and mining for gold in Alaska, including handling frozen ground, prospecting in general, the operation of churn drills, the necessity of accuracy in sampling, shaft prospecting, hydraulic mining, open-cut mining, dredging, and drift mining.

6901—ALASKA—The Forty Mile Gold-Placer District. L. M. Prindle. (U. S. Geol. Surv. Bull. 345, 1908; 11 pp.) Discusses the geography, geology, origin of gold, mining developments, and the production of gold in this district of Alaska.

6902 — COLORADO — Treasure Mountain, Colorado. C. W. Purington. (Min. and Sci. Press, July 4, 1908; 3 pp.) Describes the geological conditions existing at this Colorado camp which produces gold accompanied by silver, lead and zinc. Illustrated.

6903—COSTS AND PROFITS in Silver-Lead Ore Production. James Ralph Finlay. (Eng. and Min. Journ., June 27, 1908; 3¾ pp.) Factors governing costs of mining, smelting and marketing. Comparisons of conditions in the Coeur d'Alene, Broken Hill and Park City districts. 20c.

6904—CYANIDE COSTS. A. R. Parsons. (Min. and Sci. Press, July 11, 1908; ½ p.) The data in this article refers to the cost of cyaniding at the plant of the Desert Power and Mill Company, Millers, Nev., for the month of May, 1908. 20c.

6905—CYANIDATION in Nevada. A. G. Kirby. (Min. and Sci. Press, June 20, 1908; 4 pp.) Describes actual mill runs on about 700 tons of the sulphide ores taken from the lower levels of the Combination and Mohawk mines at Goldfield. Contains details of all the steps in the tests. 20c.

6906—CYANIDATION — Veta Colorada Cyanide Mill, Parral, Mexico. Claude T. Rice. (Eng. and Min. Journ., July 18, 1908; 2¾ pp.) This is the first mill to introduce cyanide treatment for the silicious silver ores from the Veta Colorada vein. The process proposed is fine grinding, agitation and filtration. 20c.

6907—DREDGING PLACER GRAVELS at Breckenridge, Colo. Arthur Lakes. (Mines and Minerals, July, 1908; 5½ pp.) A description of the ground at Breckenridge, Colo., and the construction and operation of the dredges. Illustrated. 20c.

6908—MEXICO—El Rayo Gold Mine, Near Santa Barbara, Mexico. Claude T. Rice. (Eng. and Min. Journ., July 11, 1908; 2⅓ pp.) Discusses the method of development, mill treatment, zinc-dust precipitation and the percentage of extraction of the El Rayo gold mines near Santa Barbara, Mex. Illustrated. 20c.

6909—MEXICO—Mining and Transportation at Santa Eulalia. Claude T. Rice. (Eng. and Min. Journ., July 4, 1908; 3 pp.) The conditions are favorable, the mines are dry, the country rock requires little support and labor is good and not expensive in this Mexican mining district. Illustrated.

6910—MEXICO—Ores and Mines of Santa Eulalia, Mexico. Claude T. Rice. (Eng. and Min. Journ., June 27, 1908; 4 pp.) In spite of low metal prices this district is fairly active owing to the demand for its oxidized silver-lead ores. Illustrated. 20c.

6911—NEVADA—Geological Possibilities at Goldfield. Arnold Becker. (Min. and Sci. Press, June 20, 1908; 1 p.) Discusses the possibilities of an extension of the producing area at Goldfield indicated by geological formations. 20c.

6912 — NEVADA — Goldfield, Nevada-V. T. A. Rickard. (Min. and Sci. Press, June 20, 1908; 4 pp.) The fifth article of the series treats of the metallurgical development and describes the mill treatment of the ore. Illustrated. 20c.

6913—NEVADA — Goldfield, Nevada-VI. T. A. Rickard. (Min. and Sci. Press, July 4, 1908; 2½ pp.) Describes transportation facilities by automobile in the Nevada desert and the existence of gambling at Goldfield. Illustrated. 20c.

6914—NEVADA — Goldfield, Nevada-VII. T. A. Rickard. (Min. and Sci. Press, July 11, 1908; 3¾ pp.) Deals with the losses which have been experienced by the various mining companies. The mills of the district are described. Illustrated. 20c.

6915—NEVADA—Seven Troughs Mining District. (Min. and Eng. Rev., June 13, 1908; 2 pp.) Describes the principal mines of this district, and also the geology and general conditions. 20c.

6916—NEVADA—The Great Ore Deposits of Eldorado. Will C. Higgins. (Salt Lake Min. Rev., June 30, 1908; 5¼ pp.) The geology and ore deposits of Eldorado cañon in Lincoln county, Nev., are described, and the details of the workings of several mines in this district are given. Illustrated. 20c.

6917 — NEVADA — The Mendha-Nevada Mining Company. Will C. Higgins. (Salt Lake Min. Rev., June 15, 1908; 2¾ pp.) Describes the operation of the old Mendha mine and adjoining property in the Highland mining district, Lincoln county, Nev. The ores of this mine have been much sought after on account of their lead-fluxing properties. Illustrated. 20c.

6918—ONTARIO—Cobalt, Ontario. H. B. Smith. (Min. and Sci. Press, June 27, 1908; 2¾ pp.) Describes the methods of prospecting, the character of the veins, and the geological formations of the Cobalt district. Illustrated. 20c.

6919—ONTARIO—Ores and Rocks of the Cobalt Region. R. E. Hore. (Can. Min. Journ., July 1, 1908; 2 pp.) Describes the ores and rocks and their occurrence in this district. 20c.

6920—ONTARIO—The Market for Cobalt Ores. Alexander Gray. (Min. Journ., June 6, 1908; 1 p.) Reviews the basis of settlement by the various smelteries that purchase Cobalt ore. Includes also a statement of the production of the principal mines together with the capital of each and the dividends paid to date by each company. 40c.

6921—ORE TREATMENT—Treatment of Gold Ores in New Zealand, South Africa, America, and Queensland. G. E. Bray. (N. Z. Mines Rec., April 16, 1908; 3½ pp.) Describes the latest methods of ore treatment at the Waihi mines in New Zealand and compares the practice with that of the United States and in South Africa. Abstract of paper before the North Queensland Min. and Mill-managers' Assn. 40c.

6922—PRODUCTION—The Market Price and Gold Production. A. Del Mar. (Eng. and Min. Journ., June 27, 1908; 1 p.) The author expresses his views regarding the much discussed question as to the price of commodities and the production of gold. 20c.

6923—REFINING—The Silver Refinery of the New Addition to the Raritan Copper Works. F. D. Easterbrooks. (Electrochem. and Met. Ind., July, 1908; 4 pp.) See under "Copper."

6924—SLIME SETTLEMENT—Theory of the Settlement of Slime. H. S. Nichols. (Min. and Sci. Press, July 11, 1908; 2¼ pp.) This is a critical consideration of the factors affecting the settlement of slime, and is illustrated graphically, showing the settlement of slime under various conditions. 20c.

6925—SLIME TREATMENT—The Butters Vacuum Filter. G. H. Clevenger. (Mines and Minerals, July, 1908; 2½ pp.) Considers the general principles underlying the treatment of slimes, and describes the construction and operation of the Butters filter. 20c.

6926—SOUTH AFRICA — Amalgamations Past and Present. (So. Afr. Min. Journ., May 23, 1908; 1 p.) Discusses recent and important combinations of mining properties on the Rand, and mentions plan for further amalgamations which are under way. 20c.

6927—TELLURIDE ORES—Some Observations of the Assay of Telluride Ores. George Borrowman. (Journ. Am. Chem. Soc., June, 1908; 3¾ pp.) Contains data which seems to warrant the conclusion that tellurium as the cause of irregularities in crucible work has been over-estimated. 80c.

6928—VENTILATION of Rand Mines. J. H. Johns, A. W. Stockett, J. Blane, S. H. Pearce, W. L. Honnold, W. T. Hallimond and J. McArthur Johnson. (South African Min. Journ., May 30, 1908; 1 p.) The Committee who studied the subject of ventilation of the gold mines of Transvaal is of the opinion that the ventilation, as a whole, compares favorably with that of metalliferous mines in any part of the world. 40c.

IRON AND STEEL

6929—ALABAMA—The Brown Iron Ores of Alabama-III. William B. Phillips. (Iron Age, June 25, 1908; 2 pp.) Deals with the ore deposits at Baker Hill in Cherokee county, Alabama. Illustrated. 20c.

6930—ALABAMA—The Brown Iron Ores of Alabama.—IV. William B. Phillips. (Iron Age, July 9, 1908; 1 1/3 pp.) Fourth instalment of the paper on the iron-ore deposits of Alabama and deals with the removal of clay and chert from the ore. 20c.

6931—AUSTRALIA as an Iron-Producing Country. (Report, Chamber of Mines of Victoria, May 28, 1908; 8 pp.). Discusses some of the conditions which have an influence upon the production of iron in Australia. It is stated that pig iron can be produced from ore at a cost of 35s.

6932—AUSTRIA—Etat Actuel de la Siderurgie en Autriche. H. Ponthiere. (Ann. des Mines de Belgique, Tome XIII, 2 livr, 1908; 27 pp.) Outlines the present condition of the iron industry in Australia, and describes the plants of some of the most important companies.

6933—CASTINGS—Hard Spots in Steel Castings, with an Account of Certain Diffusion Phenomena. Arthur P. Scott. (Electrochem. and Met. Ind., July, 1908; 5½ pp.). Describes experiments to determine the reason for the occurrence of hard spots in steel castings, to account for certain diffusion phenomena. Illustrated. To be concluded. 40c.

6934—CHAIN MAKING—How Weldless Chains are made. Alexander G. Strathern. (Trans. Min. Inst. Scot., Vol. XXX, Part 4, 1908; 12 pp.). Discusses the history of weldless and other chains covering a period of about 100 years. The Strathern process involves what is known as "segmental rolling" or "tamping."

6935—CHEMISTRY—The Chemist in the Iron Trade. George Auchy. (Iron Age, July 2, 1908; 2 pp.). Discusses the usefulness of the chemical engineer and the analytical chemist in the iron trade. Contains a criticism of colleges for the methods and scope of the training they have so far been giving along the lines of analytic chemistry. 20c.

6936—CHROMIUM AND TUNGSTEN—Function of Chromium and Tungsten in High-Speed Tool Steel. C. A. Edwards. (Iron and Coal Tr. Rev., May 15, 1908; ¾ p.) A research into the effect of chromium and tungsten in high-speed tool steel, together with a discussion of the effect upon the critical temperatures of steel by the addition of these elements. Paper before the Iron and Steel Institute. 40c.

6937—CHROMIUM-TUNGSTEN—Die Wirkung von Chrom und Wolfram in Schnelldrehstählen. C. A. Edwards. (Metallurgie, June 8, 1908; 1½ pp.). Results of a thermal investigation into rapid tool steels hardened with chromium and tungsten. 40c.

6938—COLORADO FUEL AND IRON COMPANY'S PLANT at Minnequa, Colorado. George J. Bancroft. (Min. Sci., June 18, July 2 and 9, 1908; 9½ pp.). Deals with the growth and equipment of the Minnequa plant of the Colorado Fuel and Iron Company. To be continued. 60c.

6939 — CUPOLA PRACTICE—Kupelofenbetrieb in Amerika. O. Leyde. (Stahl u. Eisen. May 27, 1908, 2½ pp.). Conclusion of article previously mentioned in this Index. 40c.

6940—ELECTRIC FURNACE—Ein neuer elektrischer Ofen zum Schmelzen von Eisen B. Igewsky. (Metallurgie, June 8, 1908; 2 pp.) Describes a new furnace for electric smelting of iron ore, and enumerates its advantages. 40c.

6941—ELECTRIC FURNACES— Electric Iron and Steel Furnaces. (Engineering, June 12, 1908; 2¾ pp.) Conclusion of article on electric iron and steel furnaces, describing the Kjellin, Schneider, Colby and other electric furnaces. 40c.

6942—FATIGUE—Eine neue Ermüdungsprobe für Eisen und Stahl. A. E. Stanton. (Metallurgie, June 8, 1908; 2½ pp.) Describes a new machine for testing the fatigue of iron and steel, and compares results of a number of specimens of known composition. 40c.

6943—FERROALLOYS in the Foundry. W. M. Saunders. (Iron Age, July 2, 1908; and Foundry, July, 1908; 1½ pp.) Discusses the properties of manganese silicon, aluminum, phosphorus, titanium, vanadium, nickel, etc., when alloyed with iron and used in the foundry. Paper read before Am. Foundrymen's Assn., June, 1908. 20c.

6944—FOUNDRIES—Iron, Steel, Malleable and Brass Foundries in the United States and Canada. (Foundry, July, 1908; 3 pp.) It is shown that there are 5,812 iron, steel, brass and malleable foundries in the United States. The leading centers are pointed out and the list of the principal cities containing foundries is given. 20c.

6945—FOUNDRY COSTS—Uniform Foundry Costs. (Iron Age, June 25, 1908; 3 pp.) Discusses a chart which shows the main divisions in a scheme of foundry cost distribution. The paper also takes up various phases of the jobbing foundry, and the large and small foundry selling mostly to the trade and to its own machine shop. 20c.

6946—FOUNDRY PRACTICE—Chemistry: Its Value in Modern Foundry Practice. Milton L. Hersey and Ira B. Lesh. (Journ. Soc. Chem. Ind., June 15, 1908; 3 pp.) Describes the properties of cast iron and points out the advantages to be obtained by employing a chemist in mixing iron for castings. 80c.

6947—GALVANIZED IRON—Testing Galvanized Iron. Sherard Cowper-Coles. (Eng. and Min. Journ., July 4, 1908; ½ p.) From the results of experiment the copper sulphate test has been found to be quite unsuitable for testing electro-zinced, Sherardized or Cowperized surfaces. 20c.

6948—GAS POWER—The Gas Engine for Iron and Steel Work. H. J. Gibbons. (Gas Engine, July, 1908; 2 pp.) The great fuel economy of gas engines as compared with steam engines has made gas producer plants popular in iron and the steel works. 20c.

6949—GERMAN IRON AND STEEL INDUSTRY. T. Good. (Cassier's Mag., July, 1908; 6 pp.) A discussion of the developments of the pig-iron and steel industry in Germany considered from the standpoint of the British manufacturer. 40c.

6950—GERMAN POTASH—Deutschlands Kalibergbau. (Der Bergbau, June 11, 1908; 3 pp.) Reviews the present state of the potash salt industry of Germany. 20c.

6951—HYDRO-ELECTRIC PLANT of Penn. Iron Mining Company, at Vulcan, Michigan. Thomas W. Orbison and Frank H. Armstrong. (Proc. Lake Superior Min. Inst., June, 1908; 29 pp.) The Penn Iron Mining Company has installed an electric plant at Vulcan, Mich. This installation is fully described and illustrated.

6952—IRON WORKS—La Belle Iron Works Improvements. (Iron Age, July 2, 1908; 5 pp.) Describes the blast furnace, open-hearth and power plants of this Ohio concern as well as its coal and iron mines in Minnesota. A new 72-in. plate, jobbing and sheet mill has been added to the works. 20c.

6953—IRON-WORKS LABORATORIES—Zur Organisation moderner Eisenhütten-laboratorien. A. Wencelius. (Stahl u. Eisen, May 27, 1908; 4½ pp.) Conclusion of article previously mentioned in this Index. 40c.

6954—MAGNETIC PROPERTIES—A Laboratory Experiment to Illustrate the Changes in Magnetic Properties Occurring at the Thermal Critical Points in Steel. H. M. Boylston. (Electrochem. and Met. Ind., July, 1908; 1½ pp.) Describes apparatus to determine the critical points in steel and points out that the method might be used commercially for determining the critical points in an unknown high-carbon steel. It is also suggested that the apparatus described might be used as an automatic quenching device for small steel articles without the aid of a thermal couple. Illustrated. 40c.

6955—MANUFACTURING METHODS—Ironmaking North and South Contrasted. (Mfrs. Rec., June 18, 1908; ¾ p.). Discusses the economic features in the production of iron in the South and in the North. The South at present has the advantage in the matter of lower cost in the making of foundry iron. 20c.

6956—NICKEL AND CHROMIUM—Determination of Nickel and Chromium in Steel. E. D. Campbell and Walter Arthur. (Journ. Am. Chem. Soc., July, 1908; 4½ pp.) Discusses various methods for determining nickel and chromium in steel and describes the authors' method which they claim to give satisfactory results. 80c.

6957—PIG IRON—Kohle und Eisen in Nordamerika. Prof. Baum. (Glückauf, June 13, 1908; 8 pp.) Continuation of article previously indexed; this section deals with the cost of manufacturing pig-iron. 40c.

6958—ORE TRANSPORTATION — Kohle und Eisen in Nordamerika. Baum. (Glückauf, May 30, 1908; 8¼ pp.) Continuation of article previously indexed; this section discusses the transportation of iron ore from the Lake Superior ranges to the consuming centers, and the cost thereof. 40c.

6959—PHOSPHORUS IN IRON—Eisen und phosphor, die Konstitution ihrer Verbindungen. B. Saklatwalla. (Metallurgie, June 8, 1908; 5 pp.) A study into the nature of the phosphorus found in iron. 40c.

6960—PHOSPHORUS IN IRON—Iron and Phosphorus, Constitution of Their Compounds. B. Saklatwalla. (Iron and Coal Tr. Rev., May 15, 1908; 1¾ pp.) Discusses the compounds of phosphorus and iron, and discusses the effects of phosphorus upon the physical and chemical properties of iron. 40c.

6961—PRODUCTION—Iron and Steel Production of the World. (Eng. and Min. Journ., July 4, 1908; ½ p.) In order to produce the pig iron of the world nearly 250,000,000 tons of ore, flux and fuel are required. The fuel production of the world showed a larger proportion of gain than did that of pig iron. 20c

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6970—STORAGE WAREHOUSE—The Ryerson Iron and Steel Warehouses. (Iron Age, July 9, 1908; 4⅓ pp.) A description of the construction and equipment of a warehouse for the storage of large quantities of iron and steel merchandise. Illustrated. 20c.

6971—SULPHUR—Eisen, Kohlenstoff und Schwefel. D. M. Levy. (Metallurgie, June 8, 1908; 2 pp.) Reviews various opinions and gives results of experiments on the in-

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6980—TESTING—Data and Discussion of Methods of Testing California Oil. J. C. Christensen. (Cal. Derrick, June, 1908; 5 pp.) It is pointed out that the fact that an oil is distilled between certain temperatures is no guarantee that it will be of any value whatsoever as an illuminant or a lubricant. The physical and chemical properties of California oils are discussed and the methods for testing refined oils are given. 20c.

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6985—TITANIUM — The Estimation of Titanium. G. B. Waterhouse. (Chem. Engr., April, 1908; 2½ pp.) Titanic acid may be separated from the large mass of iron in an iron ore by strongly heating the sample in a stream of hydrogen until the iron is reduced, then dissolving the iron with dilute acids and separating the silica by hydrochloric acid; the titanic acid is then brought into soluble condition by fusing with acid potassium sulphate. 40c.

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6986—QUARRYING—The Penrhyn Quarry. Henry Briggs. (Mines and Minerals, July, 1908; 3¼ pp.) The method of working and the arrangement of labor in the largest quarry in the world. The Penrhyn slate quarry is situated near Bethesda, North Wales. Illustrated. 20c.

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6987—ALASKA—The Building Stones and Materials of Southeastern Alaska. Charles W. Wright. (U. S. Geol. Surv. Bull. 345, 1908; 11 pp.) The only stones of value in southeastern Alaska, so far as known, are the marble and granite. These stones together with gypsum and cement rock are discussed.

SULPHUR

6988—SICILIAN SULPHUR INDUSTRY. (Min. Journ., June 27, 1908; ¾ p.) Discusses the Sicilian credit bank. American competition; the export trade in sulphur and the sulphur trade with British colonies. 40c.

TIN

6989—ALASKA—The Seward Peninsula Tin Deposits. Adolph Knopf. (U. S. Geol. Surv. Bull. 345, 1908; 17 pp.) This paper summarizes the results of the geologic investigations which have been carried on in Seward Peninsula since the close of 1906. The known Alaskan tin deposits that are of a character sufficiently encouraging to warrant prospecting, are limited to the extreme western part of Seward Peninsula, and are embraced in an area of about 400 sq. miles.

6990—FRANCE—The Mines of Montebras. (Min. Journ., July 4, 1908; 1 p.) A description of the developments, dressing plants, the mineral reserves, the alluvial deposits, geology and other features of this mining district in France. Illustrated. 40c.

6991—ORE DRESSING—The Final Stages of Tin and Wolfram Dressing. S. L. Terrell. (Min. Journ., June 13, 1908; 1 p.) Deals with the final treatment of tin and tungsten after concentration, and takes up calcining and acid treatments. 40c.

6992—ORE DRESSING—Tin-Dressing at Stannary Hills, North Queensland. W. Lauder Cleveland. (Proc. Aust. Inst. Min. Eng., April, 1908; 12 pp.) The methods employed in dressing tin ore up to the required percentage of purity depends principally upon whether the ore is free milling or is a complex milling ore. Contains a description of the mill and some of the principal machinery. Illustrated with working drawings.

6993—REFINING—Die Elektrische Raffination des Zinn. O. Steiner. (Elektrochemische Zeit., June, 1908; 2½ pp.) Conclusion of article previously mentioned in this Index. 40c.

6994—SOUTH AFRICA — Potgletersrust Tin Fields. (So. Afr. Min. Journ., May 23, 1908; 1½ pp.) Output to date, geology of the district, Dr. Merensky's opinions, failure of government scheme and success of private producers. 40c.

TUNGSTEN

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6996—ORE DRESSING—The Final Stages of Tin and Wolfram Dressing. S. L. Terrall. (Min. Journ., June 13, 1908; 1 p.) See under "Tin."

ZINC

6997—BRANGLE ORE. H. A. Wheeler. (Eng. and Min. Journ., June 27, 1908; ⅓ p.) The term "brangle" is used in Wisconsin to designate the upper, highly leached portion of the Galena limestone. 20c.

6998 — METALLURGICAL CALCULATIONS. J. W. Richards. (Electrochem. and Met. Ind., July, 1908; 2¼ pp.) These problems deal with the condensation of zinc and mercury vapors, and are of interest not only to students, but also to metallurgists. 40c.

6999—MILL CONSTRUCTION in the Joplin District. Otto Ruhl. (Eng. and Min. Journ., July 18, 1908; 3⅓ pp.) The increased capacity has introduced changes in practice and the probable removal of the building to a new site is provided for in the plans. Illustrated. 20c.

ECONOMIC GEOLOGY—GENERAL

7000—ALASKA—The Distribution of Mineral Resources in Alaska. Alfred H. Brooks. (U. S. Geol. Surv. Bull. 345, 1908; 12 pp.) Gives a review of the principal minerals found in Alaska.

7001—ALASKA—The Mineral Deposits of the Lost River and Brooks Mountain Region, Seward Peninsula. Adolph Knopf. (U. S. Geol. Surv. Bull. 345, 1908; 4 pp.) The Lost river region displays a various mineralization, and prospecting has disclosed, in addition to the tin deposits, silver-lead, tungsten-lead, copper and perhaps gold deposits.

7002—ALPS—Notizen über einige Mineralvorkommen der Ostalpen. F. Cornu and K. A. Redlich. (Centraiblatt f. Mineralogie, May 1, 1908; 7 pp.) Describes the occurrence of various interesting and economic minerals in the eastern Alps. 40c.

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7006—ORE DEPOSITION—Evolution of Knowledge of Veins and Ore Deposits. Arthur Lakes. (Min. Sci., July 2, 1908; 2 pp.) A brief review of the various character of veins and ore bodies from which the knowledge of occurrence has been advanced. Illustrated. 20c.

7007—ORE DEPOSITION—Waters, Meteoric and Magmatic. T. A. Rickard. (Min. and Sci. Press, June 27, 1908; 3½ pp.) In discussing the article by J. F. Kemp in a previous issue, the author gives some additional information concerning meteoric water and their relation to ore deposits. 20c.

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7009—SOUTH AFRICA—Uebersicht über die nutzbaren Lagerstätten Südafrikas. F. W. Voit. (Zeit. f. prak. Geol., May, 1908; 27 pp.) A careful geological study of the deposits of all the useful and valuable minerals of South Africa, including gold, diamonds, copper, tin, and iron ores, magnesite, asbestos, etc. 40c.

7010—SOUTH AUSTRALIA—Report of Geological Reconnaissance from Van Dieman Guif to the McArthur River, etc. (Adelaide, 1908: C. E. Bristow, Government Printer; 15 pp.) A detailed description of the expedition, containing a study of the geology of this Australian district.

7011—TUNIS—L'industria Mineraria in Tunisia. (Rassegna Mineraria, June 11, 1908; 3 pp.) Reviews the progress of the mining industry in Tunis, with special reference to zinc and lead ores, and phosphate rock. 40c.

MINING—GENERAL

7012—ACCOUNTING—Monthly Companies' Audits. (Report Chamber of Mines of Victoria, May 28, 1908; 2⅓ pp.) Points out the relationship existing between auditor and manager and shows how these two departments may work together for the benefit of the mining company.

7013—ALASKA—Lode Mining in Southeastern Alaska, 1907. Charles W. Wright. (U. S. Geol. Surv. Bull. 345, 1908; 21 pp.) Discusses the geology and ore-deposits of southeastern Alaska, including the mines on Douglas Island, and the copper, silver, lead and zinc prospects of this portion of Alaska.

7014—ALASKA—The Mining Industry in 1907. Alfred H. Brooks. (U. S. Geol. Surv. Bull. 345, 1908; 24 pp.) Discusses the progress of the mineral industry in Alaska during 1907 and gives data of the mineral production during 1906 and 1907.

7015—ALASKA—Water Supply of the Fairbanks District, 1907. C. C. Covert. (U. S. Geol. Surv. Bull. 345, 1908; 8 pp.) These investigations were for the purpose of determining both total flow and the distribution of flow during the open season, and of collecting data regarding the general conditions affecting the water supply and its development.

7016—ALASKA—Water Supply of the Nome and Kougarok Regions, Seward Peninsula, 1906-7. Fred F. Henshaw. (U. S. Geol. Surv. Bull. 345, 1908; 14 pp.) Describes the systematic measurements of the flow of streams in Seward Peninsula to determine the total flow and the distribution of flow of various streams during the mining season; collecting facts in regard to general conditions affecting the water supply; and gathering statistics with regard to the diversion and use of water.

7017—AUSTRALIA—Mining in Australasia in 1908. F. S. Mance. (Eng. and Min. Journ., July 18, 1908; 2 pp.) Conditions of the mining industry in the southern Continent in the current year. Gold, silver, lead, copper, tin, and zinc, are produced. 20c.

7018—BRITISH COLUMBIA—Annual Report of British Columbia Mines. (B. C. Min. Exchange, June, 1908; 3 pp.) Contains the statistics of the ore production of British Columbia which amounted to nearly a million dollars more than the production of 1906. Contains a review of coal mining in British Columbia during 1907. From Report of the Minister of Mines. 20c.

7019—BRITISH COLUMBIA — Mineral Production of British Columbia. Ernest Jacobs. (Eng. and Min. Journ., June 27, 1908; 2½ pp.) Official returns from the leading mineral province of Canada. Decreased production of gold, silver, and lead, but gains in coal and coke are shown. 20c.

7020—BURMA, CHILE AND BOLIVIA—Recent Mining Wanderings in Burma, Chile, and Bolivia. J. H. Curie. (Min. and Sci. Press, June 27, 1908; 4 pp.) An account of the travels of the author through Burma, Chile, and Bolivia, and his description of the mining industry in these countries, together with some interesting accounts of the conditions existing at various mining camps. 20c.

7021—CHINA—Mineral Production of China in 1907. Thomas T. Read. (Eng. and Min. Journ., June 27, 1908; 2¾ pp.) The empire has abundant resources but the mineral industry is slow in developing and little information is available. Deals with the production of coal, iron-ore, gold, tin, copper, other minerals and foreign capital in China. 20c.

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7023—COMPRESSED AIR—The Dense-Air System. George S. Binckley. (Am. Min. Rev., June 20, 1908; 2½ pp.) The basis of this system is the maintenance of a high "artificial atmosphere" in the closed system within which the air circulates as the medium for the transmission of energy from the prime mover to the machine to be driven. Illustrated. 20c.

7024—CONVEYING OF MATERIAL—The Elements of Chemical Engineering. (Chem. Engr., June, 1908; 8¼ pp.) This is the third article of the series and deals with the conveyance of solids. The subjects treated are screw conveyers, belts and chain elevators, and bucket elevators. Illustrated. 40c.

7025—COSTS—Variations in Mining Costs. T. A. Rickard. (Min. and Sci. Press, July 4, 1908; 2¼ pp.) The author adds some valuable information relative to the cost of mining at the Bunker Hill and Sullivan mine. 20c.

7026—DAM CONSTRUCTION—Hydraulic Filling of Dam. Donald F. Campbell. (Min. and Sci. Press, July 4, 1908; ¼ p.) Gives data of the building of a dam for a small reservoir accomplished by the use of a small giant fed by a 4-inch centrifugal pump. Illustrated. 20c.

7027 — ELECTRIC EQUIPMENT — Zur Frage der Wirtschaftlichkeit elektrischer Förderanglagen aur Kaligruben. W. Philippi. (Glückauf, May 30, 1908; 3½ pp.) Discusses the economy of electric hoisting at the potash mines. 40c.

7028—EXCAVATION—Nine Examples of the Cost of Wheel Scraper Work, with Comments on Handling Scraper Gangs. (Eng. Con., July 8, 1908; 1¾ pp.) Discusses in detail the cost for each kind of work in handling scrapers and excavating dirt by means of them. 20c.

7029—EXPLOSIVE—A Magazine and Thaw House for Dynamite. G. F. Samuel. (Eng. News, June 25, 1908; ½ p.) Describes and illustrates the construction of a thaw house built and tested by the Aetna Powder Co. 20c.

7030—FIRE EXTINGUISHING—Die vereinigte Busfeuerwehr und Freiwillige Rettungstruppe der Zeche Rheinpreussen bei Homberg a. Rhein. O. Dobbelstein. (Glückauf, June 6, 1908; 6 pp.) Describes the equipment for fighting mine fires and saving life at this mine. 40c.

7031—GEORGIA—Mining and Metallurgical Industry of Georgia. Henry A. Mather. (Min. Wld., June 20, 1908; 1¾ pp.) A description of the geology of the Dahlonega district, together with a discussion of the gold, china, clay, talc, and rare-ore deposits of Georgia. This State has produced, since 1825, ten million dollars in gold. 20c.

7032—GREAT BRITAIN — Twenty-five Years of Mining. Edward Ashmead. (Min. Journ., July 4, 1908; 2¼ pp.) A review, covering the years 1880-1904, of mining companies registered in Great Britain, with notes and comments and the names and capitalization of the principal mines. (To be continued.) 40c.

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7034—HOISTING ROPES—Wie Sollen Seil- und Kettentriebe mit Rücksicht auf die Haltbarkeit des Zugorgans konstruiert sein? Ernst Heckel. (Stahl u. Eisen, June 10, 1908; 8¼ pp.) A valuable exposition of the manner in which wear occurs in hoisting ropes and chains, with suggestions for reducing the deterioration of such ropes. 40c.

7035—IDAHO—Mining in the Coeur d'Alene District. J. P. Rowe. (Mines and Minerals, July, 1908; 2 pp.) A description of the country, the history, the geology, the principal mines and long tunnels of this Idaho mining district. Illustrated. 20c.

7036—LAKE SUPERIOR MINING INSTITUTE. (Eng. and Min. Journ., July 11, 1908; 1 p.) Describes the meeting of the Lake Superior Mining Institute held recently on the Mesabi range and gives an account of the excursion taken in this Lake Superior mining district. 20c.

7037—MEXICO—The Mines of Northwestern Aitar, Sonora, Mexico. George W. Maynard. (Eng. and Min. Journ., July 11, 1908; 1¾ pp.) Description of La Abundancia mine, the Leones group on the west side of the mountain, the Ruizena group, and the general prospects of the mines of northwestern Altar, Sonora, Mex. 20c.

7038—MINE METHODS and Timbering. W. H. Storms. (Am. Min. Rev., June 20, 1908; ¾ pp.) Cutting and timbering stations at shafts; advisability of pockets beneath the level; skips vs. cages. (To be continued.)

7039—MINE METHODS and Timbering. W. H. Storms. (Am. Min. Rev., July 4, 1908; 1½ pp.) Deals with the draining of mines by hailing, fenders for the protection of the shaft timbers when blasting, and the cable mat. Illustrated. 20c.

7040—MINE SURVEYING. Chas. W. Helmick. (The Transit, Published by Eng. Soc. State Univ. of Iowa, 1908; 11 pp.) Contains some notes upon the salient features that present themselves in the general routine surveying in mining work.

7041—MINING ENGINEERING—The Human Side of a Mining Engineer's Work. Edmund B. Kirby. (Eng. and Min. Journ., July 18, 1908; 1½ pp.) Discusses the everyday life of a mining engineer and gives valuable advice to young men in the profession. 20c.

7042—MINING LAW—Discovery before Location. R. W. Raymond. (Can. Min. Journ., June 15, 1908; 1 p.) Since the possession of mineral land is contingent upon a certain amount of annual work it is claimed that it is not necessary to make discovery before locating. 20c.

7043—MINING LAW—Short Talks on Mining Law—III. A. H. Ricketts. (Eng. and Min. Journ., July 11, 1908; 1¾ pp. The third of a series of papers on mining law discussing the meaning of certain terms, the right of location, and the expenditures or assessment work upon claims which have been taken. 20c.

7044—MINING LAW—Short Talks on Mining Law—IV. A. H. Ricketts. (Eng. and Min. Journ., July 18, 1908; 2 pp.) This is the fourth of the series of mining-law articles and deals with the actual discovery of mineral, marking the locations, the identification of the claim, and the right of possession. 20c.

7045—NEW MEXICO—Development of San Pedro Mountain, N. M. Robert B. Brinsmade. (Min. Wld., June 27, 1908; 3¾ pp.) Mines worked by the early Spaniards are now controlled by Eastern capital. Geology of the ore deposits, dredging and other methods of recovering the precious metals. Copper mines of the district. Illustrated. 20c.

7046—NORTH CAROLINA—The Mining Industry in North Carolina During 1906. Joseph Hyde Pratt. (N. C. Geol. and Econ. Survey, Economic Paper No. 14, 1907; 142 pp.) This report deals especially with a description of the producing gold mines, and a general discussion of the occurrence of mica in North Carolina. In addition the economic minerals and metals of the State are discussed and figures of production are given for 1906 and previous years.

7047—PERU as a Field of Interest to Mining Men and Investors. L. Lema. (Min. Sci., June 18, 1908; 2¼ pp.) Continuation of article previously indexed, giving a short account of the topography, climate, mineral resources and other interesting facts. Illustrated. 20c.

7048—RESCUE WORK—How Rescue Work can be Carried on Effectively. W. E. Mingramm. (Min. Wld., June 27, 1908; 1⅓ pp.) Rescue stations and their equipment for mines. Selecting and training men for rescue work. Use of oxygen for resuscitating asphyxiated persons. 20c.

7049—RESCUE WORK—Truppe und Gerätewagen der Bergwerksgeseilschaft Hibernia für dem Rettungsdienst. F. Hagemann. (Glückauf, June 6, 1908; 5 pp.) Describes an emergency wagon for carrying the apparatus needed for extinguishing fires and rescuing laborers at this mine. 40c.

7050—RESCUE WORK—Die Zentraistelle für Grubenrettungswesen in Beuthen O. S. mit besonderer Berücksichtigung der Entwicklung des Grubenrettungwesens im oberschiesischen Industriebezirk. Mandel. (Glückauf, June 6, 1908; 10 pp.) Describes in detail the building and the equipment used at this mine for doing rescue work and for training the corps of life savers. 40c.

7051—ROCK EXCAVATION by Mechanical Power Instead of Explosives. (Eng. News, June 25, 1908; 1 p.) Describes the excavation of rock submerged under water. It is comparatively easy to excavate in this manner, but the cost is high. 20c.

7052—STOPING—Notes on Hand Stoping and Underground Management on the Rand. J. A. Wickes. (Min. Journ., June 20, 1908; ¾ p.) This is an article on hand stoping written especially for surveyors, samplers or shift bosses, and takes up the subject of timbering and underground organization. 40c.

7053—TUNNEL DRIVING at Low Cost. Walter H. Bunce. (Min. and Sci. Press, July 11, 1908; 1 p.) Although the driving of the Chipetaadit tunnel at Ouray, Colo., was not especially notable, the driving was rapid and the costs were low. 20c.

7054—TUNNEL LINING—Examples of Labor Saving Machinery and Methods for Placing Concrete Tunnel Lining. (Eng.-Con., July 1, 1908; 3⅓ pp.) Detailed working drawings are used to illustrate the methods for placing concrete tunnel lining, and for handling material economically. 20c.

7055—TUNNELING—Cost of Excavating and Lining a Small Tunnel, with Shafts, Under a River. Clarence Mayer. (Eng. Con., July 8, 1908; ¾ p.) Contains data valuable to the engineer who is called upon to construct a small tunnel. The costs of each class of work are given in detail. Illustrated. 20c.

7056—TUNNELING—The Cost of Driving an Earth Tunnel for a Railroad. (Eng.-Con., July 1, 1908; 2⅓ pp.) Contains data for

driving an earth tunnel including the pay of all labor, cost of explosives, tunnel excavation, timber lining and other items of construction. 20c.

7057—WEST AUSTRALIAN MINING PRACTICE—VII. E. Davenport Cleland. (Monthly Journ. Chamber of Mines of W. A., April 30, 1908; 21½ pp.) In the seventh instalment of this article the underground transportation of ore is discussed which includes tracks, cars, cages, skips and safety appliances. Illustrated by photographs and working drawings.

7058—WIRE ROPE—The Stress in Wire Ropes Due to Bending. R. W. Chapman. (Proc. Aust. Inst. Min. Eng., April, 1908; 21 pp.) Gives formulas for the determination of bending stress in wire rope, and also changes in the curvature of the wires of a rope when bent around a pulley. Contains useful tables and data on the subject of stress in wire rope. Illustrated.

ORE DRESSING—GENERAL

7059—ORE SAMPLING by Machines. John A. Church. (Eng. and Min. Journ., July 18, 1908; 2¾ pp.) Conditions necessary to accurate sampling. The disturbing effects of uncontrolled gravitation. The control of feed would be a valuable noveity.

7060—SARDINIA—Les Laveries Sardes. M. Minette d'Oulhaye. (Rev. Univ. des Mines, April, 1908; 27 pp.) Describes and discusses the eight leading concentrating works on this island, giving general conclusions.

METALLURGY—GENERAL

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