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The Caving System on the Menominee Range

North of England Method Has Been Radically Modified. Block-caving, Sub-level and Back-stoping Methods. A New Power Plant

BY REGINALD MEEKS

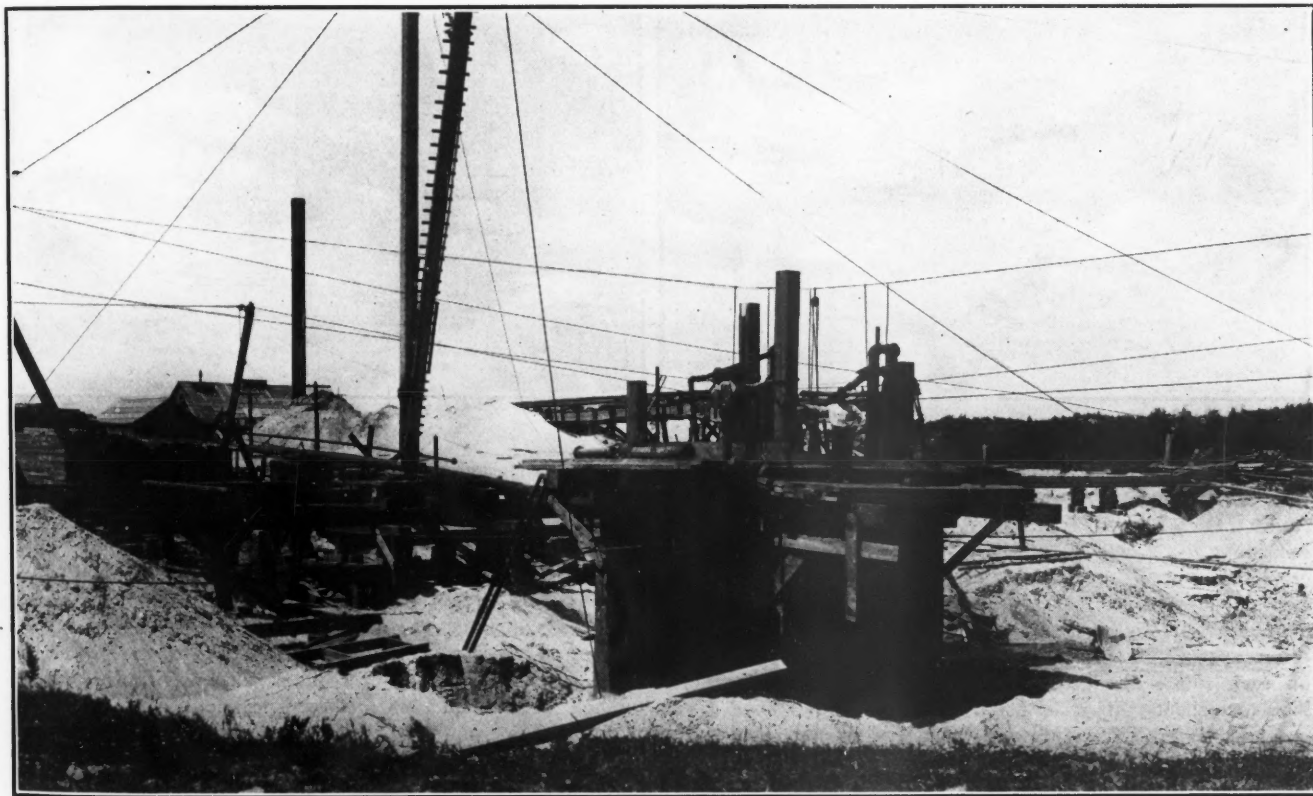
The Menominee iron range extends from about Vulcan, Mich., westward to a point a few miles beyond Iron River. The western end of the range has been neglected heretofore, because of the high phosphorus content of the ore; but now that high prices prevail for iron ore, mining in this portion of the range has assumed considerable activity. At Iron River, Crystal Falls, Stambaugh and Florence nearly all the companies are working or developing mines, and at Green Valley,

and are generally more narrow than those of the Marquette range. Many of the companies have had to contend with severe water trouble and the beds of treacherous quicksand, overlying a number of mines, have made it difficult to sink shafts. Moreover, the walls do not dip as uniformly and a shaft sunk well into the footwall may, at depth, penetrate the ore on account of the divergence in the direction of the walls. The Gogebic range on the other hand, has many dikes, some

phosphorus and is suitable only for foundry pig-iron.

The mines on the eastern end of the range have both bessemer and non-bessemer ores, and in some cases the two grades are found not only in one mine, but sometimes in the same stope. Such conditions necessitate careful sampling and mixing and frequently the methods of mining must be either changed or modified to suit each case.

All these varying conditions of geology



SINKING A DROP-SHAFT THROUGH QUICKSAND

just east of Stambaugh, Pickands Mather & Co., Youngs, the Buffalo & Susquehanna (Rogers, Brown & Co.), the Commonwealth and other companies are proving the ground by diamond drills and test-pits. The Green Valley mines so far are nothing more than prospects.

To the mining engineer the Menominee range presents more interesting and difficult problems than any of the other ranges. The orebodies have not the regularity nor continuity of the Gogebic,

of which intersect. Aside from this the Gogebic is remarkable for its continuity.

CHARACTER OF THE OREBODIES

On account of the varying character of the orebodies no uniform method of mining can be laid down for the Menominee range and a number of different systems have been adopted to suit conditions. In the eastern half of the range bessemer ore is found in large quantities, but to the west of Iron mountain the ore is high in

and mining, together with an inflow of water of from 500 to 3000 gal. per min., and the beds of quicksand 40 to 125 ft. thick, present problems which are overcome only by the closest study and the application of skilful engineering.

BLOCK-CAVING METHOD FOR LOW-GRADE BESSEMER ORE

At one of the mines at Iron mountain there is a large body of bessemer ore so interstratified with thin seams of Jasper

that the iron content is reduced to about 45 per cent. The extremely low phosphorus (0.004 per cent.) enhances the value, but the grade of the ore will not permit of any but the cheapest methods and timber must be entirely eliminated in actual mining. As the ore is so low in phosphorus it may readily be mixed with high-grade high-phosphorus ore and still keep the mixture within the bessemer limit.

The caving system as practised in northern Michigan, Wisconsin and Minnesota has many modifications. The similarity between the systems is great, in some cases, whereas at other times the difference is more marked. To say that a mine is using the "caving system" conveys only the idea that the ground above the deposit caves when the ore has been removed but does not make clear which of the several methods is being employed. In opening and mining a large orebody of low-grade ore such as is mentioned above, shafts are sunk at each end of the orebody, in the footwall, and the main footwall-drift is carried the whole length of

cept that they are now 50 ft. apart instead of 30 ft. as before. The miners shovel the ore into cars which are pushed back to the main drift and hauled to the shaft by electric locomotives. The ore is worked back from the hanging to the foot wall and as it is removed the roof descends; when sandstone or other roof rock appears, work is stopped and a new vertical slice is removed. In this way all of the ore, except the small quantity mixed with the sandstone, is extracted. While the ore is being mined from one level the main crosscuts, the crosscuts and the footwall drift are being driven on the level below and these are completed before all the ore on the upper level has been taken out.

BLOCK-CAVING WITH AND WITHOUT CHUTES

Another method of block-caving does away with shoveling the ore after it has caved, but necessitates cutting a large number of raises, or chutes, through which the ore runs into cars. This method requires timber in the crosscuts and later the pillars must be removed. It is prob-

PRELIMINARY DEVELOPMENT

The shaft is sunk near one end of the orebody and a crosscut run to the hangingwall. A hangingwall drift then extends the whole length of the ore. In that portion of the mine where the block-caving system is to be used crosscuts are run to the footwall at a distance of 24 ft. between centers. Along these crosscuts 15-ft. raises are put up every 14 ft., and as they are staggered, there will be a raise every 7 ft. along each crosscut. At a height of 15 ft. the raises are connected both parallel with and at right angles to the walls. This divides the block, which may be 200 to 250 ft. square, into many small pillars about 14x24 ft., each of which has a raise at the corners. These raises are made funnel shaped at the top and act as chutes, down which the ore readily mills. The pillars are then blasted down, working from the foot to the hanging-wall, and the block of ore above, lacking all support, crushes into small fragments, which fill the chutes and may be drawn out into the cars below. Large lumps of ore sometimes clog the chutes, but a stick



POWER PLANT OF THE PENN IRON MINING COMPANY



DAM ACROSS STURGEON RIVER

the ore. Two main crosscuts extend from foot to hanging wall, 250 ft. apart. Between these a crosscut is run every 30 ft., extending also from wall to wall. Other crosscuts are run, at right angles to the first set, also 30 ft. apart. This divides the orebody into pillars, 30 ft. square, covering a rectangle approximately 250 ft. on each side. The crosscuts are 8 ft. high and about 7 ft. wide. When these openings have all been made, a slope is cut up to the level above (100 ft. high) at both the foot and hanging walls. This frees the ore from the walls and the pillars give the only support. The pillars along the hanging side are then undercut for 8 ft., and the ore 100 ft. in height, 250 ft. long and 8 ft. thick, being unsupported, caves down and breaks up, of its own accord, into fine pieces. Another 8 ft. is then undercut and this is continued until the whole block has caved and has been broken into small pieces and fine dirt. This gives a great mass of broken ore about 250 ft. square and 100 ft. high. To extract this, new crosscuts are driven through the broken ground as before, ex-

cept that the rehandling of all the caved ore is more costly than cutting raises and timbering chutes and crosscuts, but no comparative data are available. In both methods of block-caving the ore is sufficiently soft to permit caving, and yet is unlike some of the soft ore of other ranges. In character it lies midway between the hard and soft ores of the Marquette range. The method of mining, whether by the block-caving or the sub-level system, is determined by local conditions. Cheapness, width of orebody, character of ore, strength of roof, etc., enter into the choice of methods.

The method of block-caving, using chutes to draw down the ore, is in successful practice at Crystal Falls, Mich., and elsewhere. The mine visited has an irregular orebody with walls which conform to no uniform dip or direction. The phosphorus content of the ore ranges between 0.50 and 1 per cent., which limits it to the manufacture of foundry pig. Hence mining costs must be as low as possible and timber must be limited to the drifts, crosscuts and chutes.

or two of powder quickly relieves the congestion. Drawing is stopped when the roof begins to come with the ore.

SUB-LEVEL CAVING SYSTEM

All through the Menominee range the sub-level caving system is used and it is only where the nature of the ore permits of, or requires, block-caving that the latter method is carried on. This method does not require the elaborate system of frequent crosscuts and permits an earlier extraction of ore, for which reasons it is preferred by many mine managers. The crosscuts are run from the hangingwall (or footwall if advisable) drift and raises are staggered, as in the block-caving system. The levels are usually from 100 to 125 ft. apart, and in the mine visited the distance was divided into three sub-levels, each separating 20 vertical feet of ore. The main-level drifts are 7 ft. high and 14 ft. of ore is left at top and bottom of the space between levels.

The chutes are cut funnel shaped at the top and are about 14 ft. high. A raise is then put up to the level above and the

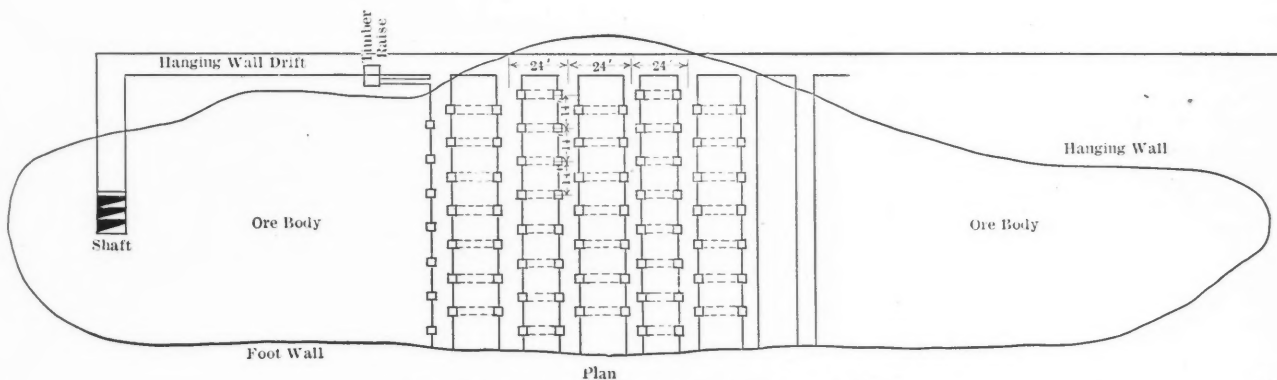
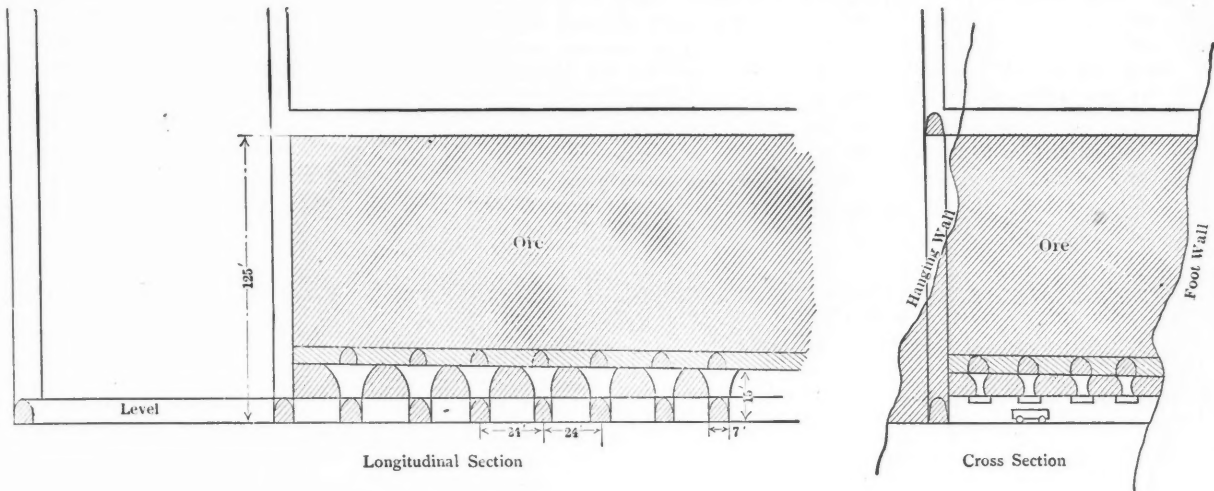
ore is divided into three, four or five parts by sub-levels running parallel to and in line with the crosscut running through the center of the orebody. At the upper sub-level, crosscuts are run at right angles and 40 ft. apart. These are extended to the two walls. The ore is broken down,

differences are matters of detail only, and are arranged to suit conditions. Each sub-level is worked back toward the raises, and as the ore is removed, timber and lagging are set in place. If the ground will not cave naturally, the supports are blasted down. This method is similar, in

lower slice. The sub-level method, or, as it is called locally, "subbing," is the most popular system on the Menominee range.

BACK-STOPING

The pillar-and-room method of mining without the use of square-sets or other

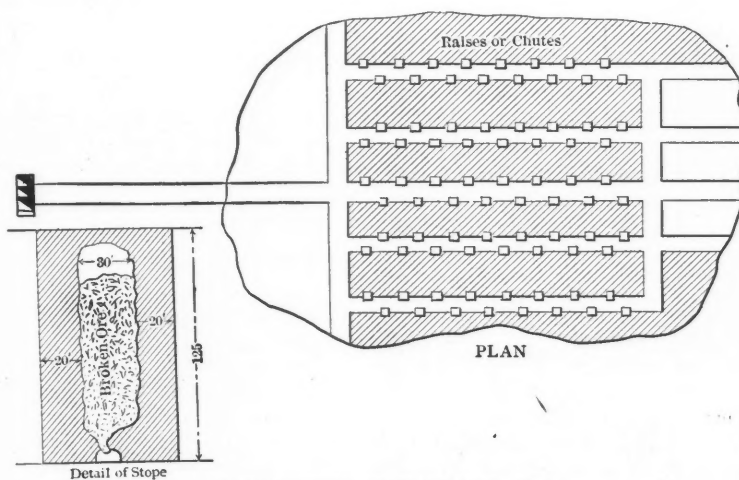


BLOCK-CAVING USING CHUTES TO EXTRACT THE ORE

beginning at the set of timbers farthest from the raise and working back to the raise. Three 10-ft. holes are drilled into the breast, one being horizontal, and the other two slanting up and down. As the ore is removed, the cap or roof settles lower and lower. When this rock begins to appear with the ore, work is stopped and another 8-ft. slice is taken out. In this manner all of the ore is removed from the upper sub-level. While the work is progressing, ore is also being mined on the lower "subs," but the miners on the upper sub-levels are always in advance of those immediately below, so as not to endanger the men.

Timber and supplies are sent down the raises from the main level above, and the ore is shot down to the level below into cars. These are pushed to the main drift and trammed by electric locomotives to the shaft.

The sub-level caving system is used, with slight modifications, at different mines, some using three sub-levels and others four or five. Nor are the levels always the same distances apart. These



BACK-STOPING IN HARD IRON ORE

many respects, to the "top-slice" system practised on the Marquette range, and differs principally in the general arrangement of the workings and the frequency of the raises. Also it is not necessary to remove the entire top slice and cave the ground before starting the second or

timber is known as "back-stoping" and is used where the deposit is extremely long as compared to the width, and where the ore is quite hard and strong. The main shaft is usually sunk near the center line of the orebody and back in the footwall about 60 to 80 ft. A main drift runs

through the center of the deposit, and the main crosscuts are driven at right angles to the drift, with crosscuts every 45 to 50 ft. Staggered raises are cut 24 ft. apart, along these crosscuts, which divides the level into pillars 20 ft. thick, the length being limited to that of the orebody. The raises are the usual height, 14 ft., and are funnel shaped as in the other method. The ore is then stoped out, above the raises, and for the full length of the orebody, or that portion mapped out. These stopes are about 30 ft. wide and extend up to the level above, leaving only an arch to support that level. The ore blasted down fills the stope and

cave, and which have strong, uniform walls.

CONDITIONS AT THE EAST END OF THE RANGE

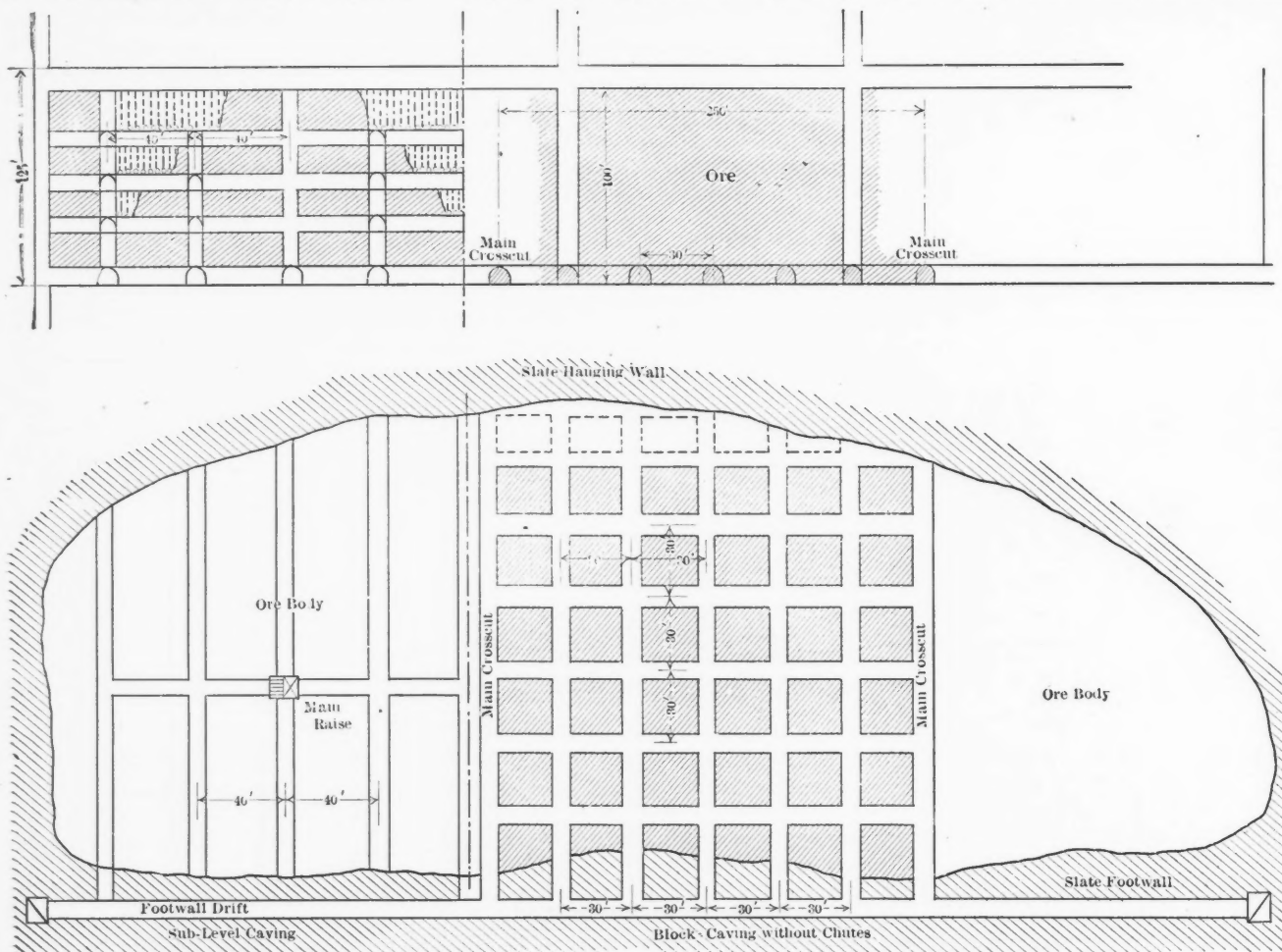
The orebodies at or near Vulcan, Mich., are irregular, being, for the most part, steeply dipping and quite narrow. They are rarely more than 100 ft. thick, and usually occur between walls of slate and jasper. Both bessemer and non-bessemer ores occur, but the latter grade is much lower in phosphorus than the ore at Iron River and Crystal Falls. By careful grading the non-bessemer ore can be kept at about 0.15 phosphorus.

The orebodies dip from vertical to 45

The deposits have been proven to a depth of 1500 ft.; below this no exploratory work has been done.

At the West Vulcan the flow of water suddenly increased from 300 gal. per min. to 2000 gal., later decreasing to about 1100 gal. per min. This water is handled from the main pumping station, 1000 ft. from the surface. Here are located three pumps, two triple-expansion and one compound, and three more triple-expansion pumps are placed 200 ft. below to lift to the upper set. A small pump is sufficient at the bottom of the mine.

A feature of this group of mines is the power plant, which has just been com-



TWO METHODS OF MINING IN THE SAME MINE

supplies the necessary footing for the miners and machine drills. When the broken ore begins to fill the stope too nearly, some is drawn from the chutes and this allows the men more room in which to work. When all the ore is broken down it is withdrawn from the chutes down which it readily runs. Finally, when the stopes are empty the pillars are undercut and are blasted down simultaneously by the more expert miners and these pillars again fill the chutes and the ore is withdrawn as before.

Absolutely no timber is required for mining and the method is applicable to narrow deposits which are too hard to

deg., and contain many "horses" of jasper or lean iron ore.

Several methods of mining are used at the Vulcan mines, the caving system being given the preference where practicable. Square-sets or, with extremely narrow deposits, stulls are used. The ore is reached by crosscuts from vertical shafts driven in the footwall. The East Vulcan shaft sinks vertically and then turns and follows the footwall. At the West Vulcan mine crosscuts disclosed an orebody which gave no surface indications. A shaft was started to meet the deposit, but was abandoned, and the ore is now taken out through crosscuts to the older shaft.

pleted at Sturgeon Falls on the Sturgeon river. Work began Sept. 1, 1905, and the machinery was installed in April, 1907. The equipment consists of four pairs of Lefel turbines, connected to a horizontal shaft, and having a speed of 180 r.p.m. To this shaft is connected a 1500-kw. General Electric Company's generator, delivering current at a pressure of 6600 volts over three miles of transmission line. This power will be used at all of the company's mines at Vulcan, to drive the underground locomotives, hoist the skips, operate the pumps, light the surface plants, etc. The plant was constructed by the company's engineers.

Re-locating Mineral Lands

Rights of Original Locators and Re-locators of Mineral Claims on Public Lands. A Discussion of Court Decisions

BY ROSSITER W. RAYMOND

If a lode-location upon public mineral land withdraws from the public domain the tract it covers, so long as the conditions of possessory title are complied with by the locator, and if failure to perform the annual "assessment-work" prescribed by the United States statutes (to say nothing of failure to comply with any other requirements, local, Territorial, State or Federal) makes the said tract open to re-location, "in the same manner as if no location of the same had ever been made," does this relapse of the said tract into the public domain validate the rights of junior locators, made after the original location, but prior to such abandonment thereof, and overlapping the whole or part of the previously located, and thus forfeited, area?

THE DECISION OF 1905

This question was decided by the United States Supreme Court in a highly questionable way, on May 29, 1905, in the celebrated case of Lavagnino vs. Uhlig (198 U. S., 443), by an opinion practically declaring that the abandonment and forfeiture of a prior location validates the claims of overlapping junior claims, located before the forfeiture of the senior claim. This decision is ably discussed and controverted by Henry M. Hoyt, 2d, in the *Mining and Scientific Press* of June 1. I think he is logically right in his contention that, if a given tract has been, and so long as it continues to be, segregated from the public domain and transferred to private possessory ownership by reason of a valid mining location of it, no private title can be legally initiated to any part of it by acts performed during the period of such segregation. On the other hand, I think it cannot well be questioned that the universal custom has been to regard every recorded claim of possessory mining title as good against all subsequent claimants, and entitled to complete validity as to all those parts of its area, to which the rights of prior claimants have lapsed.

As to the status of a mining location, the United States Supreme Court has made declarations which are not easily to be reconciled. In many cases, prior to 1897 (for example, in the leading case of Belk vs. Meagher, 104 U. S., 284), it declared in substance that a perfected valid mining location operated to withdraw the tract from the public domain, and to make it, so long as such appropriation subsisted in unimpaired validity, private property.

In accordance with this doctrine, it was held by the lower Federal courts that entrance upon a located claim was a trespass, through which no legal title could be initiated by the trespasser. Thus, in the case of Montana Company vs. Clark (42 Fed. 626), it was decided that a location, required under the statute to have parallel side-lines, was not valid if it had the form of a triangle, and could not be made valid by placing stakes beyond its limits upon prior locations, so as to make a rectangle, and "claiming" the said rectangle, while "disclaiming," at the same time, the portions thereof already covered by location, so as to leave, in fact, as the real location on public land, only a triangular tract.

THE LAST CHANCE DECISION

This decision was never reviewed at Washington; but, some years later, in *Del Monte Company vs. Last Chance Company* (171 U. S., 55, 84) the United States Supreme Court took the opposite view, ingeniously arguing that a lode-location was "withdrawn from the public domain," not completely, but only in such a way that the United States still held it as a trustee for the rights of the locator. In this decision, the Court said: "A valid location appropriates the surface, and the rights given by such a location cannot, so long as it remains in force, be disturbed by any acts of third parties."

But the Court declared also, that it did not necessarily follow that a later locator might not lay some of the lines of his lode-location upon the tract of a senior location, for the purpose of acquiring rights not to conflict with the claim having priority. On this point, the decision says:

"Certainly, if the rights of the prior locator are not infringed upon, who is prejudiced by awarding to the second locator all the benefits which the statute gives to the making of a claim?"

While this statement may have been intended to cover no more than the placing of boundary-lines upon an existing prior location, simply to secure for a later location the required or preferred rectangular form, and not for the purpose of acquiring any contingent future right to part of the area of the said prior location, yet both its language and its logic go much further. For it practically asserts that, so long as the senior locator is not wronged, nobody else is wronged by the act of a junior locator establishing

an overlapping claim; and this doctrine might easily be (as, indeed, it has been) extended to cover all the rights which the junior locator might have initiated by his location, if there had been no senior locator at all—in other words, it declares in substance that the extinguishment of the senior rights renders valid against everybody the junior rights, which were already valid against everybody but the senior.

WHO IS WRONGED?

Taken in this wider application, the rhetorical question of the Court, "Who is wronged?" could have been promptly answered. The United States is wronged: because it never undertook to surrender its mineral lands to any other than actual first locators; because it gave notice that it would resume possession upon the failure of such locators to fulfil the conditions of possessory ownership; and because both the letter and the spirit of its over-generous offer of possessory title excluded the notion that such title could be prophetically or conditionally acquired by parties who, upon a given tract, established no occupancy and made no developments, but simply put up stakes indicating expectation, and waited for a lucky inheritance of the rights of their predecessors. Moreover, the citizens of the United States, engaged in the discovery and location of mineral deposits on public lands, are wronged, because they have been assured by the statute that, when (not *before*) a given location has been forfeited, the tract which it covered is open to re-location, as if it had never before been appropriated; yet, when they attempt to act upon this explicit assurance, they find that a *pre*-location nullifies re-location.

It may be that neither the decision in the Last Chance case, cited above, nor any of the later decisions which followed that precedent, went quite so far as this; but the Lavagnino decision unquestionably took the final step in the series. Under it, everybody may set up his potential claim to any part of an existing mining location, not yet surveyed for patent; and, when that location is legally forfeited or abandoned, it does not necessarily become subject to re-location, but may fall, in whole, or piecemeal, into the hands of waiting pre-re-locators, in the order of their priority.

THE RIGHT OF THE FIRST COMER

In my judgment, this decision simply reflects the old notion of the pioneers.

formed before the United States had asserted by any statute its rights as owner of the public mineral lands—the notion, namely, that these lands and their valuable mineral contents belonged, under such limitations and conditions as might be locally established, to the first comer; that whenever, and to whatever extent, his rights should fail, they reverted to the second comer; and so on, without any opportunity for the intervening assertion of the superior right of the United States as the real owner.

Decisions of the Federal courts prior to 1866, and the terms of the Acts of 1866 and 1872, aided in confirming this notion, which has seriously affected the construction of later statutes by the United States Supreme Court itself.

I do not now care to argue further as to the propriety or consistency of the decisions of that tribunal. So far as I can see, it has fallen into contradictions which will ultimately require some retraction or adroit reconstruction of its declarations.

Indeed, if I correctly understand the later decision in *Brown vs. Gurney* (201 U.S., 184), this necessary process has already begun. For that unanimous opinion, delivered by Chief Justice Fuller, contains the following plain announcement of the old and sound principle which had been overridden in the *Lavagnino case*:

"Of course it is essential that, at the date of a location, the ground located on should be part of the public domain."

The decision proceeds explicitly to deny, as to the ground in conflict, the claim of an overlapping location made before the abandonment of a prior location, and to recognize the possessory title of one made after such abandonment. How the Court reconciled this utterance with its previous decision in the *Lavagnino case*, nobody knows, and possibly nobody will ever know. The *Lavagnino case* was cited as authority for the plaintiff in *Brown vs. Gurney*; but I do not find any mention of it in the decision. Perhaps that was the wisest way to deal with it.

It is not the business of any inferior court to explain a contradiction which the Supreme Court has left unexplained; and every lower court is justified in accepting as conclusive the latest deliverance of the highest tribunal, whether it be, at the same time, clearly consistent or not. Following this rule, the Supreme Court of Utah, in the recent case of *Lockhart vs. Farrell* (86 Pac. Rep., 1077), after mentioning the revolutionary effect of the *Lavagnino* decision, and declaring that it does not believe such an effect to have been intended, says: "It is sufficient for us that we follow *Brown vs. Gurney*, more recently decided," etc.

A clear, careful and convincing discussion of this and other decisions, by Grant H. Smith, of Salt Lake, appeared in the *Mining and Scientific Press* of June

15, as a comment upon the article of Mr. Hoyt, to which I have referred. Mr. Smith does not controvert, but, on the contrary, complements and confirms, the views of Mr. Hoyt.

NECESSARY REFORM OF THE LAW

But what interests me, at this time, more deeply than the maintenance of consistency, or any attempt to recover it, on the part of the United States Supreme Court, is the consideration that all embarrassments of this particular class could be simply and completely removed at once by the wholly unobjectionable measure which I suggested in my recent article in the *ENGINEERING AND MINING JOURNAL* on "The Reform of the United States Mineral Land Law"—namely, the establishment of the rule that locators of mining claims should be required to initiate their rights by suitable notice to the United States. The creation of potential, secondary and expectancy rights could thus be cut off, as it ought to be. For the main source of the trouble now is, that when any individual records a mining claim overlapping some other claim, the county clerk or the district recorder makes no objection thereto, and the United States Land Office receives no notice thereof. In fact, neither authority possesses knowledge enough to decide whether the alleged location is on unappropriated public land or not.

So long as the United States does not know what land it owns, it cannot require possessory owners or prospective purchasers to have that knowledge, and it will be obliged to continue saying to them: "Claim (within the prescribed limits of size) whatever ground you want, and maintain your claim according to Federal and local regulations (which do not, however, finally determine its original validity or its exact boundaries) as long as you choose. Whenever you, or any other applicant, shall desire to buy of me outright the ground thus claimed, then, and not before, I will have it surveyed, and there shall be a free fight among the claimants; whoever of them does not enter the fight, will be counted out; and of the rest, I will recognize the victor, and give to him a deed for the land, together with such mining rights as he may subsequently find it to convey." And this impotent promise to give, at an indefinite future time, to the survivor or victor among an indefinite number of claimants, a quitclaim title to an indefinite tract, conveying indefinite mining rights, the United States Supreme Court is called upon to recognize and interpret as a system of mining law!

The Republic of Panama has provided for the minting of subsidiary nickel coins to the amount of \$25,000. The coins are to be made from an alloy of 75 per cent. nickel and 25 per cent. copper.

Antimony in Slocan District, B. C.

SPECIAL CORRESPONDENCE

The discovery late last season of stibnite on the north fork of Carpenter creek, in the Slocan district of British Columbia, has been reported by the gold commissioner for that district to the provincial department of mines. The Golden Crown Gold and Silver Mining Company, Lewis Hind, Three Forks, manager, owns the property—the Alps group of three claims situated on a branch of the north fork of Carpenter creek, $8\frac{1}{2}$ miles from Three Forks and about 7000 ft. above sea level. The ore occurs in a quartzite dike about 30 ft. in width and traceable for 3 to 4 miles. Ore has been found in quantity in three places along a distance of about 600 ft. Each good showing is where the vein appears to have been pinched by the intrusion of very hard schist. In two places the ore seems to be in place, lying on the schist, which is the footwall, while quartzite is the hanging. As a rule the ore occurs clean, but in places it is mixed with soft, yellow quartz and is then difficult to sort. Where first found it was in large lumps of high-grade ore, occurring in decomposed quartzite. These weigh up to 1600 lb. The ore contains as high as 67 per cent. antimony, and small silver and bismuth values as well. The greatest width of ore is about 4 ft., where the vein is well defined. The ore is to be shipped to Scotland for treatment and shipments will be made after the construction of an aerial tramway about 4000 ft. long, already arranged for, shall have been completed. Substantial quarters are to be built for the accommodation of a number of men.

The Am. S. & R. Co. Smelting Works at Chihuahua Mex.

It is announced that the furnaces of the Chihuahua smelting works of the American Smelting and Refining Company will be blown in about Nov. 1. The structural steel work of the blast furnace building, the power house, machine shops and sampling is completed and the brick work of the furnace is ready.

The brick stack will be 370 ft. high with an inside diameter of 16 ft. About eight miles of track have been laid, connecting with the Mexican Central, the Kansas City, Mexico & Orient, the Chihuahua & Pacific and the Mineral road to Santa Enlalia.

A hotel has been built for employees and 192 houses for laborers. Provision has been made for a complete water and sewer system which will embrace all the buildings of the plant, officers, residences and houses for laborers. At present about 350 men are employed, largely skilled mechanics.

The Mines of La Luz, Guanajuato, Mexico—I

Some New Points in the Geology of an Important Section of the Guanajuato District Which Is Now Being Reopened

BY JOHN A. CHURCH*

The broad area which contains the mines of Guanajuato has a length of nearly 13 miles, about N. 40 W., and a width of 10 miles. The Veta Madre passes through the whole length a little south of the center, in a direction N. 75 W., but with a strong curvature, the concavity being toward the south. The vein is covered by a multitude of claims stretching over a width of nearly two miles. Near the eastern side of the rectangle lie the connected districts of Santa Rosa, Peregrina and Cubo, about six miles long and lying in a general N. 50 W. direction, but strongly concave toward the northeast. Santa Rosa claims cover a width of a mile and a half, but at Peregrina the district is less than a mile wide. In the extreme northwestern corner of the rectangle is La Luz district, five miles long and 1.5 mile wide, with an axial direction of about N. 45 W.

In writing about the Pinguico mine. I spoke of the valuable geological work in progress under the direction of Prof. C. W. Botsford, the head of the engineering department of the Guanajuato Development Company. This work has advanced far enough to afford data of great importance in the study of the whole Guanajuato district.

I have not visited Santa Rosa or Peregrina and therefore except them from anything I have to say about La Luz district, which is the one of the three that I have had some opportunity of studying.

THE SCHIST

Much of the area between La Luz and the Veta Madre, and including the whole of La Luz, having a width of more than four miles, contains either as surface exposure or underlying rock a dark red feldspathic agglomerate or a dark aluminous "schist" which underlies the agglomerate. Professor Botsford informs me that the schist is found at Santa Rosa, though in diminished thickness, which makes it cover practically the whole Guanajuato rectangle.

One of the important determinations by Professor Botsford is that this schist is a propylitic alteration of the agglomerate. As the schist is the country rock of many of the mines on the Veta Madre and all La Luz veins, this conclusion of Professor Botsford must form one of the funda-

mental factors in the geology of Guanajuato and I examined the evidences with great interest upon which he relies.

On the surface and for 30 to 50 ft. in depth this rock looks somewhat like a shale though not shale in structure, but in the ravines, especially that of Bolañitos river, 1500 ft. below the highest hill tops, its true character is discernible. In color it has the shades of gray, green and brownish red, or purple, with which we are familiar in roofing slate. In texture it varies from complete schistosity to a dense, fine grained and extremely hard rock with granular fracture, and to a sub-agglomerate structure and finally to a rock in which the agglomerate structure is preserved fully though both matrix and pebbles have been highly altered. Occasionally coarse crystals of hornblende mixed with quartz are found and sometimes there is a resemblance both in texture and composition to a fine-grained porphyry, but this resemblance is not sufficient to place it among the "meta" eruptives. Small, lath-like feldspars are infrequent but are seen.

The crucial test of Professor Botsford's identification comes at the points where the completely schistose rock occurs, for immediately adjacent to them, in every case, are points where the agglomerate structure is more or less well preserved. Alteration has rounded the angular pebbles of the agglomerate and the appearance is much like that of an ordinary conglomerate, though consisting of feldspathic rock only.

METAMORPHIC AGENCIES

Since it is reasonable to conclude that the conditions of heat, access of water and other metamorphosing agencies which produced the uniform alteration of this rock over so great an area and thickness were in themselves fairly uniform, we may conclude that the differences we see are due entirely to variations of pressure. Undoubtedly it is so at the places where real schistose structure and well preserved agglomerate are in juxtaposition. The pebbles have been preserved because in some way they have been defended against the prevailing pressure, and the schists are schists because those points had to bear not only their own proper load but also the load which should have been distributed to the pebbles.

All of the appearances which I have described occur in patches. There is no

continuity of texture or color. I doubt if any one condition seen in the ravine extends farther than 100 ft. and usually the changes are more frequent. Elsewhere in the district schistosity has developed over considerable areas. There is not the slightest appearance of sedimentation even in a highly altered form. After examining the "schist" minutely I accepted Professor Botsford's conclusion without reserve.

The alteration of the agglomerate is of the kind called propylitic and though the word propylite has been discarded as the name of a rock on account of early misconceptions concerning the rocks to which it was given, it might be better to rename this member of the Guanajuato series propylite as indicating its eruptive origin and the character of its alteration as well as the fact that its formation seems to have introduced the long continued and immensely effective series of changes which have made Guanajuato a great mining field.

RESULTS OF BOTSFORD'S INVESTIGATIONS

Thus the first result of Professor Botsford's work is to establish the true relationship of this widely extended and important formation, the home of Guanajuato's wonderful veins, removing it from the class of sedimentaries where it has reposed for a hundred years and placing it in the class of eruptives. The unaltered agglomerate remaining is supposed to have a thickness of 1400 ft. and the schists which were formed from its lower portion about 3000 ft. There is an old shaft at La Luz, La Asuncion, more than 1400 ft. deep, which is entirely within the schist. The hills rise 500 or 600 ft. above its mouth and a moderate allowance for erosion and for further depth below the shaft make up the remainder of the estimate which, it is apparent, may easily be an underestimate. Another important result of the geological work is the location and partial survey of an extensive granite area east and northeast of La Luz veins and covering not only all La Luz district but also the whole area between La Luz and the north end of the Veta Madre. This is undoubtedly the "syenite" of the older geologists, and I shall show presently that Humboldt gives a description of it which is accurate in observation, but which was evidently very puzzling to him.

THE GRANITE

The granite is cut off from the area

*Consulting mining engineer, 15 William street, New York.

¹The JOURNAL, Nov. 24, 1906.

containing the veins of La Luz by three faults. One lies along the eastern edge of the district and has a N.-S. strike. In it are the Bolañitos, La Joya and other veins which dip eastward contrary to the general dips of the district. The second is also a N.-S. fault, but it lies on the west edge of the district and is probably

ite, the dike and the Bolañitos-La Joya vein is shown in Fig. 1. The relation of La Joya to Bolañitos is such as to make the existence of a cross-fault between them probable. I have examined the northern part only of the granite, down to the southern end of the Bolañitos vein. The part farther south and

less we accord to that rock a greater thickness than it is believed to have had, it follows that the vertical displacement of the east block could not have exceeded 1000 ft. and may have been not more than 600 ft. The granite west of the district is found opposite the Jesus Maria mine, 75 meters below the eroded top

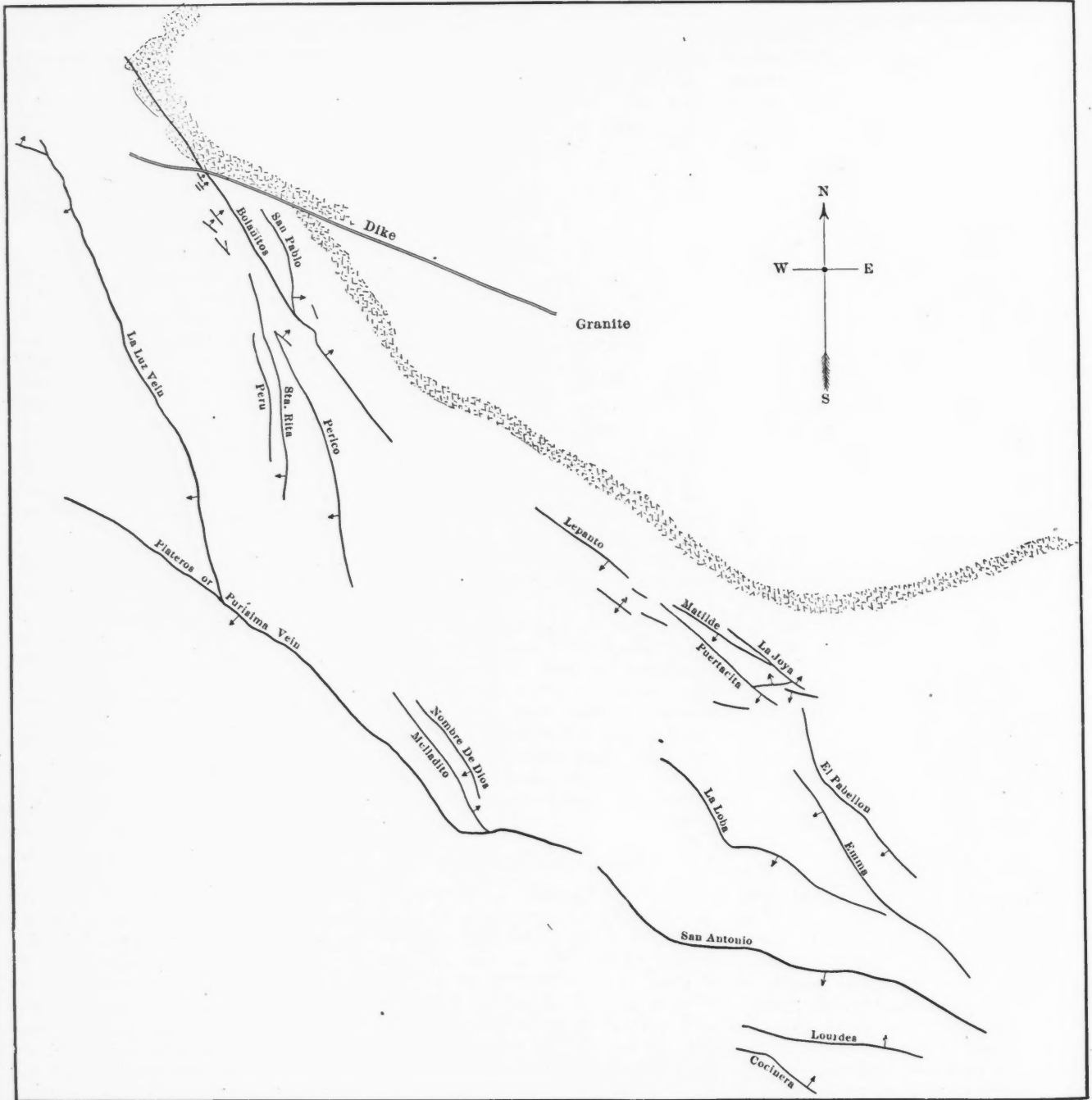


FIG. 1. VEINS IN LA LUZ DISTRICT, GUANAJUATO, MEXICO

the line which the La Luz vein occupies. It dips west. The third is an E.-W. fault situated just north of the district and now contains a dike 100 ft. thick of a rock which, in its decomposed exposures, strongly resembles rhyolite. This dike runs nearly, if not entirely, to the Veta Madre. In all cases the faulting is normal. The position of the gran-

the eastern extension are put in after Humboldt's description.

There are several matters of interest revealed by the granite. Though it occupies downthrown blocks we see the bottom of the mass, all the ravines cutting down to the schist below, and inasmuch as the summits of the higher hills must be near the top of the schist, un-

of the higher hill near by. This indicates a vertical displacement of 100 meters or more.

The comparative age of the granite is indicated by the fact that the inclusions it contains are schist. It must, therefore, be later than the propylitization of the agglomerate. These inclusions are in immense numbers; in fact, the granite is

subordinate in quantity to the schist which it incloses. On the whole I judged that only about 40 per cent. of the mass is granite, even in the heart of the area; and east of the southern part of the Bolañitos vein the proportion is not greater than 20 per cent. The contacts of granite and schist are often vertical or inclined strongly and the masses of schist are of every size from hundreds of feet thickness to small boulders. As usual it is the small things that are hardest to explain. I can comprehend the method by which the angular fragments reached their present position; but how were the boulders rounded? They never saw the surface until present-day erosion revealed them. Perhaps it is significant that I saw them only on the edges of the granite where grinding may have taken place as the cover of the laccolith was lifted gradually, or perhaps lifted and lowered alternately.

THE LACCOLITH

There can be no doubt that the granite is a laccolith which covers several square miles of territory between La Luz and the Veta Madre. Apparently the western edge was thin, perhaps a great sill covering the district. Erosion has also been active and near the veins the granite is not more than 300 ft. thick. Two miles to the northeast it rises to a summit called Buenavista mountain, probably 1200 ft. higher. It covers the whole territory north of the dike to Las Palmas river, a mile and a half, and extends eastward to the Valenciana mine of the Veta Madre. This is an extent of at least six miles from east to west and five miles from north to south.

The occurrence of the granite at the Veta Madre rests upon both ancient and modern testimony. Humboldt says: "On digging the great pit (*tiro general*) of Valenciana they discovered banks of syenite, of hornblende slate and true serpentine, alternating with one another and forming subordinate beds in the clay slate." He comments on "this extraordinary phenomenon of a syenite alternating with the serpentine" and no wonder. Laccoliths had not been invented in his day. Theodore Dwight informed me that granite boulders had been encountered in the Nueva Luz shaft, sunk in the hanging of Valenciana. There, as everywhere else, the occurrence was of a confused mass of granite and schist.

THE RHYOLITE DIKE.

Another of the late discoveries may have played an important rôle in the Veta Madre. While not shown in Fig 1, the rhyolite dike has been followed over nearly to the Esperanza mine of the Veta Madre, a mine north of the Valenciana. Humboldt, after commenting on the "immense mass" of silver taken from "the vein of Guanajuato," \$165,000,000 in 38 years, enough to affect prices in Eu-

rope, says that it was all taken from the vein between Esperanza and Santa Anita, 2600 m. in length (8500 ft.). That is to say, the richest part of the Veta Madre lies just south of the line of this rhyolite dike just as the richest part of La Luz district lies just south of the dike itself. If study of Esperanza ground discloses the dike there, Professor Botsford will have added two very important members to the Guanajuato series, besides determining the true constitution of a third.

The strike of the rhyolite dike is S. 80 E. and its dip N. 70 deg. Its western end passes out of the granite into the schist, but runs out in 400 or 500 yd. Bearing all the above points in mind the following extract from Black's translation of Humboldt's "Essai Politique" (1811), V. III, p. 183, will be read with interest:

"From the mine of Esperanza, situated to the northwest of Guanajuato, to the village of Comangillas, celebrated for its hot springs, the *clay slate* during an extent of more than 20 square leagues serves for a base to beds of syenite which alternate with *transition greenstone*. These beds are in general from 4 to 5 decimeters (15 to 19 in.) in thickness; and they are inclined by groups, sometimes to the northeast, sometimes to the west, and always at angles of from 50 to 60 deg. In traveling from Valenciana to Ovexeras we see several thousands of these banks of *greenstone* alternating with a syenite, in which quartz is sometimes in greater abundance than feldspar and amphibole. We find veins of *greenstone* in this syenite and crevices filled with syenite in the beds of *greenstone*."

RELATION BETWEEN GRANITE AND SCHIST

Humboldt's language depicts the inextricable confusion of granite and schist fragments very well and what he says of the high dips of the contacts is true. They not only stand 50 to 60 deg. but often are vertical. The "veins of greenstone" in the granite are flat slabs of schist, a foot thick, standing vertical in the granite.

It is clear that the granite is not an extreme alteration of the schist. The innumerable contacts are always sharply defined and nowhere was any sign of passage of one rock into the other noticed. The granite was subsequent not only to the propylitization of agglomerate but also to the fracturing of the schist and the completeness with which it penetrated a mass of schist, miles in diameter and perhaps 900 ft. thick, shows that it must have been under great pressure, a pressure that would have lifted a weak roof and produced a surface flow rather than an injected mass. There may have been such a flow ultimately, but the formation of this laccolith points to a strong roof. Fourteen hundred feet of

agglomerate may have been sufficient. Only eruptive flows, rhyolite and andesite, overlie the agglomerate and La Luz rhyolite dike, to which we would naturally look for the local flow of that rock, is younger than the granite. At all events the granite entered under such pressure that it penetrated the fractures in the schist and tore up the intervening fragments, producing a lifting effect that must have broken the roof eventually, thus preparing it for its complete removal subsequently by erosion.

THE FAULTING

The faulting was subsequent to the solidification of the granite, the weight of which may have had some effect. The Veta Madre and Bolañitos-La Joya faults are both normal and dip toward each other, but there is no evidence of any intimate connection between them. The immense amount of faulting in the whole Guanajuato region indicates severe and long continued stresses and the weight of the granite may have determined their effect locally.

La Luz district seems to mark the westward limit of the laccolith and its eastward limit seems to be near the Veta Madre (*Valenciana tiro general* is about a mile from the outcrop). I have spoken of its penetrating a mass of schist 900 ft. thick. This is based on the assumption that the laccolith is, or was, only 1500 ft. thick and that granite forms only 40 per cent. of its mass. Both of these assumptions need further study for their confirmation, for the thickness given is probably a minimum. Room for this injected material could have been made by faulting or by raising the cover of the schist and I am inclined to think it was the latter action that took place. Whether the granite tore out great masses of schist and floated them upward or moved them sideways it must have formed a great plastic mass. What effect the presence of this plastic mass had upon rock movements cannot be told in the present state of our knowledge. As it occupied the top of the schist I do not see how it could have produced any deep-lying effects. If the roof gave way with explosive suddenness the release from pressure may have contributed to the faulting.

Humboldt speaks of the syenite, as being often predominately silicious. Perhaps he refers to aplite dikes which are not infrequent, for the granite I saw is richest in feldspar with moderate quartz and less hornblende.

SUCCESSION OF GEOLOGICAL EVENTS

The position of the granite at the top of the schist is important because of its bearing upon the future of La Luz mines. All the mine shafts are opened at about the middle of the schist, or in the middle third of its thickness. The outcrops must be below the level of the granite.

even if it ever covered the ground in which they lie, and there is no probability that this rock will be found in the mines.

No sedimentary rocks are known in La Luz but it is supposed that the schist rests on shales here as at the Veta Madre. When the granite is thoroughly explored dikes of various rocks will be found. Fragments of diorite, of a dark brown porphyry with glassy crystals and of a red porphyry with large phenocrysts are found in the ravines but their locality has not been discovered. A thin seam of gray rock, much decomposed, with small inclusions of serpentoid mineral may be basalt.

fault is the only fact we have that indicates the time relation of the ore deposition.

THE VEIN SYSTEM

The accompanying maps, Figs. 1 and 2, and the sections, Figs. 3 and 4, show the peculiar arrangement and contrary dips of these veins. On the western side of the district is a vein about five miles long which, beginning at the north end, is known as La Luz-Purísima-San Antonio vein. Its dip is west, about 60 deg. The vein has a strong concavity toward the east, its three divisions having the following strike and approximate length as measured on the map:

up partly from Mexican sources and the structure is not so simple as shown there. It has not been possible to identify all the veins shown on the Mexican map which gives El Pabellon an east dip, while the vein which is now pointed out as El Pabellon has a west dip. Probably there is a fault vein east of it which has the east dip and which was not found in the recent survey.

The arrangement of the veins resembles an ellipse with the more important veins distributed on the boundaries. It is a district of great veins, as the following list shows. They are entered in order from west to east and in the three sections, northern, central and southern:

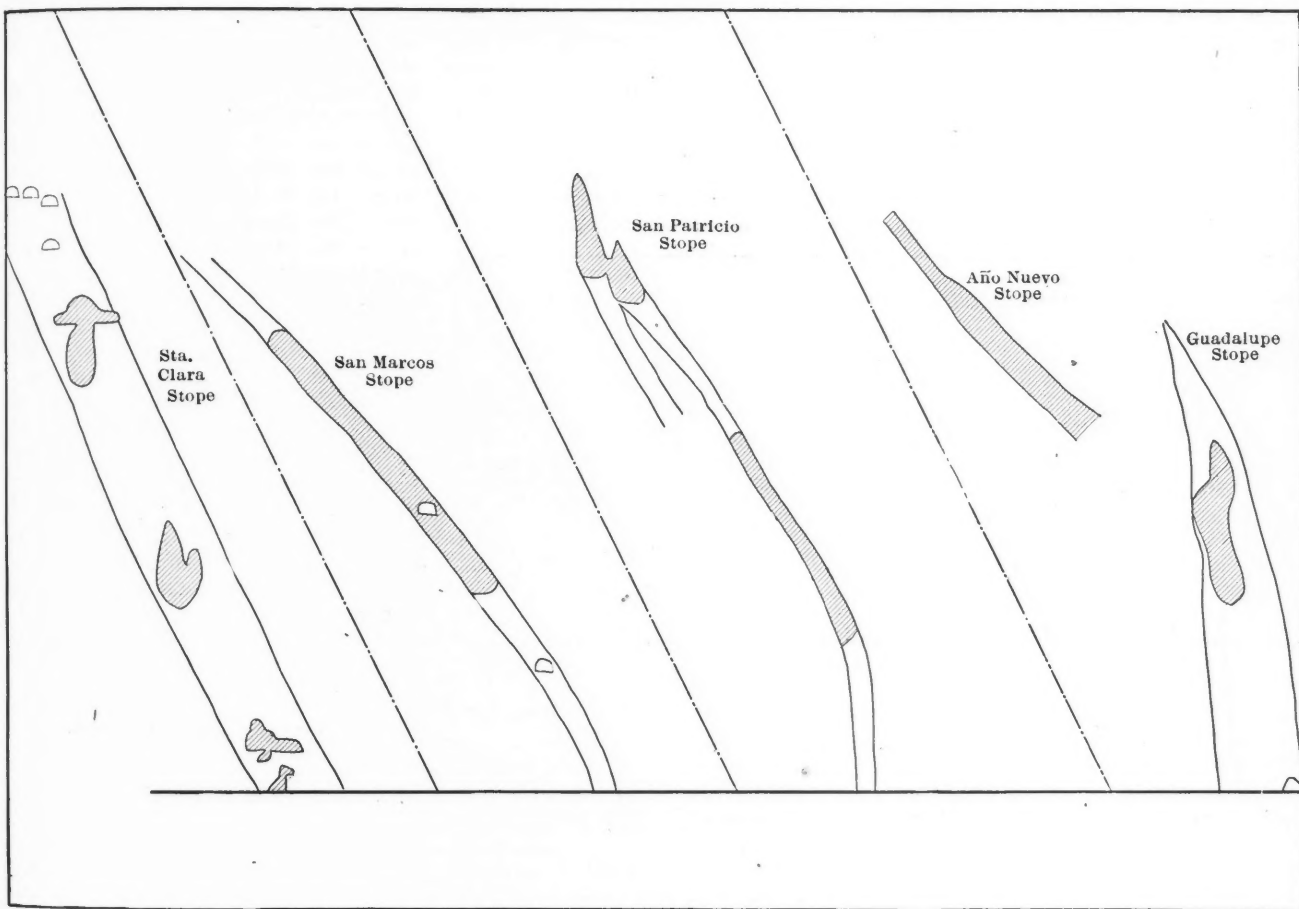


FIG. 3. SECTION OF LA LUZ VEIN

Erosion has been strong. All the agglomerate, some schist and all the granite above the vein area of the district have been removed and if there was overflow from the rhyolite dike, that has disappeared also. The succession of events seems to have been:

1. Propylitization of the agglomerate.
 2. Crushing and splintering of the schist.
 3. Entrance of the granite into the upper part of the schist.
 4. Faulting on the line of Bolañitos-La Joya and La Luz veins and of the dike.
 5. Continuance of the formation of ore.
- It is not certain that this process had its beginning after or before the faulting.

The presence of ore in the Bolañitos

	Strikes.	Lengths.
La Luz	S 21 E	9,167 ft.
Purísima	S 44 E	6,250 ft.
San Antonio	S 69 E	11,140 ft.
Total length		26,557 ft.

The central or Purísima portion continues northward beyond its junction with La Luz, forming the Plateros fork, 4000 ft. long and dipping west like the rest of the system. The mean direction of the whole vein is N. 40 W.

On the eastern side of the district there is a complex of veins 20,000 ft. long which dip west. The northern veins of this complex are nearly parallel to La Luz vein, the central ones are parallel to Purísima, but the southern ones spread out like a fan. The map, Fig. 1, is made

North.	Length.	Dip.
La Luz	9,167 ft.	W.
Peru	2,700 "	W.
Santa Rita	3,600 "	W.
Perico	4,800 "	W.
Bolañitos	7,250 "	E.
San Pablo, (a branch of Bolañitos)	4,000 "	E.
Center.		
Purísima & Plateros	9,000 "	W.
Melladito	3,300 "	W.
Nombre de Dios	2,500 "	W.
Lepanto	5,100 "	W.
La Joya	7,200 "	E.
South.		
Cocinera	1,250 "	E.
Lourdes	2,250 "	E.
San Antonio	11,140 "	W.
Santa Gertrudis	1,300 "	W.
La Loba	4,800 "	W.
Emma	4,800 "	W.
El Pabellon	3,900 "	W.

Melladito and Nombre de Dios are two small veins in the footwall of Purísima and dip into each other according

to the Mexican maps. Lourdes and Cocinera are hanging-wall veins of San Antonio. Some of the lengths given by the old surveyors are said to be exaggerated, but on the other hand the outcrops are frequently obscured and may not have been thoroughly picked up in our rapid survey. The map brings out the important fact that La Luz is a district of westward dipping veins which has been broken on its eastern edge by an eastward dipping fault now filled with ore.

POSITION OF THE VEINS

It will be noticed that the veins are crowded together and more in number at the two extremities of the district than in the center. Near the Bolañitos-La Joya fault there are a score of short outcrops running in various directions. Some of them are probably fractures due to the drag of the fault and I presume others will be found when the other parts of the district are resurveyed. The belief in the district is that these "branches" enrich the main veins at the

have no veins, has been crushed powerfully.

From all these facts, the somewhat elliptical arrangement of the veins, the tangle of crossing veins, the distribution of *ramaléos* everywhere, the reduplication of veins at the north and south ends, I judge that the veins have been formed by end pressure, parallel to their strike. The force operating was great enough to open two lines of fracture five miles long besides others from a half mile to a mile in length. The depth of mining on these fractures is only 1000 ft. at present, but they are undoubtedly very profound.

The curvature of the veins may point to flow of the rock and if the center of the district is really so barren of veins as the Mexican maps indicate there may have been crowding there. There is no doubt that the pressure and the splintering of the schist, like all the metamorphosing agencies, were regional, affecting the entire Guanajuato rectangle. The effects appear to have been intensified or concentrated on three lines, La

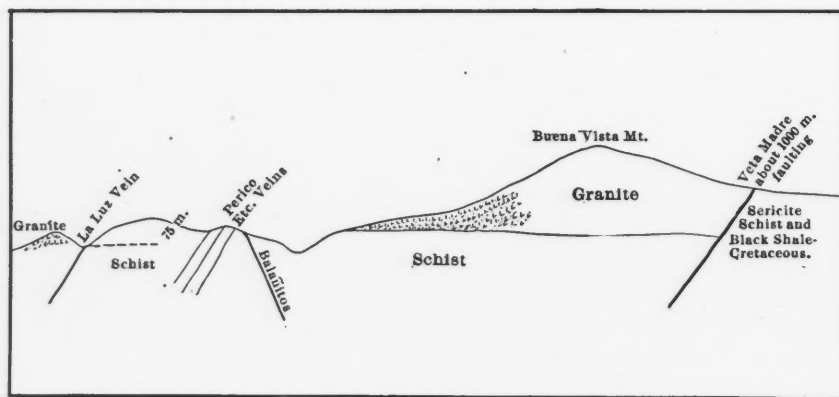


FIG. 4. SECTION, SHOWING FORMATIONS

junction. The distribution of these veins near La Joya vein is shown on Fig. 2.

The line of the veins is more sinuous in the southern end of the district than in the northern and more sinuous on the western side than on the east. The fault veins are remarkably straight and the parallelism between La Luz vein and the Bolañitos fault is noticeable. The two parallel fractures Melladito and Nombre de Dios, within 300 ft. of Purisima, show a tendency to slabbing which is also visible in Fig. 2.

The rock near the veins is crowded with irregular seams of quartz and calcite, called *ramaléos*, stringers. They are more or less abundant even at a considerable distance from the veins. In going down the Cuervo shaft, which is 210 ft. from the Bolañitos outcrop, I saw *ramaléos* as soon as the solid rock was reached, about 20 ft. down. The numerous shafts and pits all over the district, so far as I have seen it, show *ramaléos* everywhere. Evidently the whole district, except perhaps the center of the ellipse, which the map shows to

Luz, Veta Madre and Santa Rosa-Peregrina, and it is possible that, when the whole area has been surveyed carefully, facts will be discovered that will indicate the causes for this concentration. The east dip of Bolañitos fault is due probably to the local effect of the granite. Otherwise La Luz veins have a dip generally parallel to the Veta Madre and their strike is also parallel to that of the north end of the Veta Madre.

(To be continued.)

In a novel method of toughening metals lately introduced the metal to be treated is placed in a closed retort with a small quantity of mercury, says the London *Engineer*; the retort is subjected to pressure, and as it is heated to a point below melting temperature, a current of electricity is passed through the metal. Besides increased toughness, greater resistance to sea-water corrosion is imparted. The hardening is especially adapted for iron and steel, but is claimed to be useful for other metals.

Placer Gold Mining in the Cariboo District, B. C.

Numbers of men are being taken into the Cariboo district, B. C., to work on the placer-gold properties acquired from the Consolidated Cariboo Hydraulic Mining Company last year by Guggenheim interests, afterward incorporated as the Cariboo Gold Mining Company. Others are being employed in excavation and construction work on an enlarged water-supply system. Special stages convey the men about 100 miles from Ashcroft, on the Canadian Pacific main line of railway, to Bullion, the company's headquarters in British Columbia.

The old company obtained water for gravel washing from Morehead, Bootjack and Polley's lake reservoirs, but the ditch was cut away for nearly a mile and three-quarters, and washing cannot begin this season until after the lower section of the new ditch, from the Spanish lake system, has been completed, some time in July. The snowfall on the watershed supplying this mine was greater last winter than for several winters.

The mine is equipped with a gravity tram, hydraulic elevator and Loveridge derrick, and much preparatory work has been done. The new water-supply system, known as the Spanish lake system, is designed to overcome the chief difficulty under which the old company operated. Much preliminary work on the Bullion section was done before the coming in of the winter. Steam shovels are on the ground. The total expenditure on the Spanish lake system last season was nearly \$100,000; to complete it a further expenditure of \$450,000 to \$500,000 will be required.

A Large Gates Crusher

The new stone-crushing plant of the Dolan & Shepard Company at Gary, Ill., which has a rated capacity of 300 cu.yd. per hour, contains a No. 9, "K," Gates crusher, remarkable for its size. The top of the crusher hopper is 32 ft. from the ground and stands on a heavy concrete base rising 19 ft. from the floor. The output passes through two circular screens 4 ft. in diameter and 12 ft. long, which separate all pieces under 2½ in. in diameter, the size used for blast-furnace flux. The big crusher is capable of producing approximately 3000 tons of crushed rock in 10 hours.

Up to two or three years ago the standard size of rotary kilns in use in cement manufacture was about 60x6 ft.; at present the preferred size is from 7 to 8 ft. in diameter, and from 60 to 100 ft. long, a kiln of 100 ft. in length being favored by the majority of the progressive manufacturers.

Refinery of Rio Tinto Co., Port Talbot, Wales

New Works for the Production of Copper Ingots, Wire-bars and Cakes from Precipitate and Bessemer Bars Obtained in Spain

BY EDWARD WALKER

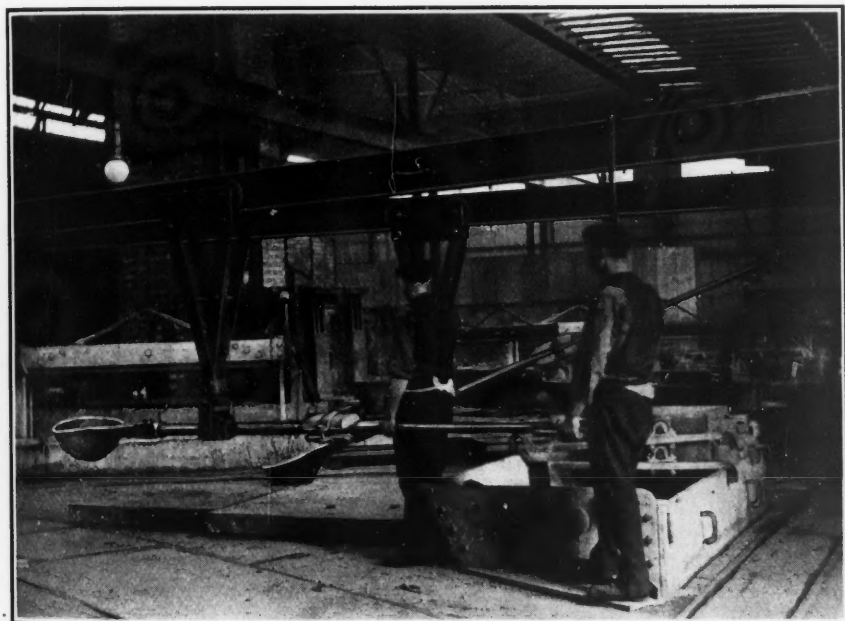
Until a few years ago the mattes and precipitates produced at the Rio Tinto mine in Spain were treated at the company's works at Cwmavon, a few miles up the valley from Port Talbot. Subsequently the bessemerizing process was introduced in Spain and the work at Cwmavon was correspondingly curtailed. The only operations left for the Welsh works were the refining and the production of ingots, wirebars and cakes. As a good part of the works was rendered useless, it was considered a suitable opportunity to move the scene of operations to a more favorable situation, and a piece of ground on the seaboard was secured, immediately adjoining the Port Talbot docks. Here the new refinery was erected, and opera-

draw up to the works and discharge directly into them. The works also adjoin the Great Western Railway, which communicates with manufacturing centers where the copper is consumed. Two other local coal railways have termini at Port Talbot, so that cheap fuel is at the doors of the works. Port Talbot is also in communication with Hamburg and French ports, and the distribution of the company's products to customers on the Continent is accordingly facilitated. On the return journey the company's steamer carries coal and other stores to the works in Spain.

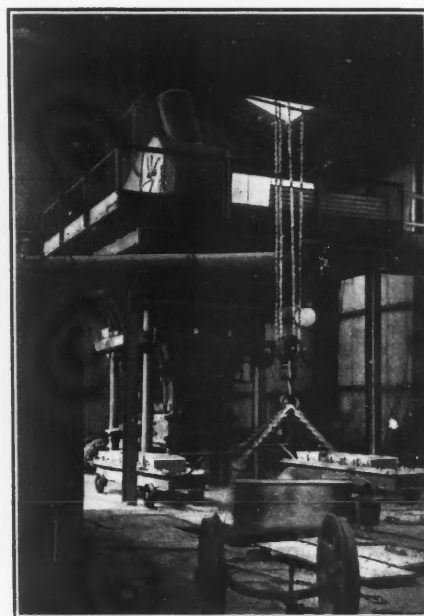
Casual observers might ask why the refining of copper was not moved to Spain, as well as the rest of the operations. It

operations on the most approved and most economical principles. Also, the Rio Tinto was not exactly a prosperous concern until it came under the management of those who are responsible for the present remodeling of the plant. It is only fair, therefore, to give every credit to C. W. Fielding, the chairman of the company, and to George Deer, the manager at Cwmavon, for the excellence of the work at Port Talbot.

The accompanying view shows the "Don Hugo" being unloaded. There are two Temperley transporters worked electrically, which carry the bags of precipitate and the bessemer bars into the ore sheds. There are five refining furnaces, each of 30 tons capacity. They are not



LADLES SUPPORTED BY OVERHEAD BEAMS



WATER-JACKET FURNACE

tions commenced about a year ago. Why the old works were located at Cwmavon is not quite clear, for it is a few miles both from the seaboard and from the Great Western Railway, and the cost of transport was therefore unnecessarily increased. Probably the situation was chosen because it was at the foot of a steep hill, up which a flue was built to catch dust and discharge the gases in an elevated and isolated spot.

CONVENIENCE OF THE NEW LOCATION

The position where the new refinery is located is an ideal one, for the company's vessel, "Don Hugo," bringing the bessemer bars and precipitates from Spain, can

is, however, as cheap to carry bars and precipitates to South Wales as to carry refined copper, and the carriage of the necessary fuel to Spain is obviated. Besides, South Wales is a more convenient distributing center for refined copper than Huelva.

When the new refinery was built the plans and arrangements were worked out on the most scientific and methodical principles. There is not a better designed or a better administered refinery in existence. Some people may say that a rich company like the Rio Tinto can afford all the latest and most improved plant, but I would point out that it is not always the rich mines and companies that conduct their

all in use at once. At present about 20,000 tons of copper are passed through the refinery every year.

THE REFINING PROCESS

The copper contains some precious metals, but there is no electrolytic refining at present. The refining furnaces present no novelty except that they are double the size of those hitherto used in South Wales. The charging wagons are operated electrically, being passed along a line over the tops of the furnaces. The slag is discharged from the side instead of being raked out at the front of the furnace. The furnaces are charged about 6 o'clock every evening, and the refining

process is completed about 10 o'clock in the morning.

The old ladles carried by hand have been abolished and larger ladles, the weight of which is supported on carriers, have been substituted. One of the illustrations shows a ladle containing five or six hundredweight supported on a traveling carriage that runs on rails. The handle at the other end is formed in such a way

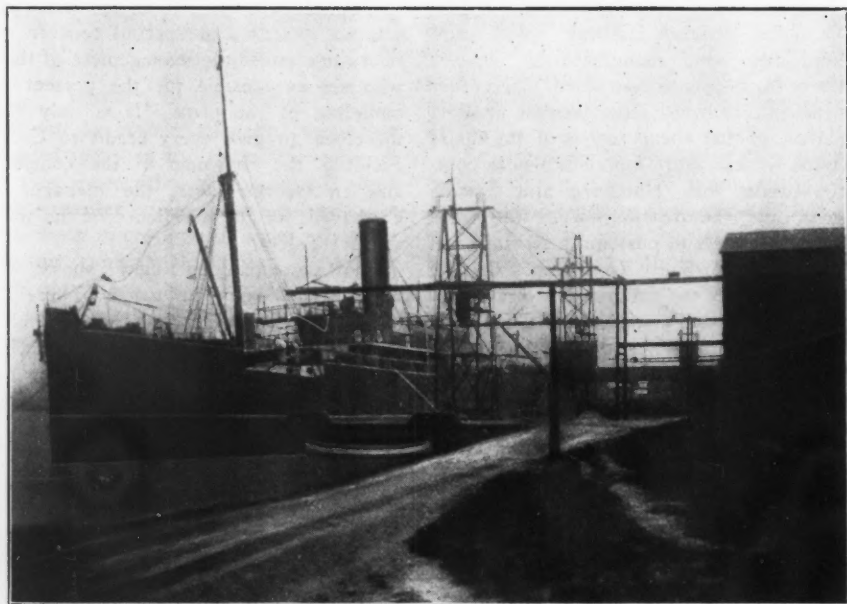
The slag and copper from the furnace are not discharged into molds fixed in the ground outside the furnace, but direct from the spouts into molds which are carried on cars. These are shown in the illustration.

The whole of the lifting and carrying of materials is effected by electric power, and the amount of hand labor is reduced to a minimum. The power is supplied by

The Magnetic Separation of Tin Oxide and Wolframite

In separating tin oxide from wolframite by means of the magnetic separator the Cornish mines have found an unexpected difficulty. Though tin oxide is not magnetic, considerable quantities of it pass over with the wolframite. This difficulty has been met with both at East Pool and at Clitters, and the engineers at these two mines have arrived independently at a solution and devised a method of removing this hindrance to the success of the magnetic process. The patent taken out by F. Dietzsch, consulting engineer, and J. Paull, manager of the Clitters mine (British Patent 23,567 of 1906) contains interesting details. It may be said in passing that the East Pool engineers combat the validity of the patent, claiming simultaneous or prior invention.

The patent in question states that it has been found that in magnetic separators for treating tin-tungsten ores magnetic substances adhere to the non-magnetic particles and so cause the non-magnetic constituents of the ore to be drawn out with the wolframite. This is found to be the case especially after subjecting the ore to a magnetic roast. The invention consists in treating the ore chemically so as to remove the magnetic iron oxide, or to reduce it to a non-magnetic oxide of iron.



RIO TINTO REFINERY—THE "DON HUGO" DISCHARGING

that the ladle can be guided to tip up and down, and to rotate round the axis of the rod which carries it. There is therefore no difficulty in scooping a ladleful out of the furnace. The carriage on which the ladle-rod is pivoted runs on wheels, which are provided with ball bearings, and a metal weight slides on the handle side of the ladle rod so as to counterbalance the weight of the charge. After the ladle is filled, it is withdrawn and brought to the molds, which are duly charged. After solidifying, the contents of the molds are tipped into the water bosh for cooling. The water boshes contain as an inner lining a sort of cradle with perforated sides, so that when sufficient ingots or bars have accumulated the cradle and its contents are elevated by means of a traveling electric crane, which runs the length of the building, and carried to the stock room.

Other ladles used for casting large cakes hold five to ten hundredweight, and these are not supported on carriages that run along the ground, but are suspended from wheels that run along the girders. These are shown in another illustration. The molds in which these cakes are cast are not tipped into water, but are carried by the electric crane to the cooling bath.

The slags from the refining furnaces contain from 4 to 6 per cent. of copper. These are smelted in a water-jacket furnace, which is shown in the illustration.



LADLE ON TRAVELING CARRIAGE AND WATER TANKS, RIO TINTO REFINERY

dynamos coupled direct to Westinghouse high-speed steam engines running at 425 r.p.m. The works also contain a laboratory, an interesting feature of which is the installation of electric heaters.

The limit of capacity of a centrifugal pump is fixed only by the limit of pipe sizes and sizes of passages in the pump.

This is done by leaching the ore with sulphuric acid and subsequently washing and drying before passing it to the magnetic separator.

Pig iron containing only 0.40 per cent. titanium has been produced in electric furnaces from sand containing 17 per cent. titanium oxide.

Some Practical Points on Mine Surveying

Slovenly Habits an Unmixed Evil, Accuracy Involving Little More Expense. Greasy Note-books May Be Replaced by Filing Cards

BY LAURENCE C. HODSON*

At many mines where the engineer may have to undertake the development, there will probably be but one instrument for all the surveying and leveling. It is evident that it must be an all-around instrument, and that if it is to fill all its functions in the very best way, it must possess a number of conflicting qualities. In such a case the selection of the instrument becomes a matter of compromise. It must be of high enough grade to allow of good triangulation work and not too sensitive for rough usage; light enough to carry around the surface, and on distant surveys in a mountainous country, and the horizontal circle graduated to 20 seconds of arc. For average surface work, moderately high magnifying powers are demanded, but the underground work will be at close range, and in poor light where small magnification is better. Taking all things into consideration, probably a 4 to 4½-in. horizontal circle reading to 20 seconds, full vertical circle, U-shaped standards, light mountain transit will outline the best instrument for the work. It should be procured from the best American manufacturers, and will be expensive. Something can be saved by omitting some of the usual extras. The U-standards and small circle will do away with a compass in the usual place. This omission will be disapproved of by some, largely from habit, I believe. As a matter of fact, the compass, as an attachment to the transit, does not earn its salt, and is a distinct disadvantage in the correct construction of the instrument itself. That the compass is not used, in fact scarcely expected to be used, is shown by its being put in the most inconvenient place for reading, and where at best, it cannot be read accurately.

POSITION OF THE COMPASS

The best place for the compass is in a trough which can be placed on the telescope and taken on or off as occasion requires. The length is then not limited to the distance between standards, but to the length of the telescope. It is therefore more accurate, since the sensitiveness of a needle is proportional to its length; it is in the proper position for observation, and the angle between the magnifying needle and the point to be observed can be accurately measured and

read on the transit verniers. This arrangement should satisfy the most exacting. Those who merely use the compass occasionally to guard against gross errors of angle reading, will find a pocket compass sufficient. The latter, especially if it is a Brunton pocket transit, can be used to advantage in taking side notes. The U-standard offers so many decidedly valuable constructive advantages that its use is to be always recommended. It will permit of lighter and at the same time more substantial construction. It presents a better appearance and is less apt to get out of order. Many would hesitate to use a 4-in. horizontal circle in triangulation work, but the amount of such work is small, permitting of extra care in repeating angles and of doing it on clear, still days.

An auxiliary telescope is not so much of a necessity for this class of work as is usually supposed. Certainly if the shafts follow a vein inclined at the impossible angle for one telescope, and if there is a reasonable amount of such work to do, the purchase of the extra telescope is justified. But if its use is only a convenience once or twice a year, a makeshift method should be used when required and the \$50, more or less, saved used in the purchase of conveniences which will pay their way.

THE SUBJECT OF TAPES

Don't stint on tapes. A 100-ft. tape will be the standard and if only one such is purchased, it will not last very long. A number of men in the party or around the mine can use a tape and probably only one man the instrument. Get two or more vest-pocket tapes for miscellaneous work. A long tape, 300 or even 500 ft. in length, will pay for itself in a short time in surface work in a rough country. A good many mine measurements fall between 100 and 200 ft., so a 200-ft. tape is sometimes just the thing. It will pay to study the question of tapes carefully. Have all graduations in feet and tenths or finer and the other side blank, not in feet and inches, which leads to confusion, sometimes to errors, and encourages borrowing habits on the part of the mine carpenter and timberman.

A good reel for each tape is a necessity, making for a contented chainman and a long-lived tape. The tape manufacturer

provides fancy reels which nine times out of ten are worthless. Unless absolutely sure of the make, the reels should be left out of the order and the mine blacksmith should be consulted.

Inexperienced help will be the rule, therefore all practical small conveniences should be ordered. For example, levels for plumbing rods will save time and temper. In the office the stadia slide-rule will be a great convenience in working up topography. The busy surveyor will be amply justified in ordering slide-rules and log and traverse tables.

MINE MAPS

The office exists mainly to furnish a place to work on the mine maps and to consult them. The place of honor should be furnished the map tables. The scale to which these maps are drawn will depend on the amount of detail to be shown. Not much can be given on a scale of more than 50 ft. to the inch. Many mines have a length of a mile on the lode and a width of two claims or 1200 ft. If one map is used, a sheet 60x106 in. will be required. Frequently mines have maps of this size and larger, with no better means of drawing on them than a flat table of the same size. The draftsman must stretch out flat on them when working up the middle areas. There is no better back-breaking device made. The maps are always dirty and in poor shape. The whole work is a botch and a money loser.

It will pay in the beginning to give the present and future needs of the mine, in the matter of maps, a thorough study. Without going into the subject very deeply, it may be pointed out that the facts to be shown on mine maps naturally group themselves as follows: Those facts which illustrate the character of the surface ground and improvements and their relation to points underground; the kind, extent and nature of ground penetrated in all underground openings; geological data, surface and underground, and metallurgical facts, as the value and kind of ore. Their use follows two general lines; they are the official records of the past and present development of the mine, and they are essential or of great help in planning development work and improvements.

Whether there should be a set of maps for each of these groups of facts will depend upon the individual case. In general the work of mapping will be greatly systematized and the readiness with which

Note—Slightly condensed from an article in the *Iowa Engineer*, May, 1907. VII, III, 127-132.

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¹For a method of carrying a survey down a shaft by transit without auxiliary telescope, see *ENGINEERING AND MINING JOURNAL*, May 16, 1903.

the maps can be consulted will be improved if the attempt to attain the impossible be abandoned in the beginning. All details cannot be shown on one map nor is it desirable that they should be. Take the surface group for illustration. One map will be needed, showing property lines, roads, trails, buildings, streams, etc., and for the surveyor's convenience, some of the permanent survey points. So far a small scale only is needed; in fact the small scale is best, since the eye can grasp essential facts, when brought together on one compact sheet better than scattered over a larger surface. However, some parts of the surface, for example around the shafts and mill, require greater detail. These data should be given on separate sheets, called detail sheets and finished as required. Their number, the scale, etc., should be planned in the beginning, their position shown on the main map, and reference points given on each detail sheet, so they can be brought together and displayed as a whole. The underground facts should be treated in the same way. In order to make the plan a consistent one, a style sheet should be worked out in the beginning, showing just what facts are to be placed on the main map, what on the detail sheets and just how each fact is to be represented. With this style of mapping the equipment of the office is simplified. The maps will all be of the same size on Whatman's mounted drawing paper or similar material, and drawn on a convenient drawing table. All maps can be kept flat and filed in drawers in a compact manner away from dust. If the powers that be demand all details on a large map of small scale then a long table with rounded edges and rollers underneath for taking care of the extra width is needed. Some protection should be provided for the map where it passes over the edge of the table.

SURVEYING

Before surveying begins, the surveyor should look over the field, and fix upon the proper position for permanent monuments. The system should be planned as a whole, allowing of course, ample room for expansion. With good judgment in their selection, a small number of triangulation stations can do such excellent service that any point required on the mine surface can be reached by a 300-ft. tape from the instrument set up within view of two triangulation stations, if the country is suited to triangulation work at all.

Any survey worth doing, is worth doing well and preserving both in the notes, and on the ground, unless from its nature it is a temporary affair. Beware of the word temporary—no one can always surely say what will be temporary or permanent in a survey.

This question will soon arise, "What

degree of accuracy is necessary?" It is usually considered accurate enough in a mine survey if the closure is within a sphere of 1 ft. So far as any one closed survey is concerned this is certainly good enough, but who can tell what the end of any particular survey will be? A successor may pick up an intermediate point and project it on into an important survey, and the first surveyor become discredited. There is a satisfaction in doing good work with good closings, that is of far-reaching effect in the *esprit de corps* of any surveying party. Beware of slovenly habits. Is anyone gifted enough to say just what amount of slovenly work can be done in any particular case, resulting in just the allowable error and no more? After all how much is saved by doing unimportant work just a little bit carelessly? The survey in which the closure allowed is say 1 ft., may, in fact, nearly always does, cost just as much as the one in which the allowed survey is say 0.2 ft.

NOTE-BOOKS

Note-books are a source of trouble in any survey, more especially in underground work. The surveyor who can keep a clean note-book which tells any other surveyor just what was done, and how, in a wet mine, using candles for light, is a rare man. This greasy book has to be handled in the office when mapping, causing soiled hands and maps. Again if an engineer is employed in the office he will often need the book when it is in use underground. Bad as the note-book is it is better than the opposite plan of taking notes on scraps of paper and transferring them to clean note-books. This practice prevails at one well known mine. It is hardly necessary to point out its faults.

I have tried the following plan which seems to eliminate all difficulties. Cards of the size of ordinary filing cards, are ruled in columns for note taking. Sheets of paper of the same size are ruled in the same way. These are placed in an envelop of oiled paper, the front of the envelop being printed with the same form as the card, and bearing the same serial number. For note taking the outside of the envelop is used, but copies are preserved on the card and sheet by means of carbon paper. The clean card is filed in a card-index cabinet and is not to be removed from the office, while the sheet is kept in a loose-leaf note-book, which can be carried whenever it is needed. By good indexing and use of different colored cards for each class of surveys, all notes become instantly accessible at all times, no matter what note-book happens to be out of the office.

The export of gold from Venezuela in 1906 was valued at \$439,684, against \$295,718 in 1905.

Production of Monazite in 1906

According to the U. S. Geological Survey, the monazite produced in the United States in 1906 all came from North and South Carolina. The output of crude sand amounted to approximately 2,000,000 lb., averaging about 30 per cent. monazite. The grade of this sand was so variable, and the prices realized on different lots were so irregular that cleaned sand has been used as an estimate of the quantity of monazite produced, an additional reason for so doing being furnished by the fact that the greater part of the crude material is cleaned by local mills before shipment, and the grade brought up to 80 per cent or more of monazite. On a basis of 80 per cent. production, North Carolina produced 607,275 lb. of the mineral, valued at \$125,510; and South Carolina, 148,900 lb., valued at \$26,802; the total for the United States amounted to 846,175 lbs., valued at \$152,312. The production for 1905 amounted to 1,352,418 lb., valued at \$163,408. This amount represented in part crude and in part cleaned sand—a fact that explains the increase in quantity without corresponding increase in value.

The condition of the monazite market in the United States in 1906 was fairly strong, despite the fact that the price of thorium nitrate, which is manufactured principally from monazite, was reduced nearly one-half early in the year by the German thorium combine. Though made with the intention of killing all competition, this cut has resulted only in the temporary closing down or the bankruptcy of a few of the smaller companies.

Meerscham in New Mexico

Mines of meerscham are located in the Diablo range of mountains, about 20 miles northwest of Pinos Altos, to which a branch of the Santa Fe Railroad runs from Deming. There have been stripped two true fissure veins, continuous for 1500 ft. each, in which meerscham is carried between strongly defined walls in widths of 20 in. A wagon road is now being built from the mines to Pinos Altos, a distance of 20 miles, and when this is completed the meerscham will be marketed. The properties belong to the Meerscham Company of America.

Recently a fire and load test of a reinforced concrete beam has been made. The beam, 17 ft. 4½ in. long, was heated up to about 1000 deg. C. under constant load. The beam sagged while the temperature rose, until almost 5 in. out of the straight three hours from the start, and upon cooling the total deflection was 8 3/16 in. Large pieces of concrete had scaled from the beam.

Tail-rope Haulage with Continuous Drive

An ingenious mechanism for reversing the direction of ore-cars, dumping into pockets, is in use at the West Vulcan mine of the Penn Iron Mining Company, at Vulcan, Mich. Instead of the usual method of reversing the driving motor or engine, the reversal is accomplished by changing the direction of rotation of the sheave. The details are shown diagrammatically in the illustration herewith. The shaft *M*, connected to an electric motor, turns the gear *A* engaging with the gear *B*; this turns the shaft *N* in the opposite direction to *M*. The shaft *N* carries gears *C* and *F*, which mesh with gears *D* and *E* externally and internally respectively; gears *D* and *E* will therefore turn in opposite directions. The latter rotates

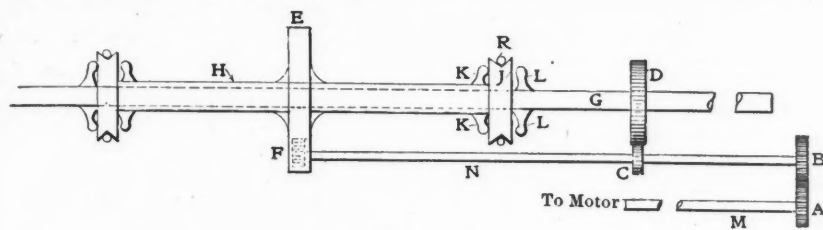
AN AUTOMATIC TRIPPER

The car used with this tail-rope haulage is designed to dump from the side into any one of several bins, depending upon the grade of ore being hoisted. The bottom is inclined at about 45 deg., which allows the ore to slide out by gravity. Only one-half of the volume of the car holds ore, but as each of the two cars used carries one skip-load, this makes little difference. The car is well built throughout, and is giving satisfactory service on the trestle. At each pocket there is a tripper, which is set at a different height from the next one. The wheel *A* is set, at the shaft-house, so as to come in contact with the desired tripper which causes the wheel to rise, carrying with it the bar *BC*. This lifts up the lever *F*, lowering the catch *G*, which is pivoted at *H*. The door-catch being disengaged from

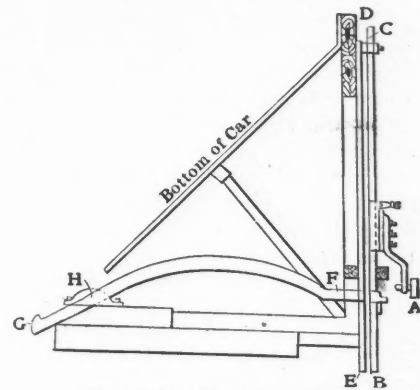
The Copper Mines of Servia

BY WALTER HARVEY WEED*

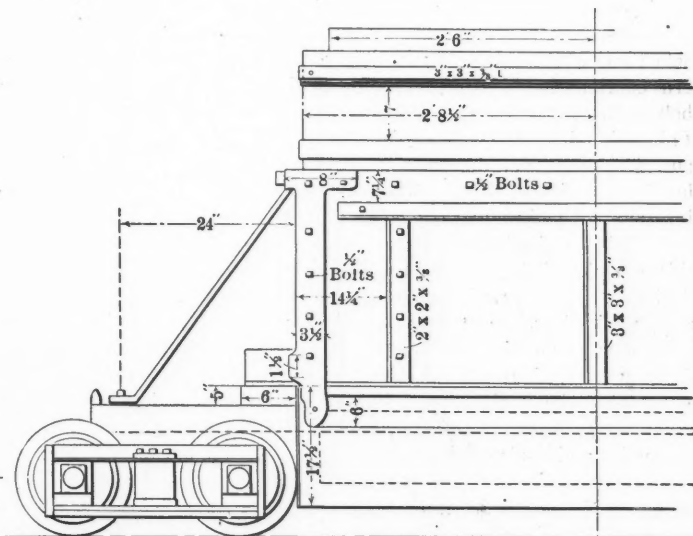
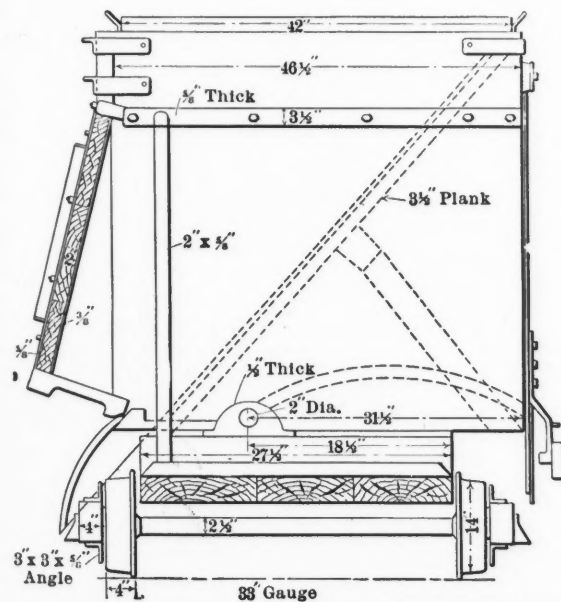
Copper mining in Servia has been carried on for many years, though the amount produced has been small and no deep mining has been attempted. A few years ago the government, in order to develop the mining industry, adopted a new policy, granting concessions for large areas, covering the more important deposits, as an inducement for the investment of capital in the building of transportation lines and roads, and for the proper development of



DIAGRAMMATIC ARRANGEMENT OF REVERSING-GEARS



DETAIL OF RELEASING DEVICE



SIDE-DUMPING CAR USED WITH TAIL-ROPE HAULAGE

the hollow shaft *H*, and the former the solid shaft *G*, which fits loosely in *H*. The sheave *J* fits loosely on *G* and is wide enough to allow three or four turns of the rope *R*. Several sheaves and ropes may be used on the same set of shafting. The friction clutch *KK* is bolted to shaft *H* and similarly clutch *LL* is fastened to shaft *G*. When *KK* is thrown in against *J* the sheave revolves with shaft *G*, and when *LL* engages the sheave reverses and rotates with shaft *G*. The motor-shaft *M* revolves in a constant direction at all times.

G, permits the door to swing free and the ore slides down the inclined bottom into the pocket. By using this system electric locomotives or tramping by men is dispensed with, and the ore is handled with comony and despatch.

Silicon is not necessarily the cause of carbon coming down as graphite. Phosphorus reduces the percentage of combined carbon and the depth of the chill, while for manganese the reverse holds good. Aluminum reduces the depth of chill and converts white iron into gray.

the deposits themselves. The result of this work is now apparent; one of the two companies produced 1,257,289 lb. of copper in the last half of 1906, while the other company has completed its preparatory work and finished a reduction plant consisting of concentrating mill, smelting plant and acid works, and will be an active producer in 1907.

The mines are situated in the eastern part of the country, in the eastern spurs of the Balkan mountains, a region which

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has been devoid of railroad or water transportation except that afforded by the Danube river. This stream, which forms the northern boundary of the country, is navigable for six months of the year and has heretofore been the only outlet. The copper and gold mines of the region have recently been described by Iovanovitch, who gives a full account of their history, geological features and present condition, and these notes are abstracted from his work.¹

The two districts of greatest importance are Maidenpek and Bor, located about 80 miles southeast of Belgrade. The Maidenpek district has long been known to students of ore deposits, having been described by von Cotta and other well-known writers many years ago. The village, near which the mines are located and from which they take their name, is 10 miles from Milanovac on the Danube river. An overhead wire tram connects the mines and the river. The Belgian company which owns the mines (La Societe des Mines du Cuivre de Maidenpek) controls the entire district, having a concession of 18,800 hectares (46,455 acres). Under the old régime the ores, which averaged about 3 per cent. copper, were treated in blast furnaces producing a black copper, which analyzed 96 per cent. copper; 2.10 iron; 0.67 sulphur; 0.05 zinc; 0.06 nickel; 0.03 cobalt; traces of antimony and arsenic, and 13.214 oz. of silver and 1.244 oz. of gold per ton.

The district is underlain by gneiss, mica-schist and amphibolite, forming the southern continuation of the crystalline schist belt of the Carpathian range. Argillaceous Paleozoic slate and Mesozoic limestone and dolomite cover the country generally, but in the mining district they are cut by igneous rocks, the oldest being serpentine and olivine euphatites with later andesites, this complex being cut and overlaid by dacites and microgranite-porphyrries which are genetically related to the ore deposits.

The ores contain chalcopryrite as the dominant ore mineral, but bornite, covellite and copper glance also occur. The gangue is quartzose. Pyrite masses with admixed magnetite and chalcopryrite also occur, the ores carrying from 0.3 to 1.5 per cent. copper, which will be extracted after acid has been manufactured. The new works will treat about 120 tons of 3 per cent. ore in the furnaces and 280 tons of the pyritic ore will be treated each day in the lixiviation works.

The ores are found at the contact between andesite and either mica-schist or limestone; but veins in the andesite also occur. Quartzitic deposits are found in a belt 4 miles long, with a coördinate width and depth.

The Bor deposits are in a district about 30 miles south of Maidenpek. The district is a volcanic plateau averaging about

1500 ft. above the sea. It lies in the midst of hills of Cretaceous limestone 800 to 3000 ft. high. This plateau includes a group of little villages, Bor, Zlot, Metovnica, etc., from which the deposits take their names. Throughout the entire district andesites of varying color, texture and mineral composition prevail. They are mainly amphibole-, augite, or hypersthene-andesites. The ores consist mainly of pyrite and chalcopryrite, usually in a hard, compact and uniform mixture, which fills the entire vein.

The Compagnie Francaise des Mines de Bor owns the St. George concession, which covers the communes of Bor, Krivelj and Ostrelj, comprising a 50-year concession for 2400 hectares and a renewable lease on 6500 hectares more. The ores occur in fissure veins traversing andesites and volcanic tuffs and breccias. The veins are wide, varying from 50 to 103 ft. (at Cuka-Dulkan). They have a general north-south course and extend along a belt a mile or two wide and 10 miles long. They are from 1300 to 1967 ft. apart, but are not traceable for more than a few hundred feet along their course. The veins are usually found at the contact between solid, unaltered andesite, and propylite, the altered form. This latter rock covers large areas. The vein filling at Bor and at Krivelj consists of pyrite and of chalcopryrite, with covellite-bornite, chalcocite and enargite, as well as small amounts of galena and blende. The ores contain small but recoverable values in gold and silver. Rich ore also occurs in fragments and balls scattered through a mass of leached kaolinized rock.

As indicating the size and richness of the deposits, Iovanovitch gives the results of the detailed sampling of several veins. That of Cuka-Dulkan gave 6 per cent. copper with 29 to 75 per cent. silica and 11 to 23 per cent. iron for the average of all samples taken 1 m. apart across a vein 27 m. wide. At Krivelj the vein is 12 m. wide and carries an average of 5.5 per cent. copper as bornite, glance and chalcopryrite. At Crveno-Brdo there are three irregular ore chimneys and the deposit has been developed for a length of 250 m. and a depth of 70 m., showing an average width of 26 m. and a content of 7 per cent. copper. Limonite-gossan outcrops are common in almost all the ravines of the region.

The new Bor reduction works contain two Fraser & Chalmers blast furnaces, four converters and 360-h.p. Babcock & Wilcox boilers. The book contains analyses of clays and quartz used for converter linings as well as of roasted ores, flue-dust, slags, etc. The latter vary from 0.38 to 0.64 per cent. copper. A branch of the Budapest-Constantinople Railway is under construction to the district.

Recently the United States Steel Corporation at its works at Canton, Ohio, made a heat of 30 tons of vanadium steel.

Moose Mountain Iron Mines, Ontario

SPECIAL CORRESPONDENCE

The Canadian Northern railway system having been completed as far as the Moose mountain iron mines, in Hutton township, Ontario, some 30 miles north of Sudbury, shipments of ore will shortly be commenced. According to Eugene Coste, of Toronto, there are in these mines millions of tons of excellent ore. For the time the ore will be transported by rail to the lake and shipped thence to smelters at Midland and Hamilton, in Ontario, and probably to United States points as well. There is another ridge of iron-bearing country about 30 miles north of Moose mountain, and the early extension of the Canadian Northern railway to these deposits is expected.

Professor Coleman, of the Ontario Bureau of Mines, some time since examined the Hutton township iron range (see Report of the Ontario Bureau of Mines, 1904, Part I, pp. 216-221). A report by Chas. K. Leith, professor of economic geology, University of Wisconsin, who made a somewhat detailed examination of the area during the fall of 1902, was published in the report for 1903 of the same bureau (pp. 318-321). In making a comparison with the Vermilion iron range, of Minnesota, Professor Leith notes several points of similarity, but in other respects there is a marked difference. Among the latter is the character of the ores, the Moose mountain ores being magnetite while those in the Vermilion range are hematite. Professor Leith further observes that the differences noted are such that in the absence of any structural connection with the Vermilion district any correlation of the Moose mountain and Vermilion iron-bearing series would be a mere guess.

Professor Coleman gives the following analysis of iron ore from Moose mountain:

	Per cent.
Ferrie oxide.....	58.30
Ferrous oxide.....	28.08
Silica.....	7.92
Alumina.....	1.22
Lime.....	1.28
Magnesia.....	2.35
Sulphur.....	0.056
Phosphorus.....	0.011
Manganese.....	0.20
Titanium.....	None.
Total iron.....	62.64

The ores are similar in character to some of the Swedish magnetites. The deposits are controlled by the chief owners of the Canadian Northern Railway.

If a can of gasoline be left open near a flame it is likely to explode by ignition of its vapor and water is useless as a means of quenching the flame. Alcohol does not have this objection as it mixes with water in all proportions, and in so doing becomes non-inflammable.

¹"Or et cuivre en Serbie orientale" par Douchan Iovanovitch, Dunod Pinat, Paris, 1907. Price, 10 francs.

Stoping With the Air-hammer Drill

A Record of Practical Experience in Stoping and Other Mine Work with the Air-hammer Drill at Cripple Creek

BY G. E. WOLCOTT*

The past few years have witnessed a great deal of experimental work by mine operators and mining-machinery manufacturers upon the problem of producing a rock drill that would replace the cumbersome and costly piston machines heretofore in use, which have held their own in spite of many recognized drawbacks. Most of this experimental work has been with the development of the air-hammer drill. It is the purpose of this article to record the actual results where this type of drill has been in operation for a considerable length of time.

The Findley Consolidated Gold Mining Company has had this type of machine in operation for a considerable length of time and has entirely replaced the piston drill with it for overhead stoping operations. The machine used is the Murphy rock drill, manufactured by the

from 6 to 8 ft. between the broken rock and the roof. In starting to drill all that is necessary is to lay a short plank on top of the muck pile, place the point of the air-feed upon this and start the machine. In practice it is easy to begin drilling in less than 15 minutes after entering the stope, all that is necessary being to bring the machine to place and connect the hose. A plank to stand the air-feed upon is not even necessary, as when the broken rock lies rather close to the roof the end of the air-feed can be thrust into the muck pile and drilling carried on as well as with a plank to rest upon.

I have seen a miner when short of steel put in a 5-ft. hole with one length. This was done by starting the hole with the end of the air-feed well down in the muck pile, and drilling to the end of the

and this, catching the falling particles of dust, throws them into the eyes of the operator. This is overcome by the miners by placing a hood over the end of the machine, with a rubber band holding it tightly around the steel above the shank. This hood is usually made by cutting off a portion of the leg of a pair of discarded overalls, and turning one end down over the other, the rubber band being first placed in the middle. By this simple device the dust difficulty is almost entirely overcome.

A NEW FORM OF BIT

The drill used at the Findley mine is a radical departure from that usually used with machines of this type. Usually the six-point bit has been used with hollow steel; and the six-point or cross bit with solid steel. At the Findley, the single

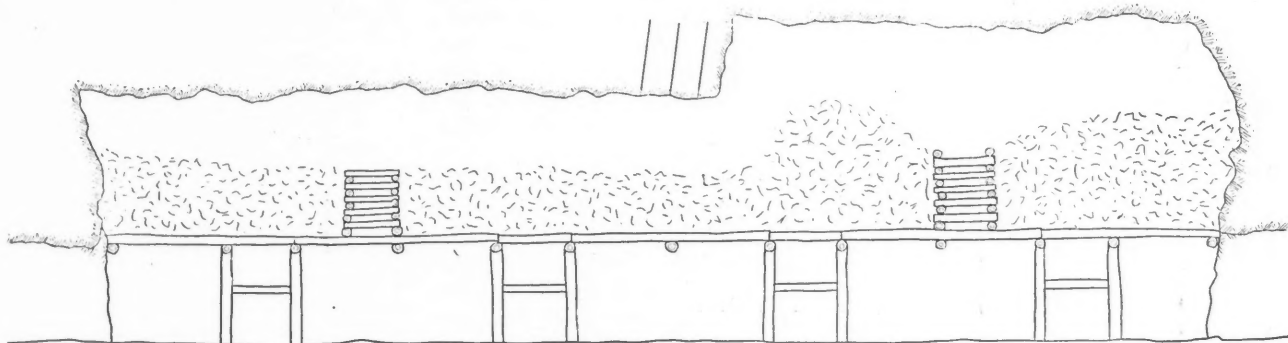


FIG. 1. METHOD OF STOPPING

C. T. Carnahan Manufacturing Company, Denver, Colo. It is not the purpose of this article to advertise any particular make of drill, as there are now several machines on the market, any of which may be better or worse than the one here in use. The point to be emphasized is the fact that the air-hammer drill has come to stay, and to my mind, is destined to replace almost entirely the heavier piston machines for all overhead work. For sinking and drifting it has not as yet so clearly demonstrated its superiority, at least not to my knowledge.

METHOD OF STOPPING

At the Findley mine the machine used is surmounted with the air-feed attachment. The method of stoping is the ordinary filled stope system, as represented in Fig. 1. The ore is drawn out from the stopes so as to leave a working space of

air-feed; this done, the machine was raised upon a plank and finally two large boulders were placed one upon the other on top of the plank, the machine being mounted on them and the hole completed. While this does not of course represent good practice, it shows the adaptability of the machine.

PREVENTION OF DUST TROUBLE

Considerable adverse criticism has been offered on account of the amount of dust raised in the stope where hollow steel is used with part of the exhaust escaping through the steel. This is indeed a serious objection to this style of drill. However, under most circumstances, hollow steel is not necessary for overhead stoping, and with solid steel the amount of dust raised is, under proper working conditions, much less than would be the case with the piston drill. With the Murphy drill a part of the exhaust escapes around the shank of the steel,

bit is used as illustrated in Fig. 2. With this bit it is necessary to turn the steel one-half way round instead of one-quarter or one-sixth, as with the other types. In general appearance this steel seems unwieldy and inefficient. Difficulty would be expected in starting holes or stoping faces and from fitching in seamy ground. From the blunt point (about 90 deg.), poor cutting efficiency also would be expected. In practice, however, it has given the greatest satisfaction. While fitching more readily than the six-point drill, it will pass seams much more readily than the piston machine, and a hole may be started on a sloping face with very little difficulty. With the blunt point it is possible to give the bits a very hard temper without danger of breakage. By referring to Fig. 2, it will be noticed in the plan of the bit that the distance between the corners of the bit $a-b$ and $a'-b'$ is greater than that along the chisel point $c-c'$. It is therefore evi-

*Cripple Creek, Colo.

dent the the corners $a'-c$, $a-c$, $b-c'$ and $b'-c'$ must act as cutting edges, and to this fact the drill owes, in a great measure, its efficiency.

The amount of rock to be cut in a hole varies as the square of the distance from the center, and on this account the further from the center of the bit the greater should be the number of cutting edges.

To make the matter clearer, reference should be made to the small diagram marked *D*, Fig. 2, in which *AB* is the diagonal of a parallelogram, while *CC* being equal to one side must be shorter. Therefore *CA*, *BC*, etc., must act as cutting edges, as the chisel point *CC* will not cut a hole of sufficient diameter to permit the rotation of the entire bit. It is impossible in practice to make a bit that

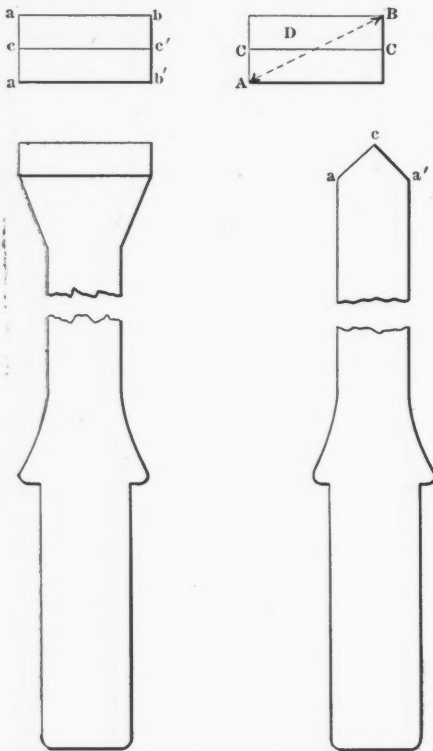


FIG. 2. BITS FOR DRILL

will correspond mathematically in cutting edges to the amount of rock to be cut, but the nearer this is accomplished the greater should be the drilling capacity before re-sharpening. In practice, if the number of points be multiplied the necessity of making the bits small renders it impossible to form one that will stand in hard rock; while in soft rock the bit will not clear itself of the cuttings. Both of these difficulties are overcome by the style of bit here shown, and we have in it one that will stand well in hard ground, and also clear itself readily in soft ground.

STOPING CAPACITY

With regard to stoping capacity it is impossible to make an absolute comparison between the air-hammer drill and the piston drill, for the reason that the

amounts of rock broken will vary with the quality of the ground. Moreover, in narrow veins the value of the air-hammer drill is not measured solely by the amount of rock which it will break.

At the Findley mine most of the veins are in phonolite, which varies greatly in hardness, but in most cases is dry enough so that holes will clear themselves readily up to an angle of 20 to 30 deg. from the vertical. Stopping operations are carried on as shown in Fig. 1. Holes are drilled parallel to one another and at a slight angle from the vertical so as to allow the drill cuttings in falling to clear the machine. With the air-hammer drill it is possible to place the holes as desired and in the proper direction, while with the piston drill, using a bar, the holes must radiate from the bar as a center, and furthermore, the number of holes drilled is limited by ground in reach from the set-up. In ground such as is found in the Findley mine, the $2\frac{1}{4}$ -in. piston drills will not average over 25 ft. of drilling per eight-hour shift, and the depth of hole drilled is very seldom over 5 ft. With the air-hammer drill the average number of feet drilled is 40, or over, and the holes will average over 5 ft. in depth. Seven- and eight-foot holes are not uncommon in good drilling ground, the bottom of the hole being a little over 1 in. in diameter. Some difficulty is occasionally met in getting drills out of the hole where the ground does not clear readily, and for this purpose the tool shown in Fig. 3 is used. It is simply an iron bar shaped at the end like a chuck wrench, which is placed over the shank of the drill and pounded with a single jack. Solid steel, $1\frac{3}{16}$ in. diameter, is used for all lengths of drills, the shanks being upset upon the steel. Breakage of shanks or bits is comparatively rare.

ADVANTAGES OF THE AIR-HAMMER DRILL

With the bits used the chisel point is seldom dulled, and the steel is usually discarded from the fact that when the outer cutting edges are slightly worn it becomes difficult to turn the bit in the hole. For this reason it is desirable that the sides of the bit $a c a'$ — $b c b'$ in sharpening should be slightly concaved. This gives the bit a longer life as well as adds to its cutting efficiency.

With regard to the air consumption, a fair comparison can hardly be made on the basis of the number of cubic feet of free air per minute. Such a comparison would be unduly favorable to the air-hammer drill. The piston drill is running at most no more than one-half of the time in an eight-hour shift, while the air-hammer drill is running the greater part of the time. On this account the air-hammer drill, while perhaps not consuming one-half the amount of air per minute that the piston drill will, may con-

sume almost the same amount per shift. This same fact is the reason for the larger number of feet drilled. It is a mistake to assume that the value of the air-hammer drill lies in the fact that it will drill faster than the piston machine, for under most circumstances it will not. Its value lies in the fact that it can be more simply and lightly constructed, thus entailing less expense for first cost and less for repairs; and to the fact that less time is consumed in the stope in setting up, tearing down, changing steel, etc.

At the Findley the air-hammer drills have replaced the piston drills for both raising and stoping. In driving raises they have the disadvantage of not being able to pull the cut holes as well as the larger drills, as, owing to the smaller holes, the powder cannot be placed at

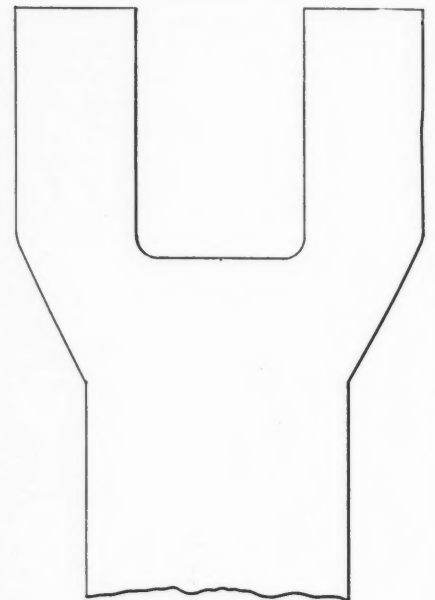


FIG. 3

the bottom of the hole where it is desired in this class of work.

There are comparatively few American smelters who are equipped, or are in a position, to extract silver and lead from the zinc ore which they treat. There will doubtless be, however, an extension of interest in this direction. In such cases, as the smelters are especially in the market for this class of ore, the practice in purchasing is similar to the European. Thus, one contract for Canadian ore provided for the payment of silver in excess of 8 oz. per ton at the rate of 50 per cent. of the New York quotation for silver. On an ore assaying 20 oz. silver per ton, 40 per cent. zinc, and over 5 per cent. lead, a price of \$9.50 per ton f.o.b., London, was made in August, 1905; with a zinc variation of 75c. per unit above or below 40; and a silver variation of 40c. per oz. above or below 20.

New Machine for Drawing and Loading Coke

A Device Which Employs Drags or Hooks of the Usual Form Operated by Means of Wire Rope and Winding Drum

B Y W . M . N I X O N *

In the manufacture of coke from bee-hive ovens drawing or pulling the hot coke from the ovens is hard, hot, disagreeable labor, requiring strong men who can endure great heat. The usual practice in the production of furnace and foundry coke from bee-hive ovens, burned from 68 to 72, and in some instances 96 hours, the drawing is all done by hand, the operator first wetting down the hot coke in the oven, when with a hook or drag, or an implement called a "beaver" the operator pulls the steaming hot coke in small batches out at the oven door and lets it fall at his feet to cool, with or without more wetting. The coke is much brighter when watered only in the oven.

After the coke is thrown back on the yard and allowed to cool and dry out, it is loaded into the railroad cars by what are termed loaders. The loading is accomplished by shoveling or forking the coke from the yard or wharf over the side and top into the car, or it is sometimes run into the door of the car on a wheel-barrow. In case of box cars the loading can only be accomplished in this way, or by throwing into the middle of the car and again shoveling it back into the ends of the car. No class of labor is harder to obtain or hold than coke oven labor. For this reason the operators of coke ovens in some sections of the South are paying this labor in cash every night in an effort to attract capable men from other work and maintain a sufficient force to keep the ovens in operation. Negroes and Italians have so far proved best adapted for this heavy, hot work, as American labor is rarely equal to the task.

The results accomplished depend upon the varying conditions at each coking plant, such as the size and design of the ovens, the character of the coal used, the size of the charge, the time of burning, the width and height of yard or wharf, the character and size of railroad cars to be loaded, the method of handling them, and many other conditions and contingencies. But under the most favorable conditions the labor is so strenuous and disagreeable that not more than three or four ovens per day per man can be depended upon. At some plants the puller and loader work together, attending to the pulling and loading of the coke from a given number of ovens, rarely more than six or eight ovens per day for two men, and

this they regard as a task and do not attempt more. In summer time it is usual for the puller to commence work at 3 or 4 o'clock in the morning to accomplish his task before the intense heat of the day comes upon him.

COKE SUFFERS FROM WANT OF PROMPT ATTENTION

It is said that making coke is like baking bread, when it is done it begins to burn or deteriorate, unless it is promptly attended to. Allowing it to remain in the oven after it is ready to pull, not only injures the coke by loss and increase of ashes, and loses the use of the oven for another charge, but to some extent permits the oven to cool, which is heat lost, to be regained only with and at the expense of the next charge.

At the present time coke oven labor is in such great demand that every excuse to lay off is accepted or availed of, which results in the finished coke being held in the ovens. A scarcity of cars, an accumulation of coke on the yard, and every other excuse is availed of for a lay-off, all at the expense of the quality of the coke, the output of the ovens, and enhanced cost of operating and production.

THE SUBSTITUTION OF MACHINES FOR MANUAL LABOR

Several machines have been devised to overcome these difficulties, but many objections have developed among which are the following:

1. A specially designed oven for the purpose with large doors and other requirements, nearly level bottoms, etc.
2. The machinery is heavy, unwieldy and more or less complicated and uncertain in its results. Some machines are operated by electric power and require high-class operators.
3. Machines are expensive in first cost or investment, and the ovens and equipment are a loss, if the installation is not successful.
4. Some machines injure the ovens and shorten the life of the plant, tearing out the door jambs and the tile bottoms.
5. Some machines require a clear yard, or they cannot operate when most needed.
6. Other machines carry the coke direct, while hot, from the oven to the railroad car without permitting it to cool off making necessary a stoppage of operations when there are no railroad cars, etc.

THE NIXON PATENT COKE MACHINE

The accompanying illustration of the Nixon coke machine, shows that the coke is drawn by means of the same character of hook, drag or beaver, as is used by hand, but of a heavier and stronger construction, and the manipulation in engaging the hook is done in the usual way, but the pulling is done by machinery in much larger chunks or batches, so a smaller number of loads, pulls or drags, should practically empty an oven. This device permits the directing and manipulating of the drawing tool the same as the present hand operation. The equipment of an ordinary plant of ovens with this machine when conditions are adapted can be done for approximately \$2500, in some instances for much less.

No change in design, construction or operation of the ovens is necessary. The plant can be operated one day or one week with this apparatus, and the next week or the next day return to the present hand method without a single change. By this method every other oven can be drawn or every other pile of coke loaded. Yet the device can be used either to draw or to load the coke, or do both, or to clean up the yard by drawing or stacking up the coke.

CONSTRUCTION OF THE MACHINE

There is a line of track on top of the ovens between the funnel heads and the coping; the closer to the coping the better, so that the track is anchored safely. On this track is mounted a small quick-motion, reversible hoisting engine operated from a line of steam or air pipe near the center of the ovens, or alongside one of the track rails operating the usual charging car. Connection from this supply pipe to the hoisting engine is accomplished by using a length of air or steam flexible hose, long enough to cover two or three locations of the engine. The hoisting engine carries about 100 ft. of $\frac{1}{4}$ - or $\frac{3}{8}$ -in. wire rope, which works around a sheave at the extremity of the boom in front of the ovens. The hoisting engine is mounted on wheels and easily moved from one place to another on the track.

When the conditions warrant, the power can be connected to one of the axles, that the engine may be moved by its own power when desired. The guiding sheave on the end of boom in front of the ovens is on a swivel bearing, open style, and quickly moved from place to place, vertically or horizontally to permit

*National Coal and Coke Company, Chattanooga, Tenn.

the proper pull required in manipulating the coke-drawing hook, or drag, and the loading rake or the buggy or receiving car. The pull rope is attached to a hook at the end or middle of the handle of the drag or rake, or up at the hook where the latter is joined to the handle. This permits a direct pull from where the hook is engaged, or has caught in the coke.

OPERATION OF DRAWING

The coke puller operates the hook or drag in the same way as at present, except that he catches loads three, four, or five times as large or heavy, and has the pulling out done by the hoisting engine. As soon as the load is delivered on the yard the pull rope is released entirely

wiggling and sweeping manipulation of the present hand method can be accomplished, but it is not required with this device.

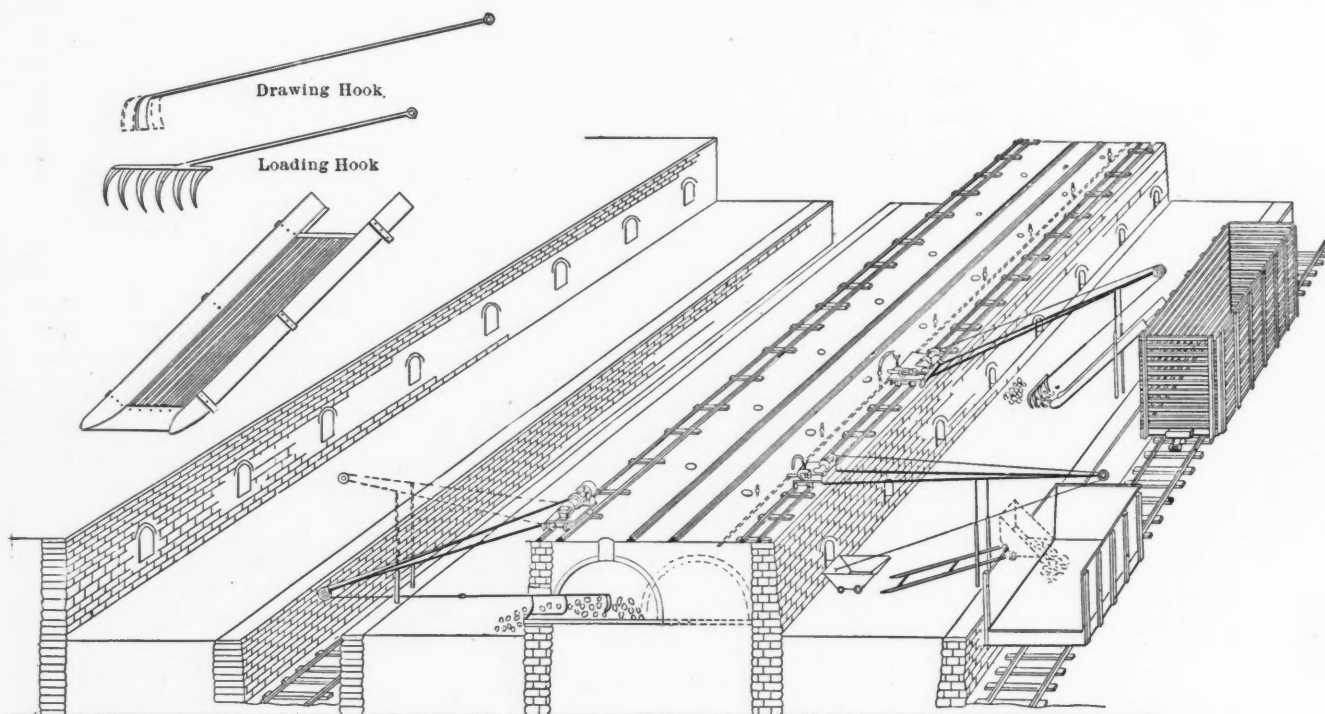
LOADING ON CARS WITH CHUTE AND RAKE

For loading coke, the operation is substantially the same as for pulling, except that the loaders use a chute or duct with a screen bottom to sift out the breeze, which chute leads from the yard to the top or into the door of the railroad car to be loaded. The loading rake consists of an implement made of two or three large coke forks bound together and having a short handle, to which is attached the pull rope from the hoisting engine. The sides of the rake are provided with stops or lugs that prevent the loading

another load of coke, repeating this operation until all the coke accessible to the railroad car is loaded, when the chute, sheave, rake and hoisting engine and boom are moved to another car, or to another pile of coke. The chute being adjustable is made longer or shorter as required. A "windrow" of coke on the yard can be pulled over out of the way of the drawer or into a pile with the rake before placing the chute and commencing loading into the railroad car.

RECEIVING CAR OR BUGGY

Where conditions permit, that is, where the coke-oven wharf is of sufficient width, instead of using the apron and trestle for the purpose of getting the coke as drawn from the oven back from the oven door,



GENERAL ARRANGEMENT OF NIXON'S NEW DEVICE FOR DRAWING AND LOADING COKE

and run off, that the puller may return the hook quickly to the oven without interference; as soon as it is caught again he signals the hoisting engineer to pull, then as quickly as the load is out of the door, he calls to the engineer to back off the rope.

In drawing coke, when the bulk of the coke is removed from the oven, the puller moves on to the next oven, leaving the cleaning out of the small leavings to his assistant, who prepares the oven to receive an immediate charge of coal, while the oven is still hot. The different points of attaching the pull rope to the hook is expected to enable the puller, together with proper handling of the hoisting engine, to get around the door jambs and always get a straight pull at the coke engaged. Considerable twisting, turning,

rake from dropping into the chute or the teeth from catching in the screen bottom.

The rake is expected to pull 300 to 600 lb. of coke at a load. The loader sets up the chute so the end projects over the top or into the door, then sets the rake behind a pile of coke on the yard, and directs the hoisting engineer to pull. The loader manipulates the rake by a handle provided with a hook, by which he forces the loading rake to remain down behind the load of coke it is pulling. The sides of the loading chute extend three or four feet beyond the screen bottom over into the car, thus preventing the loading rake from dropping into the car when the load of coke is discharged.

When this is accomplished, the loader with his hook, pulls the rake, which the hoisting engineer has released, back for

and out in the middle of the yard or wharf, without forking, a car or buggy can be used. This buggy has both ends sloping and narrowed in, so that its end may enter the oven door and permit the coke drawn from the oven to drop into the buggy. The latter is equipped with small flange wheels. When the buggy is full of coke and no railroad car is available for loading, the pull rope can be attached, and the car pulled as far out into the yard as desired. The wheels of the car strike a chock when the continued pull of the rope is exerted, and the back end of the car is then raised and the coke dumped on the yard.

LOADING DIRECTLY IN RAILROAD CARS

Where railroad cars are available, and it is desired to load the coke direct from

the oven into the railroad car, instead of dumping the coke on the yard, a pair of skids carrying light rails with bent ends, can be set up from the yard to the top of the railroad car. The pull rope is then attached to the receiving car which is pulled to the top of the railroad car, where the wheels strike the bent rails, dumping the coke, after which the car descends by its own weight to be again loaded. The receiving car should be of a capacity to unload an oven at a few loads. The bottom of the car could be made of bar iron, so that the ashes and fine coke breeze would sift out in handling:

DOUBLE BATTERIES OF OVENS

Where the batteries of coke ovens are doubled or the plant consists of a series of batteries placed beside one another with one intervening railroad track to cover the ovens on both sides, it is possible to place a light trestle and track over the railroad track from which the hoisting engine can pull direct from the ovens and yards on either side without an intervening sheave for the pull rope, this arrangement covering one side of both batteries of ovens. Under some conditions of this character, it is possible to pull the rope from one battery across the yard and railroad track to the other, working across the intervening railroad track whether encumbered with cars or not. It will be observed that the small tracks on top of the coping of the ovens can be connected by circular or other connections, thus permitting the same machine to operate on both sides of the battery of ovens.

BRACE POSTS MAY BE DISPENSED WITH

Where the conditions are suitable, that is, where the coke yard or wharf is narrow, the posts and runway to carry the sheaves may be dispensed with, and an iron boom attached to and carried by the hoisting engine can be used. At the outer end of the boom is a guiding sheave, and on the under side some feet from the end, is a detachable and flexibly attached pair of stiff legs or supports of the telescope type; this permits shifting the boom to any place. These stiff legs or braces are attached far enough back to permit the end of the boom carrying the guiding sheave to extend over or into the railroad car being loaded.

COMPARATIVE COST

With a battery of 100 ovens, producing 48-hour coke four days and 72-hour coke two days in the week, or a battery of 150 ovens, producing regularly 72- and 96-hour coke, both of which require the charging and drawing of 50 ovens per day, with an average product of about 3 to 3½ tons per oven. The drawing and loading will, with the hand method, require 15 or 20 men, at a cost approximately as follows:

Drawing 50 ovens at 50c.....	\$25.00
Loading, say 8 cars at \$2.00.....	16.00
	<u>\$41.00</u>

Equipped with the loading device, the requirement to cover 50 ovens and their output daily would be:

DRAWING.	
1 hoisting engineer.....	\$2.00
1 coke puller and two assistants, \$2.00 each.....	6.00
1 additional helper.....	1.50
2 followers to clean out ovens, etc..	3.00
	<u>\$10.50</u>

LOADING.	
1 loader to operate rake or buggy.....	\$2.00
1 man to set chute or skids.	1.50
2 men to follow.....	2.50
	<u>6.00</u>

Saving against \$11.00 per day..... \$24.50

When using the receiving car or buggy and loading directly, less force will probably be required.

The cost of charging, leveling, daubing, cleaning up, of the engineer, coke boss, etc., is the same in both cases, except that with the increased output the cost of this labor, mostly on per diem rates, would be less per ton of coke with the loading apparatus, than in the usual hand practice.

It does not appear excessive for six men, by working together, interchanging and relieving each other, to draw 50 ovens when the heavy labor of pulling is preferred by the machine. Nor is it excessive for four men working with the pullers to adjust the chute, the skids or tracks, the loading rake and the receiving car or buggy, to drag or dump the coke into eight railroad cars in a day, when relieved of the forking, or wheeling up grade. A good smooth concrete pavement on a coke yard greatly facilitates the handling of coke and ashes.

TWO HOISTING ENGINES

If the coke is to be lifted vertically some distance, and the railroad cars used are largely box cars, two hoisting engines may be required so that loading and pulling can go on at the same time. This would perhaps increase the cost of operation \$3.00 to \$3.50 per day. When box cars are to be loaded, it may be necessary to fill up the center of the car, and then drag the coke back into the ends of the car with the rake.

It is the usual practice when railroad cars are scarce, or there is coke on the yard in large or small quantities, not to pull the ovens, leaving the coke exposed to burn more or less with consequent loss; interfering with the operation and certainly not improving the quality of the succeeding charge. With the mechanical drawer, the coke may be pulled back or stacked up on the yard out of the way, whether there are cars available or not.

SUMMARY OF ADVANTAGES

The advantages claimed for the patent coke machine are:

- 1—Much less labor required around the

plant; 2—consequent reduction in loading and drawing; 3—uninterrupted and easier operation, better quality of coke, better yield from coal; 4—no stoppages on account of cars, labor not showing up or laying off, besides insuring greater output and better quality coke; 5—the example set out discloses the great reduction in the cost of drawing and loading the coke from a battery of ovens, besides the other important advantages of continuous operation.

EQUIPMENT

The equipment consists of a small hoisting engine mounted on wheels. It is reversible and has both quick and slow motion. About 100 ft. of ¼- or ⅜-in. wire rope is carried. There is also a track upon which to propel the hoisting engine; a boom or line of posts and braces to carry the pull sheave; drawing hook or drag for pulling coke out of the ovens; apron at oven door and trestle, or buggy and skid tracks; a duct or chute to load coke, and a loading rake. The hoisting engine may be operated by an electric motor supplied from the trolley wire, when steam or air power are not convenient.

Fan Ventilators for Mines

BY ROBERT GRIMSHAW*

A paper by H. Schweinitz upon this subject goes very thoroughly into the matter of arranging to have sufficient ventilating capacity for the final maximum extension of the mine, and, during the meantime saving power as far as possible.

In this connection there may be distinguished two kinds of ventilators—those driven by steam engines, and those which are driven by direct- or alternating-current electric motors.

STEAM-DRIVEN FANS

Where the fan is driven by a steam engine, it is easy, by throttling the latter, to run it more slowly and thus save power. If for example the fan, at a speed of 300 r.p.m., removes 3000 cu.m. with 100 mm. vacuum measured by the water column (say 0.29 in. of mercury), its useful effect will be shown by the formula:

$$N = 3000 \times 100 \div (75 \times 60) = 60.7 \text{ h.p.}$$

But if at first there need be removed only 2000 cu.m., there need be made, theoretically, only 200 r.p.m., as the amount removed is in proportion to the rotation speed of the fan. As the pressures are according to the squares of the amount of air removed, the height of column h_2 will be

$$2000^2 \times 100 \div 3000^2 = 44.4 \text{ mm.}$$

and the useful effect N will be

$$2000 \times 44.4 \div (75 \times 60) = 19.7 \text{ h.p.}$$

*Engineer, Hanover, Germany.

In this connection if we consider the useful power of the amount of air removed we have:

$$\frac{N}{N_1} = \frac{Vh}{V_1 h_1} \text{ and } \frac{h}{h_1} = \frac{V^2}{V_1^2};$$

therefore

$$\frac{N}{N_1} = \frac{V^3}{V_1^3}.$$

If the duty be 0.8, the necessary power will be, in the first case, $66.7 \div 0.8 = 83.3$ h.p. and in the second $19.7 \div 0.8 = 24.6$ h.p.

ELECTRICALLY DRIVEN FANS

With a fan driven by electricity, it is much more difficult to remove the air and save power in proportion. The following methods may be adopted:

- (1) Throttling the air outflow.
- (2) Lessening the rotation speed of the fan by throwing in a resistance to the electric current.
- (3) Lessening the rotation speed of the fan by using a smaller driving pulley, or a larger driven one.

In the first case it must be so arranged that all the air going in the direction of the ventilator must pass through this latter. The best way is to arrange in the suction shaft a place that is easy to get at. This must not, however, be too near the fans, otherwise the whirl caused by the throttling will have a bad effect on the fan. As regards the saving to be reached in this way, the following examples will be of use:

(a) An electric-driven fan delivers under certain conditions 3000 cu.m. of air with a vacuum of 114 mm. water column. The work of the fan is therefore:

$$N = 3000 \times 114 \div (75 \times 60) = 76 \text{ h.p.}$$

(b) If the suction shaft is throttled so that the fan takes in only 2500 cu.m. when the fan makes the same number of turns as in a, and the vacuum remains the same, the work of the fan will be

$$N = 2500 \times 114 \div (75 \times 60) = 65.3 \text{ h.p.}$$

(c) If the cross section of the suction shaft is diminished, so that only 1750 cu.m. can pass to the fan, the work of the latter is:

$$N = 1750 \times 114 \div (75 \times 60) = 44.3 \text{ h.p.}$$

According to this calculation, throttling the suction shaft would permit considerable saving. In practice, however, this has not been shown to be the case.

In the examples given above, there has been shown to be a power consumption of 89, 82 and 69 h.p. The mechanical duty was therefore, in each case, as follows:

- (a) $76 \div 89 = 0.854$
- (b) $65.3 \div 82 = 0.809$
- (c) $44.3 \div 69 = 0.642$.

The duty is therefore greatest where the fan is worked to full capacity, and lowest when the suction is throttled. The consumption of electric current was 66 kw. in the first example a; 61 kw. in the second example; and 51 kw. in case c.

In the second method, that of lessening the rotation speed of the fan; if a resistance be switched in the motor circuit, its speed will be diminished, and the air delivery also lessened, however, there will be but little current saved, as current will be lost by heating of the resistance coil.

The third method to vary the width of the pulleys, and with this the speed of the fan, is the one most used in practice. As an example: Assume that in the condition where the pulley diameters are changed caused air deliveries of 3000, 2500 and 1750 cu.m., respectively, then,

(a) With 3000 cu.m. and a vacuum of 114 mm. of water, the useful effect will be, as under 1 (a),

$$N = 3000 \times 114 \div (75 \times 60) = 76 \text{ h.p.}$$

(b) With 2500 cu.m. delivered, the speed must be run down correspondingly; and the water column will be according to the formula:

$$h : h_1 = V^2 : V_1^2, \text{ or,}$$

$$h_1 = 114 \div 3000 \times 2500 = 79 \text{ mm.}$$

The useful effect of the fan will be

$$N = 2500 \times 79 \div (75 \times 60) = 43 \text{ h.p.}$$

(c) With only 1750 cu.m. per min., the fan must have a corresponding speed; the depression will be:

$$h_2 = 1750^2 \times 114 \div 3000^2 = 39 \text{ mm. of water, and the useful effect of the fan will be}$$

$$N_2 = 1750 \times 39 \div (60 \times 75) = 15.2 \text{ h.p.}$$

Here, also, the duty will be lower with only partial use of the entire capacity of the fan. Now to compare the results of the first and third methods:

First	Third
(a)	
$V = 3000 \text{ cu.m.}$	
$h = 114 \text{ mm.}$	
$N = 76 \text{ h.p.}$	
(b)	
$V_1 = 2500 \text{ cu.m.}$	
$h_1 = 114 \text{ mm.}$	$h = 79 \text{ mm.}$
$N_1 = 63.3 \text{ h.p.}$	$N = 43 \text{ h.p.}$
(c)	
$V_2 = 1750 \text{ cu.m.}$	
$h_2 = 114 \text{ mm.}$	$h_2 = 39 \text{ mm.}$
$N_2 = 44.3 \text{ h.p.}$	$N_2 = 15.2 \text{ h.p.}$

As a formula:

$$\frac{N}{N_x} = \frac{V}{V_x} \quad \frac{N}{N_x} = \frac{V^3}{V_x^3}$$

From this it results that the third mentioned method, that is, lessening the speed of the fan by changing the driving pulley, or the driven one, or both, effects the greatest saving of power. There are, however, cases where this would not pay, or where for other reasons it should not be employed. In such cases, it would be best to choke the suction shaft. In mines which are free from fire-damp, and worked only by day, it would not be very serious to let the foul gases accumulate a little during the night and on Sundays and holidays. If, for example, the fan has a maximum capacity of 3000 cu.m. per

min., and 1750 cu.m. is enough for the night shift, the saving in 12 hours, if the kilowatt hour costs 1c., would be \$1.80, and in a year of 300 working days the saving would amount to about \$774.

A New Portable Pyrometer

A special form of pyrometer for practical use in determining temperatures of molten metals has been designed by Wm. H. Bristol, of New York, inventor of the low resistance thermo-electric pyrometer. The portable indicating instrument may be carried by hand from place to place and the temperature of a molten metal taken within two or three seconds. The possibilities and value of an instrument of this kind will be appreciated by those interested in foundry work. The outfit complete consists of a portable indicating instrument connected to a special thermo-electric couple, the two elements of which are disconnected and left without insulation. When the tips of these elements are slightly immersed into the molten metal an electric connection is made and the reading on the instrument will be the same as if the couple had been originally joined. The advantage of this plan is that the tips of the wires forming the elements almost instantly assume the temperature of the molten metal and the time-lag error is eliminated.

This form of couple has been successfully applied in measuring the temperature of molten metals, such as cast iron, copper, aluminum, brass, bronze and other alloys. When the tip of the couple becomes worn away by continued use, a fresh portion is exposed to the molten metal and the reading will be the same if the couple has not been very materially reduced. A separable junction is provided so that fresh tips can be conveniently applied before enough of the couple has worn away to appreciably affect the resistance and cause an erroneous indication on the instrument.

In the operation of the Delprat flotation process by the Broken Hill Proprietary Company, experiments were made last year with a modified separation vat, 16½ ft. deep and not lead lined. The results of this modification were so satisfactory that all the old shallow vats are now being replaced by deep ones, which have an increased capacity and produce a higher grade of concentrate. In the last official report of the Proprietary Company it was stated that no difficulty of any kind was experienced with the flotation plant, which worked with great regularity. In view of this statement, it is difficult to understand the reasons for the troubles, which some of the other companies at Broken Hill have been experiencing in the introduction of flotation processes.

William Glenn

William Glenn, aged 66 years, manager of the Henry Bower Chemical Manufacturing Company, formerly the Baltimore Chrome Works, Baltimore, Md., died Feb. 16, 1907, from congestion of the lungs. Mr. Glenn had been ill for 12 months, but had been confined to his home for only three weeks.

Mr. Glenn was born at Norfolk, Va., April 6, 1840, and was educated at Dr. Webster's school. He left school when he was 15 years old to become a chain-bearer in the engineering corps of the Baltimore & Ohio Railroad. His aptness drew to him the attention of the engineer in charge, John H. B. Latrobe, and he was rapidly promoted. He was a few years later placed in charge of a section of the road near Cumberland. During this time Mr. Glenn studied mineralogy, and laid the foundation for a career as a mining engineer, which he later took up.

When the Civil War broke out, Mr. Glenn enlisted as a private in the Norfolk Blues, Confederate Army, and served with distinction in the engineer corps, being promoted to colonel. When Johnston surrendered, Mr. Glenn was present and witnessed the signing of the papers. After the war, he became chief engineer of the Tyson Mining Company. In 1871 he married Miss Evelyn Constance Blackman, of New Jersey. Mrs. Glenn died about a year ago. Mr. Glenn is survived by one son (Robert Sterling Glenn) and one daughter (Miss Charlotte Seawall Glenn). In 1884, Mr. Glenn went to Baltimore and became manager of the Baltimore Chrome Works, which were then owned by the Tysons. The Tysons had various mining interests, especially in Vermont, which Mr. Glenn continued to look after. As manager of the Baltimore Chrome Works, he was in direct touch with the mineral industry, his company being the largest consumer of chrome ore in the United States, and on the other hand was closely identified with an important branch of metallurgical and chemical engineering. Through these various business connections he developed valuable ideas, which led to several important papers published in the *ENGINEERING AND MINING JOURNAL* and the *Transactions of the American Institute of Mining Engineers*.

After the Baltimore Chrome Works were taken over by the Henry Bower Chemical Manufacturing Company, Mr. Glenn continued in the position which he occupied at the time of his death. Mr. Glenn was not only the manager of the Baltimore works of the company, but was also the valued adviser and counsellor of the management of the entire business. His great knowledge of the technical side of the business, combined with his wonderful theoretical knowledge, not only as to the manufacture of its products, but also as

to the occurrence of its raw material, viz., chrome ore, made his services exceptionally valuable.

Mr. Glenn was a student and a scholar. He spoke both French and German, and was a fellow of the American Association for the Advancement of Science, a member of the American Chemical Society, of the Society of Chemical Industry, and of the American Institute of Mining Engineers. He was the author of a number of scientific papers and articles on engineering and chemical subjects which showed his high professional attainments. He was among the first to point out the nature of dust explosions. Personally, Mr. Glenn was a man most generous in his views of life, and as one of his intimate business associates remarked "I believe I have never heard him speak an unkind word of any man." He had high ideals and lived up to them. His loss is keenly felt by his company, his friends and his profession.

Cement Production in Canada

By J. J. BALL

That the use of portland cement in Canada is increasing at a remarkable rate, and that the market is not likely to be glutted by overproduction as was at one time feared, is shown by the figures for 1906, which have been compiled by the statistician of the mines branch of the Geological Survey.

Fifteen plants were in operation in 1906, with a total daily capacity of about 10,500 bbl. Of these eleven were in Ontario, two in Quebec, one in Nova Scotia and one in British Columbia. At least four plants are under construction, with an initial capacity of 4700 barrels.

The quantity made in Canada during the year was 2,152,562 bbl., an increase of 610,994 bbl., or 39.6 per cent. over 1905. The total sales were 2,119,764 bbl. an increase of 773,216 bbl., or 57.4 per cent. over 1905. The average price per barrel at the works in 1906 was \$1.49 as compared with \$1.42 in 1905. The total value of cement sold was, 1906, \$3,164,807; 1905, \$1,913,740.

The imports of portland cement into Canada in 1906 were 2,430,760 cwt., equivalent to 694,503 bbl. of 350 lb. each. The value was \$778,706, being an average of \$1.12 per barrel. The duty is 12½c. per hundred pounds. The import in 1905 was equivalent to 917,558 bbl., at an average price of \$1.24 per barrel.

CONSUMPTION OF CEMENT IN CANADA

Year.	Canadian, Bbl.	Imported, Bbl.	Total Bbl.
1901.....	317,066	555,900	872,966
1902.....	594,594	544,954	1,139,548
1903.....	627,741	773,678	1,401,419
1904.....	910,358	784,630	1,694,988
1905.....	1,346,548	917,558	2,264,106
1906.....	2,119,764	694,503	2,814,267

Little cement is exported from Canada. The consumption is therefore practically represented by the production plus the im-

ports. The accompanying table shows the increase in the consumption of portland cement during the past six years.

HISTORY

A brief reference to the history of the cement industry in Canada will be of interest. Its manufacture practically dates from the year 1891, when operations were begun in a very small way at Marlbank and Shallow Lake, both in the province of Ontario. The output of the first year amounted to only 2033 bbl., a trifle more than one of the modern plants can produce in a single day. In 1892 the production increased to 20,247 bbl. and in 1893 to 31,924 bbl.

During the next decade the increase each year exceeded that of the previous year, roughly speaking, by 50 per cent. In 1901 four factories were making portland cement; now there are nineteen. Among the new works projected are a branch of the Lakefield Portland Cement Company at Montreal and new works for the Canadian Portland Cement Company at Port Colborne, the Lake Erie end of the Welland canal, both of which will be equipped with the most modern machinery.

Coal in Southeast Kootenay, B. C.

SPECIAL CORRESPONDENCE

Owing to lack of railway transportation facilities in other parts of the coal-bearing districts of the Southeast Kootenay, British Columbia, the only coal-mining company producing coal is the Crow's Nest Pass Coal Company, which last year mined 806,901 tons, making its aggregate production of coal for nine years, to end of 1906, 4,253,815 tons. Concerning other coal lands in this district the local mining commissioner has reported as follows:

The Imperial Coal and Coke Company, having uncovered coal on the different groups of licenses held by it on Fording river, has obtained leases over 89 lots, covering 53,851 acres of land. The preliminary survey of a railway route to these properties has been completed.

The Elk Valley Coal Company, holding 44 licenses and leases on upper Elk river, has discovered coal on several of its claims, and is continuing the exploration of the others.

Coal has also been discovered and leases have been granted on 41 lots, covering 26,240 acres, lying immediately north of lot 4588, on upper Elk river. Coal licenses covering 13,440 acres on the north fork of Michel creek are in force.

A syndicate holds 16 coal leases at the northern end of lot 4593, covering 10,240 acres.

On account of the increase of cost of fuel oil, the State institutions of Texas are reported to be about to abandon its use and return to coal.

Colliery Notes, Observations and Comments

Practical Hints Gathered from Experience and from the Study of Problems Peculiar to Bituminous and Anthracite Coal Mining

DEVELOPMENT AND MANAGEMENT

In order to obtain a continuous flow of air at the working faces of a mine, a system of double doors should be used at all the main points along the gangways; this arrangement permits the opening of one of the double doors for the passage of cars and men without interrupting the steady flow of the air.

When overcasts are used in a mine, there is less waste of air by leakage than when doors are used; overcasts are also less liable to be destroyed than doors in case of an explosion. When properly constructed overcasts are used, a larger amount of air is circulated by the same power, and each split can be more easily supplied with pure air from the main intake than when doors are used.

Unloading coal from the hold of a ship and delivering it to a bin located from 800 to 1000 ft. away from the vessel, and then the further continuous delivery to the boilers by means of mechanical conveyers costs about 4c. per ton for a capacity of over 25,000 tons per year. The coal is unloaded from the vessel and discharged into the hopper in the elevator by a steam shovel, and is drawn from this hopper into the conveyer by means of a filler and then carried to the bin.

It has been found that there is greater security in approaching accumulations of water underground when the water is subjected to great pressure, or is under considerable head. When this latter condition prevails, the water gives evidence of its presence by seepage through the coal seams and the surrounding strata, earlier than would occur when the pressure on the water is small. It is true, however, that more care and caution must be exercised when approaching a large body of water under considerable head.

For any running rope, the long 20-ft. splice should be used. In most cases the rope can be applied endless, and in such cases should be forwarded already spliced, so as to be available for immediate use. In cases where the endless rope cannot be put on, the rope must be put around the sheaves, hove taut by pulley blocks and the splices made on the spot. In case the ropes are to be spliced by the manufacturers, the measurements given them should consist of the exact distance from center to center of the shaft and the exact diameter of the wheels on which the ropes are to run.

The recognized advantages in rope drives are many, among them being economy in first cost and maintenance. In drives where more than 200 h.p. is trans-

mitted, and where the shafts are more than 30 ft. center to center, the cost of rope drives as compared with belts varies from 15 to 50 per cent. in favor of the former. This advantage increases rapidly as the distance between shafts and the amount of power transmitted increases. The average life of a rope on a properly designed drive is from eight to ten years.

In using wire ropes, experience has shown that it is economy to increase the load rather than the speed, as the latter greatly increases the wear. Rope is damaged more and quicker by rust than by the wear and tear of constant use. For inclines, transmission and traction purposes, it is well to use coarse wire ropes, running over large drums and large sheaves. All overlapping of wire ropes on drums should be avoided. Galvanized ropes should not be used for running ropes. Steel flat ropes are sewed with annealed cast-steel wire. The sewing wire should always be softer than the steel wire composing the rope.

At the Miike mines, in Japan, there are at present nearly 6000 employees. Out of this number about 1000 are miners, 800 carriers and 1000 timbermen. Women and convicts form about 40 per cent. of the total number of employees. Miners are paid by the ton and the best miners also get a bonus besides their regular pay. All employees are paid every two weeks. The company has organized a complete school system for the education of the children of its employees. The students are graduated from the elementary schools at the mines, and then they are admitted to the company's technical institutions. In this way an opportunity is given them to qualify for posts of higher responsibility.

Careful observation has shown that where hoisting ropes are used for moderately heavy work, the cable will last four to eight years, much depending upon the care of the rope and the size of the sheave. A rope $\frac{5}{8}$ in. in diameter, after eight years of continuous service, had a tensile strength of 11,000 lb. as against 13,600 lb. when new, showing that during the eight years it lost 20 per cent. of its total strength. Another test of a round rope having all the outside wires broken showed a loss of $33\frac{1}{2}$ per cent. of the original strength. In general, those ropes that give warning of their deterioration by the breaking of the outside wires first are safer and better ropes than those whose inner wires break first, leaving the outside intact and apparently in good condition.

Conveyer boxes used in the washery and breaker should always be made of kiln-dried lumber, as any shrinkage causes the conveyer to run out of true; they should also be dressed on both sides, except for very rough work. For 4-in. conveyer boxes, 1-in. lumber should be used; for 6- and 9-in. boxes, $1\frac{1}{2}$ -in. lumber; for 12-in. boxes a 2-in. thickness is required. In order to get the best service out of the conveyers, they should be run close to the bottom of the trough. For 4- and 6-in. conveyers, the play should be $\frac{1}{8}$ in.; for larger sizes, $\frac{3}{16}$ in. Experience has shown that it is most economical to run a conveyer which is made true at a high speed. A 4-in. conveyer can be run over 100 r.p.m., a 6-in. conveyer 175 r.p.m., and a 9-in. conveyer can make 250 revolutions.

The tail-rope system of haulage, two drums with friction clutches, usually on one line shaft, forms a system most commonly used in the anthracite coalfields. The ease with which the trip can be switched off into the different entries and its simplicity of construction give it considerable advantage over some other systems. There is usually one-third more rope used in the tail-rope haulage than in the endless-rope system; but, as the endless system requires the same diameter of rope throughout its entire length, while the tail-rope system is made up of a larger main rope and a smaller tail rope, two-thirds of the rope in the latter system is therefore small rope, which reduces the cost of the extra rope required in the tail-rope method to less than the cost of the uniformly larger rope used in the endless-rope system.

In designing cylindrical and conical drums, it should be remembered that the strained coils of rope on the drums compress the metal of the drum shell and reduce the diameter. The reduction in diameter takes place near the middle of the drum's length, while near the edges, where it is supported by arms, the compression is considerably less, so that the drum becomes curved convex toward its axis. The drum recovers its normal diameter when the coils are unwound and the strain is taken off. As a consequence of these conditions it is the best practice to reinforce a drum shell by longitudinal inside ribs; if such ribs are not deep enough, they will be bent with the drum surface and are liable to crack. If extra metal is used at all, it should be constructed in the drum itself, as the use of light ribs is a source of weakness.

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A New Production of Cadmium

It is interesting to report the inauguration of a new metallurgical industry in the United States, even if it be only a small one. This is the production of metallic cadmium, which has been undertaken by the Grasselli Chemical Company at Cleveland, Ohio. Heretofore cadmium has been produced only in Belgium and Silesia. The production of the former country was never large, and recently the world's supply has been furnished by Silesia alone. The ore of the Joplin district is, on the whole, immensely richer in cadmium than the ore of Silesia, but under the general conditions of zinc smelting in this country it has not been considered worth while to attempt to save cadmium as a by-product, which would have involved the separate treatment of the first blue powder and oxides; and the use of prolongs, at least during the first part of the distillation, to effect the maximum recovery. Moreover, the production of so much cadmium as would be possible from the Joplin ore would inevitably cause the price for that metal to tumble heavily. It will be interesting to await the effect of the new production which has already been begun. The production of the metal in this country was not inaugurated until after an attempt to market the cadmium-bearing by-product in Europe had failed.

The British Commission on Safety in Mines

A year ago the British government appointed a royal commission to inquire into the advisability of introducing new legislation in connection with the working of mines, especially with a view of decreasing the many dangers to which miners are exposed. We would remark that this commission must not be confused with a similar commission appointed at about the same time to inquire into the effect on the coal trade of a proposed eight-hour day for miners.

The commission on safety was instructed to inquire into a great many subjects, such as the danger from dust, the right sort of lamp to use, a standard of ventilation, rescue work in cases of accident, etc. It was soon found that the ground to be covered was very extensive and would take years to deal with. It

was decided to take one subject at a time, and the first two subjects to be considered were the question of watering or allaying dust, and the provision of breathing apparatus for facilitating rescue work after explosions.

The report on the rescue question has now been published, and a preliminary one on dust should appear before many weeks are over.

The report on rescue work is a complete compendium of the present state of knowledge relating to apparatus which can be used for enabling a rescuer to breathe in a foul atmosphere. A large amount of the information has already been published in the *Transactions* of the Institute of Mining Engineers, of Newcastle-on-Tyne, and also in the French government reports and elsewhere, but in the collected form now issued the information is of much greater value, and the present report will prove invaluable to those who desire to study the subject. The report is far too lengthy to publish here, even in abstract, but a few points may be mentioned.

The apparatus described are divided into four heads. The first consists of a helmet such as is used by divers, through which a current of fresh air is pumped. In the second, the wearer breaths into and out of a bag, in which some means of absorbing the carbonic acid is provided, and oxygen out of a cylinder is used for breathing. The third type provides peroxides of sodium and potassium, which not only supply oxygen but also absorb the carbonic acid. In the fourth type, liquid air is used for breathing purposes. The relative advantages of these different types are discussed. The commission came to the conclusion that all of them were difficult of use, if not dangerous, in the hands of anyone who is not physically fit and well trained in their operation. For this reason it considered that the time had not yet come to recommend the compulsory adoption of such apparatus. It recommends, however, that colliery owners should take steps to adopt them voluntarily, in a tentative way at first. The proposal is that each colliery, or group of collieries, shall have a rescue station, and that the owners shall supply the apparatus, if the men will join in making a thoroughly fit and efficient rescue corps. It is evident that unless the apparatus is always ready and the corps of men kept in thorough training the rescue stations would be useless.

The commissioners express themselves as doubtful, whether any great saving of life will ever be effected by means of these breathing appliances and rescue stations, arguing that the fatalities will occur long before the rescuers can get to work. In any case the apparatus, if required for the rescuer, would also be required by the rescued, and such a supply of apparatus would not be feasible. The commission relies on other uses of the apparatus in recommending their adoption, such as the general investigation of the conditions underground, which would help in re-starting or reorganizing the system of ventilation, and also the use of the apparatus for ascertaining the nature of underground fires.

It is interesting to note in this connection that, two months ago, the French government issued regulations making it compulsory to provide these breathing apparatus. It is probable that the Courrières explosion has had a good deal to do with the suddenness of the decision. A translation of the detailed regulations for the use of the apparatus in the French collieries is given in the report of the British Royal Commission, and we refer our readers to that source of information.

A Feat in Transportation

The transportation of iron ore from the mines of the Mesabi range, in Minnesota, to the docks on Lake Superior, has reached a point which probably exceeds any record of the kind heretofore made. In one day recently the Duluth, Missabe & Northern Railroad brought down to its Duluth docks 126,000 tons of iron ore. This tonnage was equivalent to the loading of 15 of the largest class of lake steamships; and to the receipt of 65 train-loads of ore. This means further that a train of 40 or 50 ore cars passed over the line, on an average, each 22 minutes of the 24 hours, empties going back to the mines at the same intervals. With this there has been no serious accidents on the line and traffic is proceeding with great ease. The road is in the enviable position of having more equipment, both in rolling stock and terminals, than is necessary for this volume of traffic and can increase its tonnage considerably if mines can supply the ore and ships can take it away.

This position is somewhat unique for an ore road nowadays, and is due to the

foresight of the Steel Corporation in providing amply for its ore roads. The corporation is now making arrangements for a still greater traffic on both of its ore roads next year, and expects the tonnage of 1908 to be in excess of that of 1907. The Great Northern road, too, is caring for its ore business with more ease than in any recent year, and there are few, or no, complaints from mines along its lines. But unless there is some settlement of the labor difficulties at lake shipyards the supply of tonnage for 1908 will hardly keep pace with the ability of the railroads to deliver ore to the vessels. Large as the present lake tonnage is, a considerable increase will be needed if the ore traffic of 1908 on Lake Superior is to exceed that of the present season.

Metallurgical Collieries

The tendency of the larger metallurgical companies to provide their own fuel supply is a most noteworthy feature of their present practice. Among the latest to make this move are the Illinois Zinc Company, which is now developing a colliery at Deer Park, about five miles from its works at Peru, and the American Smelting and Refining Company, which is opening a large colliery at Cokedale, in Riley cañon, Las Animas county, Colo., and is building a washery and an extensive coking plant. The coking plant consists of standard bee-hive ovens, the market for the by-products of a retort-oven plant being too uncertain in Colorado to justify the installation of that more expensive type of plant.

It is particularly worthy of note that both at Deer Park and at Cokedale great pains are being taken to prepare a high class of accommodations for the employees. Cottages of excellent character are being built, the necessities for social life are being provided, the streets are being well laid out and trees and lawns are being planted. This attention to an important sociological problem is quite in keeping with the spirit of the age. The men who have to spend their working life in a coal-mining camp are entitled to this consideration, even if the money expended in this way does not yield any direct profit. However, we are confident that it will yield a commensurate return through the increased efficiency of the workmen. The more contented a man can be made, the better workman he is likely to be.

Listing Mining Stocks

The Chamber of Mines at Los Angeles, Cal., has voted to adopt a new plan—or rather an old plan revived—relating to investigation and reports on mining properties. This embraces the division of mines into two general classes: One class will include mining properties that are to be registered with the chamber and for which the chamber's certificates will be issued. The other class will consist of mining prospects upon which it is desired to have the report of the chamber after investigation. The registration fee for the first class will be \$50, and for the second class \$25, with the provision that a more detailed examination will be made at a subsequent time upon the payment of an additional \$25. The mining companies will be charged in all cases with the actual cost of the investigations.

All this sounds well; but why companies desiring reliable reports do not themselves employ reputable mining engineers to do the work for them, instead of a chamber of mines, is not explained. This sort of thing has been tried several times in San Francisco, but has met with no success, no mines of any importance having ever applied for such registration.

The Witwatersrand Miners' Strike

The JOURNAL'S Johannesburg correspondent this week reports that the miners have practically lost their fight against the mining companies on the Rand. Few, if any, stamps are hung up, and if production suffers, it is not by reason of lack of ore, but because the material sent to the mills is not sorted so carefully as usual.

Late cablegrams from the Transvaal announce the resort to dynamite on the part of the miners to enforce their demands. The first fatality occurred at Boksburg, where a hotel is reported to have been blown up, resulting in the death of three men and the injury of many others. At one of the mines a native was caught placing a stick of dynamite at a point where its explosion would imprison a number of white miners, presumably not in sympathy with the strikers. The resort to violence seems to mark the last stage of the contest, for the strikers are seldom willing to hazard the loss of popular sympathy by committing outrages of this kind until all other means have failed.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice or Suggested by Articles in the Journal, and Inquiries for Information

CORRESPONDENCE AND DISCUSSION

Ferro-Vanadium

What is the present market price of vanadium, and what is the demand for this substance? My sources of information are very meager and an early reply will be much appreciated. R. P. N.

The metal, vanadium, is never marketed in the pure state on account of its refractory nature. Alloys of iron and vanadium are for sale which contain from 25 to 50 per cent. vanadium and all impurities, such as carbon, silicon, sulphur, phosphorus, etc., are guaranteed to be less than 2 per cent. For practical purposes the 25 per cent. alloy is usually employed on account of its fusibility, and steel makers are beginning to utilize vanadium for certain special steels. It is reported that the United States Government has contracted for armor plate alloyed with vanadium.

The selling price is based upon the vanadium content of the alloy and current quotations are \$5 per lb. of vanadium. Thus a 25 per cent. ferro-vanadium alloy would bring \$1.25 per lb. The demand at present is strong, one producing company reporting that English and French contracts had practically exhausted its supply.

Mining Locations in Nevada

Will you kindly give space for the inclosed letter, copies of which have been sent to the Secretary of the Interior and the Commissioner of the United States Land Office, at Washington, D. C. It is considered that the points contained in the letter are of vital importance to those interested in mining operations, not only in Nevada, but in others of the Western States.

GEORGE D. JAMES.

Vernon, Nev., June 13, 1907.

LETTER

Sir—There are several questions at the present time with relation to mining claims in the State of Nevada, for which official authority is absolutely necessary. Among others:

Whether a prior locator has the advantage of a subsequent locator in the way of defining his boundaries, supposing he does not have his survey made in the first place. A prior locator, for instance, has his claim running northeasterly and southwesterly, 750 ft. each way, along the course of the lode or vein. A subsequent locator establishes a monument in an opposite direction, and desires to have a survey made, while the prior locator has

not the means to make a survey at the time of location, or within 90 days from the date of said location. After the subsequent locator has had the survey made, and his posts established, can the prior locator have a survey made and run across the boundaries of the subsequent locator, in which a considerable portion of the latter's claim is forfeited?

There are many cases which we find in this district in which monuments are found, and no notices contained therein; also posts of the regulation size on which there are no notations. Are these monuments in which no notices can be found to govern, when a locator states that they are the monuments of his claim? And how can a satisfactory survey be made?

If a location notice is stated as running northeasterly and southwesterly, or northerly and southerly, can the course in a transit line be defined as any point between north and east? For instance: North, 0 deg., 1 min. east; north, 89 deg. 59 min. east? I do not understand wherein a course northeasterly should not run any point between north and east.

There is an idea prevailing in this district, as well as in many others in the State of Nevada, that as long as 240 cu.ft. of work have been accomplished in connection with the location work, such work constitutes a valid location within the meaning of the law, and it is immaterial whether the work is 10 ft. long, 6 ft. deep, and 4 ft. wide, or 10 ft. deep, 6 ft. wide and 4 ft. long.

The law states that a vein must be exposed in place, but as the whole country is mineralized, and in this especial part of the district there are simply a series of blind ledges, it is almost impossible to expose the vein or lode in order to literally comply with the law, for the reason that almost all the ore can be shipped from a milling standpoint, and it is not necessary that a series of porphyritic dikes be shown on the ground.

There are a few instances wherein the dikes crop out very prominently in the Seven Troughs mining district; some of these show simply burnt over-throws, so that they cannot be taken as criterions, or actual outcropping dikes, or masses which permeate the district, and the district extends for at least 20 miles from north to south, and from 4 to 5 miles from east to west.

It is suggested that a law be passed that at the time of location of a claim, a survey should be made, or monuments containing definite information be erected for

the benefit of subsequent locators, in order that they may know wherein they stand in reference to their boundaries, and not to allow that simply location monuments be established. It is not fair to the other locators.

At the present time notices are placed in monuments under stones of all shapes; some of them are exposed to the weather, and others are buried in the monuments. They should be placed in a can, so as to be covered, and in a conspicuous place.

We also find many cases in which adjoining claims bear practically the same name. For instance: "Sage Brush No. 1," "Sage Brush No. 2," etc., etc. There may be a dozen of this nomenclature nature, and because of the influence of the weather the No. 1 or No. 2 may be effaced. It is suggested that each claim should bear different names, otherwise it is extremely difficult in the case of surveys to make proper connections, not knowing to which claim the monuments refer.

A person locates a claim, and within 90 days another locates an adjoining claim. The prior locator does not complete the location work. The subsequent locator performs his work. When the claim of this subsequent locator is defined by monuments or boundaries, can he cover the ground that would have been on the location made by the prior locator? The subsequent locator does his location work, and erects his monuments before the 90 days of the prior locator expire.

If it is not within your province to answer these questions, kindly refer this letter to the proper official from whom a reply will be greatly appreciated.

How to Outline an Electrolytic Copper-refining Plant

During 28 years' experience as a mechanical engineer in the mining-machinery branches I have two or three times been confronted with the rather difficult problem of giving the approximate cost of electrolytic refineries.

The existing refineries are but few in number and as a rule are hermetically closed to visitors. The few mining engineers in charge of such plants talk little and write less, and the literature covering this interesting process is consequently incomplete.

What I know about this subject, therefore, I have mostly picked up from mining men I have met or corresponded with,

and by comparing the different reports, adding and subtracting, I have come to some sort of understanding how, at least approximately, to outline electrolytic refining plants. How well I have succeeded can best be seen when my article has been criticized by correspondents of the *ENGINEERING AND MINING JOURNAL*, as I hope it will be.

One ampere-hour of current will deposit, according to European experience, 1.183 grams of copper. Now 1 oz. equals 28.35 grams, and in a 10-ton plant the deposit of copper per hour will be:

$$\frac{10 \times 2000 \text{ lb.}}{24 \text{ hours}} = 833\frac{1}{3} \text{ lb. ;}$$

call it 833 lb.; hence

$$\frac{833 \times 16 \text{ oz.} \times 28.35 \text{ grams}}{1.183} = 319,398 \text{ ampere-hours.}$$

Let us suppose that the whole deposit has to be accomplished in one installation and let us figure 75 vats in three series of 25 each; then the generator would have to furnish:

$$\frac{319,398}{75} = 4259 \text{ amperes.}$$

The voltage required per vat should not, in a well-designed plant, exceed 0.6; but, allowing for local conditions, purity of the anodes, etc., 0.75 or 0.8 will be a safe maximum. For 75 vats we will then have $75 \times 0.8 = 60$ volts, and $60 \times 4259 = 255,540$ watts = 342 h.p. to deposit 10 tons per 24 hours, or 34.2 h.p. per ton as a maximum figure. But, as stated above, a voltage of 0.6 per vat should be ample in a perfect plant, and based on this figure we have $75 \times 0.6 = 45$ volts, and $4259 \times 45 = 191,655$ watts = 257 h.p., or 25.7 h.p. per ton of copper deposited.

I have figured on a current density of 12 amperes per square foot anode and cathode surface, and for a generator will take maximum figures 342 h.p. and add 10 per cent. for loss in efficiency, making a total of 376, or call it 375 h.p., which I will divide up on three generators of 125 h.p. each.

It is possible that the current density I have figured is behind time, as the process probably had advanced in the last year or two; but, assuming 12 amperes per square foot to be correct, we will need

$$\frac{4259}{12} = 355 \text{ sq.ft. anode surface in each vat, say 360 square feet.}$$

Figuring a superficial area of 8 ft. per anode, we will have $\frac{360}{8} = 45$ anodes in each vat. Making the size of the anodes, say, 18x32 in., will just give us 8 sq.ft. for both sides.

Anodes should be made about 1 in. thick and should have cast on a lug with a hole suitable for a copper hook. The width of a vat depends upon how many anodes we place and connect on each single positive conductor bar. Suppose we place three on a bar and allow 2 in. space

between them and 2½ in. between anodes and sides of tank; then width of tank will be 63 feet.

Dividing the 45 anodes by 3, we will have 15 rows. A space of 2 in. should be allowed between the electrodes, and as we should always have an anode between two cathodes, it follows that we will, in this case, have 15 rows of anodes and 16 rows of cathodes.

Fifteen rows of anodes 1 in. thick = 15 in.; 16 rows of cathodes, about ⅜ in. thick = 2 in., and 32 spaces of 2 in. = 64 in., making total length of tank 81 in. Allowing 10 in. space below anodes will give us a depth of 42 in. Size of vat would be 7 ft. long by 5 ft. 3 in. wide by 3 ft. 6 in. deep.

At each series of vats the positive terminal of the generator is connected with two copper bars, well insulated, which should rest on the vat. Slightly elevated above these two bars two negative copper bars are placed, which at the end of the vat are bent and extended into the next vat as positive bars in line with the terminal bars in the first vat; and so on from vat to vat, until the end of the series, where the last pair of bars is connected with the negative terminal of the generator. Iron cross-bars from which the anodes are suspended rest on the positive conductor bars, and iron bars carrying the cathodes rest on the slightly elevated negative conductors.

Very important for a commercially successful operation is to have the solution $\text{H}_2\text{O} + \text{CuSO}_4$ circulate not only rapidly, but also quietly, in order not to disturb the mud.

In Germany a few years back a device was in use which not only purified the solution, but also gave good insulation and perfect mixture. It was arranged as follows: Under the suspended anodes and cathodes was placed a leaden tray, on which the mud was collected, with what gold, silver or other metal there might be present. This tray rested on wooden strips plated in the bottom of the vat. A 2-in. or 2½-in. lead pipe was placed in the space below the tray and at the end of the vat, bent in an angle of 90 deg. and extended up a little above the level of the solution, with a leaden hood at the top fastened to the vat. Inside this leaden pipe was a glass tube, extending down about half-way of the vertical part of the pipe, where it was drawn out to a point. The lower part of the hood extended down a little below the solution level. The hood also had a plug, allowing the glass tube to be raised or lowered.

Air was blown through the glass tube, and at the pointed nozzle of same, half-way down the leaden pipe, bubbles were formed, which lowered the specific gravity of the solution there and made the solution rise and overflow through the leaden hood. As the solution all the time entered the leaden pipe at the bottom under

the tray, a constant circulation and perfect mixing take place.

Occasionally the solution was circulated from one tank to another, but for this purpose a common leaden siphon was used.

To arrange for all the anodes in a vat to be raised or lowered in a battery and to be transferred by the help of an overhead crawl or a light traveling crane, is a matter of mere local interest and can be designed to suit conditions. Also the size of the power plant can easily be determined from the figures above.

What I am after is, as stated above, information necessary to enable me to outline an electrolytic refinery with such rules and data as I have on hand. I trust that my brother engineers will forward what information they may have acquired on this subject, and by criticizing—and correcting, perhaps—my rules and figures bring about a clearer and safer understanding of the difficult task of designing an electrolytic refining plant.

CHARLES C. CHRISTENSEN.

Chicago, June 26, 1907.

Salt in India

The primitive method of salt extraction practiced at Bawgyo in northern India is described in an interesting manner in the records of the Geological Survey of India for 1907. The existing well is square in section, measuring 3x4 ft. 8 in., and is about 45 ft. deep, the level of the brine standing about 7 ft. below the surface of the ground. The brine is bailed out with an ordinary bucket at the end of a balanced pole, enough being taken out at a time and stored in troughs made of hollowed-out logs to keep the boiling pans at work until the well fills again. Bailing for a period of about nine hours lowers the surface of the brine 11 ft. in the well, amounting to about 1000 gal. At intervals during the bailing several buckets of brine are poured back into the well with as much force as possible, in order to mix up the brine which remains below.

Boiling is carried on in shallow iron pans holding about 6 gal. It takes about two hours to evaporate the contents of each pan to the extent required, which is not to dryness, but to a point at which the residue is of the consistency of wet mortar and a crust begins to form on the surface. The wet mass is then ladled out into a cloth, allowed to drain and cool, after which it is packed in baskets for sale. The solid contents of the brine contain on an average about 60 per cent. of sodium chloride and 35 per cent. of sodium sulphate. This last substance is of especial interest, as it may become of importance in the event of the establishment of a wood-pulp industry in Burmah, which would require considerable amounts of sodium sulphate.

New Publications

PLANT ECONOMY. By H. P. Dennis. Pp. 8; illustrated. 6x6½ in.; paper. Published by the Bristol Company, Waterbury, Conn.

This is a brief discussion of the economy of power plants, and the advantages of determining accurately the various losses in the flues and stack, the efficiency of economizers, feed-water heaters, superheaters, etc., by means of recording thermometers.

PROCEEDINGS OF THE SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION, FOURTEENTH ANNUAL MEETING, ITHACA, N. Y., JULY 2 AND 3, 1906, VOLUME XIV. Edited by D. C. Jackson, C. L. Crandall and W. T. Magruder. Pp. 300. 5½x8½ in.; cloth. New York, 1907: Engineering News Publishing Company.

This volume, as its title indicates, is the annual report of a society devoted to engineering education. It contains lists of officers, members, books and periodicals for engineers, and statistics of technical education, besides numerous papers and discussions, all dealing with the training of engineers.

OILFIELDS AND GASFIELDS OF GREEN COUNTY, PENN. By Ralph W. Stone and Frederick G. Clapp. U. S. Geological Survey, Bull. No. 304. Pp. 110; illustrated. 6x9 in.; paper. Washington, 1907: Government Printing Office.

The authors have assembled all available knowledge, published and unpublished, concerning the occurrence of oil and gas in this county. The report describes the rocks from the surface to the bottom of the deepest well; the geologic structure, with a contour map of the Pittsburg coal; the oil and gas sands; and the oilfields and gasfields with suggestions for their further development. Many well records are given, and triangulation stations and bench marks are described.

COAL MINES IN THE STATE OF WEST VIRGINIA—TWENTY-FOURTH ANNUAL REPORT FOR THE YEAR ENDING JUNE 30, 1906. James W. Paul, Chief Mine Inspector. Pp. 471. 6x9 in.; paper. Charleston, W. Va., 1907: Department of Mines.

The report is the largest and most complete review of mining conditions in West Virginia, yet issued by the inspection department of that State. Many vital problems are dealt with, and details of important experiments are included. The statistical tables are unusually complete, while a directory of mines will be found useful to those interested in the industry. That section of the report devoted to fatal accidents explains the casualties in detail, and is deserving of careful perusal.

WESTERN AUSTRALIAN YEAR-BOOK, 1902-4. (Thirteenth Edition). By Malcolm A. C. Fraser. Pp. 1283; illustrated. 5½x8½ in.; board covers. Perth, W. A., 1906: A. Curtis, Government Printer.

This book is devoted to an elaborate description of the History, Geography, etc.; Government; Vital Statistics; Towns and Cities; Finance; Land and Agriculture; Trade and Commerce; Mineral Resources; Industries; Education, Law, Crime, etc.; Public Works; Statistics and Miscellaneous Data. The work contains 73 illustrations and 16 maps and diagrams.

The section devoted to the mineral resources, comprising 144 pages, gives a history of the early discoveries of mineral in Western Australia; the geological features of the country; mineral production for 1903 with the totals up to and including that date; statistical information concerning various metals arranged by camps or fields; tables of production, arranged by metals, for the years 1850 to 1903 inclusive.

The book contains much valuable information of the resources of this Australian State.

A GEOLOGIC RECONNAISSANCE IN SOUTHWESTERN NEVADA AND EASTERN CALIFORNIA. By Sydney H. Ball. U. S. Geological Survey. Bulletin No. 308. Pp. 218; illustrated. 6x9 in.; paper. Washington, 1907: Government Printing Office.

The observations of the U. S. Geological Survey party, from June to December, 1905, inclusive, furnish extremely valuable information on the geological formations of the intensely interesting mining districts of southwestern Nevada and eastern California. The book contains a wealth of detail concerning the rocks and general character of the ore deposits in and around Goldfield; along the ranges north of Pahute Mesa; in the Shoshone and Skull mountains and hills in the vicinity; in the Bullfrog hills; at Death Valley, and many other localities. A section devoted to hydrology will prove of value to the prospector in this desert region and the important signs of water are pointed out as well as the water levels of the several valleys. The bulk of the book is devoted to stratigraphic and descriptive geology and under these heads the rocks of the entire regions are discussed in detail. A large geological map showing contours and elevations is one of the features of the work, and while the author apologizes for certain inaccuracies he trusts "it may prove not only an aid to the prospector and miner, but a contribution to the geology of this interesting district."

MOODY'S MANUAL OF RAILROADS AND CORPORATION SECURITIES, 1907. Pp. 2550. 6½x9½ in.; cloth, \$10; full leather, \$12. New York, 1907: Moody Corporation.

A book of this class defies criticism; its full value can only be ascertained by long

use. As previous volumes have been characterized by care and accuracy in compilation, it is safe to say that the present one is worthy of confidence. The volume before us covers, in a broad way, the four great departments or divisions of American corporate enterprise and industry. These four fields of corporate activity are as follows: Steam Railroads, Public Utilities, Industrial and Miscellaneous Corporations and Mining Enterprises. The "Manual" furnishes uniform information regarding practically all corporate undertakings in each of these fields, and covers not only the United States of America but the Dominion of Canada and the Republic of Mexico also. Important enterprises of interest to Americans in Cuba and South America are also covered. In all, the "Manual" reports the facts (if we include the reports of banks and financial institutions) on over 20,000 distinct corporations. Full data are furnished regarding 1512 active, operating railroad corporations, 1129 electric traction companies, 1158 gas, electric light and electric power companies, 267 water supply companies, 259 telephone, telegraph and cable companies, 1510 active, operating and producing, industrial and miscellaneous corporations, and 880 active or operating mining companies. The essential statistics are also given regarding more than 13,500 banking, insurance and other financial companies in America, and the important and useful data regarding all government bond and stock issues, which are dealt in or quoted in the American markets are given in convenient form for the banker and investor. The general make-up of every statement in the book has been planned with the ideas of quick reference. All the data of use or value to the banker, broker, investor or business man generally have been included and are presented in accordance with a uniform plan. Each statement contains the date of incorporation of the company, its location, a description of its property and its business, facts regarding its capitalization, dividends paid, etc.; full descriptions of all bond issues and mortgages; income accounts and balance sheets wherever obtainable, names of officers and directors, with addresses and other useful information. In the entire volume 6132 distinct bond issues, and over 7500 different capital stock issues are fully described. This total does not include the capital stocks of banks, trust companies and financial institutions. Uniform data regarding the latter, including in many cases the par value and dividends paid, are also given. The full capitalization represented in the book, not including the capital of banks, trust companies, etc. (given in statistical form) is \$36,248,668,000. This capitalization is embraced in about 6700 different companies. The proportion which is within the borders of the United States is in excess of \$33,600,000,000, in the aggregate.

Personal

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

Wynn Meredith, of San Francisco, Cal., was recently in Vancouver, B. C.

Richard A. Parker returned to Denver a few days ago and left for New York.

S. F. Shaw is examining mines in the Ocampo district, in Chihuahua, Mexico.

R. Alvin Weiss, of New York, is in Montana in the interest of eastern capitalists.

Donald Gillis, general manager of the Schwab properties in Nevada, is in the Lake district, Michigan.

Clancey M. Lewis, South Bellingham, Wash., has returned from a business trip through the Slate Creek district.

Theodore E. Schwarz has returned to Denver from a professional trip to Arizona, and leaves next week for Leadville, Colo.

C. A. Chase, of Denver, spent several days in Jefferson county, Mont., recently examining mining ground for Boston men.

P. D. Wilcox, of Denver, Colo., was in the Manitou Lake, Ont., gold district last week in the interests of a Denver syndicate.

Robert T. Hill, mining geologist, of New York, is examining coal lands in Wyoming. He will return soon to New York.

Etienne A. Ritter, of Colorado Springs, Colo., was a recent visitor to copper mines in the Boundary district of British Columbia.

Frank C. Willis, of Hills & Willis, Cripple Creek, is spending a few weeks on professional business in Gunnison county, Colorado.

Lucien Eaton, superintendent of the Iron Belt & Shore mines, Iron Belt, Wis., was in Victoria, British Columbia, with his bride, in June.

J. C. H. Ferguson, Pacific Coast representative of the Midvale Steel Company, is on his way to visit the works, in Philadelphia, Penn.

Benjamin F. Tibbey, for years manager of the Parrot mine in Butte, but now living in Utah, is visiting Montana on mining business.

March T. Chase, superintendent of the works of the Mineral Point Zinc Company at Depue, Ill., is in Europe, on his wedding journey.

J. A. Ede has recently returned from an extended trip through Mexico, and leaves in a few days to examine some of the iron mines of the Mesabi, Minn.

Dr. James Bonar, of the Canadian civil service commission, has been appointed deputy master of the Royal Mint about to be established at Ottawa, Ontario.

J. K. Turner, consulting engineer for the A. D. Myers mining interests, has returned to Reno, after a three weeks' inspection trip of the mines at Ely, Nev.

John D. Hoffman, of San Francisco, Cal., and Howard W. DuBois, of Philadelphia, Penn., are examining a hydraulic gold-mining property in the Cariboo district, B. C.

M. A. Meyers, of Buffalo, is in Port Arthur, Ont., in company with several New York capitalists in connection with the opening up of the silver properties of the district.

George L. Walker, of Boston, spent ten days in Butte, Mont., recently, and then left for the north, intending to visit British Columbia, and mining districts of the west and south.

E. Koischwitz, formerly connected with Otto Reimers & Company, Yokohama, Japan, is now in charge of the mining and ore department of the Dr. Schulten Commercial Laboratory, Calcutta, India.

Francis A. Thomson, formerly of Nevada, temporarily appointed professor of mining and metallurgy at Washington State College, Pullman, Wash., has now a permanent appointment to that chair.

Charles Olden, of London, who went to Butte about two months ago to inspect mining ground in the interest of English capitalists, has gone to Wyoming to examine two properties. From there he will proceed directly to London.

Royal P. Jarvis, who has filled the chair of mining engineering and metallurgy for the past four years in the Washington State College, Pullman, Wash., has resigned to accept the professorship in mining recently established in the University of Tennessee.

Edward Stables, of London, England, is at Victoria, B. C., awaiting completion of arrangements for the acquirement by the Vancouver Company of the Lenora mine at Mt. Sicker, Vancouver island, before reopening the mine which adjoins the well known Tye mine.

Charles R. Hitchcock, formerly mining engineer at the Quincy mine, has been appointed superintendent at the Adventure mine succeeding Samuel Brady. The new superintendent has been connected with the Quincy mine since 1901 and is a graduate of the Columbia School of Mines.

Dr. George W. Maynard, after having spent five weeks examining copper properties in the Whitehorse district, Yukon territory, left for Vancouver, B. C., on June 19. He intended before returning to New York to visit the Monitor Copper Company's mine, near Alberni, and the Tye Copper Company's smelting works at Ladysmith, both on Vancouver Island, B. C.

George E. Roberts, for nine years past director of the United States Mint, has re-

signed that position to become president of the Commercial National Bank, of Chicago. Mr. Roberts' administration of the Mint has been a successful one, and many improvements have been made under his direction. He is an acknowledged authority on financial matters. His successor as director of the Mint is Frank A. Leach, who has been in the service for a number of years, and who has been for some time past superintendent of the Mint at San Francisco.

Obituary

Dr. Sidney A. King, of Kingsville, Essex county, Ont., died on July 8 of Bright's disease, aged 65. He was largely interested in oil wells in the western Ontario oilfields, and was instrumental in piping natural gas from South Essex to Windsor and Detroit.

Alexander W. Hill, Milwaukee agent for the Milwaukee-Highland Zinc Mining Company, died suddenly of heart disease in his office on July 1. He was 55 years old and came to Milwaukee from New York 30 years ago. He was interested in the lead and zinc district in southwestern Wisconsin.

James Waddell, for many years a resident of Wyoming valley, Penn., and operator of the Waddell colliery, at Luzerne Borough until about eight years ago, died at Carthage, Mo., July 5, of heart disease. Mr. Waddell was born near Edinburgh, Scotland, 73 years ago, and at an early age came to Pennsylvania where he was active in coal mining for many years, later becoming interested in mines in Missouri.

Sir William Henry Perkin, the discoverer of aniline dyes, died in London, July 14. He was born in 1838. Last year the jubilee of his discovery that waste coal tar could be made to yield innumerable valuable compounds was celebrated both in this country and in England. The industries founded upon his discovery give employment to 120,000 men in Germany alone. More than 700 distinct colors are produced from aniline, besides many other important substances.

Societies and Technical Schools

Michigan College of Mines—The State legislature has appropriated for the college of mines at Houghton \$43,000 for a new central heating and power plant, and \$75,000 for a library and museum building.

Colorado College—The thirty-third annual bulletin, issued at Colorado Springs, Colo., contains besides a historical sketch of the institution, the yearly calendar, lists of instructors, courses of study, requirements for admission to the various

departments and other information. The department of mining and metallurgy is under the direction of Prof. Thomas T. Read.

Lake Superior Mining Institute—The following papers are announced for the annual meeting which is to be held at Duluth, July 24-27: "Sampling of Iron Ores," by L. S. Austin, of Houghton, Mich.; "Biographical Sketches," by J. H. Hearing, of Eveleth, Minn.; and "The Standard Boiler House of the Oliver Iron Company," by A. M. Gow, of Duluth, Minn. Spencer S. Rumsey, F. A. Cokefair and others will also present papers, the titles of which will be announced later.

University of Tennessee—The board of trustees of this university at Knoxville has recently established a chair of mining and metallurgy. The present equipment and the courses hitherto offered will be greatly increased. The plans for the mining and metallurgical laboratory comprise a complete equipment for a modern assay laboratory, with gas, coal and coke furnaces; an ore-dressing laboratory, with small and standard-size machines; a metallurgical laboratory equipment with smelting and roasting furnaces of various types; with other necessary appliances for carrying out experiments on the treatment of ores and the refining of products. Provision will also be made for investigations along electro-metallurgical lines and in metallography.

American Brass Founders' Association—This new association was organized in Philadelphia on May 22, and will be developed along lines similar to those of the American Foundrymen's Association. Those eligible to active membership are: Producers of non-ferrous metals or their alloys; producers of manufactured goods from such metals or alloys; manufacturers of supplies used by producers of metals and metallic goods; and persons holding positions of responsibility with the producers and manufacturers described. The organization began with a charter membership of 50, and the following officers were elected: Charles J. Caley, president; Andrew M. Fairlie, McCays, Tenn., secretary, and John H. Sheeler, treasurer.

Industrial

The offices of De Golia & Atkins, mine operators and dealers in mineral products, San Francisco, have been removed to No. 1020 Crocker building, corner of Market and Post streets.

The Northern Engineering Works, Detroit, Mich., recently shipped a 24-ton crane having a 62-ft. span to the power station of the Buffalo & Susquehanna Coal Mining Company at Sagamore, Penn.

The American Electric Furnace Com-

pany, 45 Wall street, New York, has taken over all the business pertaining to electric furnaces heretofore carried on by the American Gröndal Kjellin Company, of New York, and the Induction Furnace Company, of Newark, N. J. The new company acquires all of the patents taken out by F. A. Kjellin and E. A. Colby, which were formerly owned by the separate companies.

The Gesundheit-Osgood Company, New York, has been organized to carry on the business of manufacturing engineers and business methodizers. The purpose is to serve industrial firms in a consulting capacity with the object of developing their earning power by improving methods of accounting, equipment and process, etc. The members of the firm are Maurice Gesundheit and Henry Osgood.

Robert W. Hunt & Company, of Chicago, will inspect the materials for the Southern Pacific Company's pipe line and all pumps and machinery. The line includes 256 miles of 8-in. rifled pipe and machinery for 24 pumping stations, containing 46 duplicate pumps, and 72 boilers. The pumps will be provided by the Jeanesville Iron Works, Hazleton, Penn.; the pipe by the Lorain plant of the National Tube Company, and the boilers by the Edgemoor Iron Company, Edgemoor, Del.

Trade Catalogs

Receipt is acknowledged of the following trade catalogs and circulars:

Du Bois Iron Works, Du Bois, Penn. Steam and Power Pumps. Pp. 31, illustrated, paper, 6x9 in.

Buffalo Forge Company, Buffalo, N. Y. Buffalo Blacksmith Tools. Pp. 8, illustrated; paper, 3x7 in.; 1907.

The D. T. Williams Valve Company, Cincinnati, Ohio. General Catalog. Pp. 164, illustrated, paper, 5x7 in.

Kolesch & Co., 138 Fulton street, New York City. Barth's Gear Slide Rule. Circular, illustrated, paper, 6x9 in.

The Wood Shovel and Tool Company, Piqua, Ohio. Shovels, Scoops, Spades. Drainage Tools. Pp. 61, indexed, illustrated, paper, 8x11 in.

Machinery Buyers' Magazine. The Morse Brothers' Machinery and Supply Company, Denver, Colo. Pp. 48, illustrated, paper, 6x9 in.; June, 1907.

D'Olier Engineering Company, Philadelphia, Penn. Bulletin, Series T, No. 8. Centrifugal and Turbine Pumps. Pp. 8, illustrated; paper, 7x10 in.; June, 1907.

McCall Ferry Power Company, 60 Wall Street, New York. Bulletin No. 3. Electric Power from the Susquehanna River. Pp. 26, illustrated, paper, 9x11 in.; June, 1907.

Allis-Chalmers Company, Milwaukee, Wis. No. 4006. Allis-Chalmers Belted

Generators Type "AB." Folder and monthly calendar; illustrated, paper, 3x6 in.; June, 1907.

Rockwell Engineering Company, 26 Cortlandt St., New York. No. 10. Rockwell Rod Heating Furnaces. No. 11. Rockwell Bolt Heating Furnaces. Pp. 4, illustrated, paper, 6x9 in.

Utah Mining Machinery and Supply Company, Salt Lake City, Utah. Bulletin No. 400. Callow's Settling and Pulp Thickening Tank. Pp. 16, illustrated, paper, 8½x11 in.; June 1, 1907.

The New York Flexible Metallic Hose and Tubing Company, 173-177 Lafayette St., N. Y. Bulletin No. 25. "Nyflexmet" Lead Covered Flexible Metallic Hose and Tubing. Pp. 11, illustrated, paper, 6x9 in.

General Electric Company, Schenectady, N. Y. Bulletin No. 4495. Direct-Current Fan Motors, Type D1. Pp. 4, illustrated, paper, 8x10½ in.; June, 1907. Bulletin No. 4506. The Edison Gem Filament 50 Watt Lamp. Pp. 8, illustrated, paper, 8x10½ in.; June, 1907. Bulletin No. 4516. MR Circuit Breakers. Pp. 4, illustrated, paper, 8x10½ in.; June, 1907.

Construction News

Ely, White Pine County, Nevada—The McDonald Mining Company is preparing plans for a new 50-h.p. hoisting plant.

Lawrence County, South Dakota—The Pluma Mining Company plans to install a cyanide mill. T. A. Harding is secretary.

Slate Creek District, Whatcom County, Washington—The management of the Anacostes mine has announced the intention to erect a 10-stamp mill this season.

Pennington County, South Dakota—The Standby Company intends to equip its 60-stamp mill with cyanide tanks. J. B. Baker, of Lead, is one of the chief owners.

Iron County, Utah—The Jenny Gold Mining Company will probably enlarge its milling plant in the near future and will install cyanide equipment. C. A. Short, at Gold Springs, is manager.

Ontonagon County, Michigan—The Winona Copper Company plans to erect a stamp mill at the mouth of Misery river a short distance from the mine. The mine office is at Winona, Mich.; the main office is at 199 Washington street, Boston.

Boundary, British Columbia—Surveys have been ordered by M. M. Johnson, consulting engineer and managing director of the Dominion Copper Company, for an aerial tramway it is planned to construct from the company's mines at Phoenix five miles down to its smelter at Boundary Falls. Continued shortage of railway cars necessitates other provision for conveyance of ore to the smelter, the treatment capacity of which is now 1200 tons daily.

Special Correspondence from Mining Centers

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

REVIEWS OF IMPORTANT EVENTS

San Francisco

July 10—It is hoped that within a month two of the big producers at Angels, Calaveras county, the Utica and Lightner mines, may be able to start up again on the open-shop plan with the old nine-hour-day schedule. The mines have been closed down some time owing to the strike of the miners' union.

The Southern Pacific Company has started men grading for an extension of the main line from Wabuska, Lyon county, Nev., to reach Aurora in the same State, and then Bodie and Masonic mining district in Mono county, Cal. Bodie is one of the old camps and still has several producing mines. Masonic is a comparatively new district, but there are numerous properties under active development, many of them very promising, and a few are shipping ore.

The extreme northeastern county of this State, Modoc, is about to be prospected for oil. The first field is at Canby, 20 miles from Alturas. H. G. Betts has formed the Modoc Oil Company, which has secured the right to explore about 1000 acres at Canby, the owners of which are to receive 10 per cent. of any output.

The old drift mining town of Iowa Hill, on the Iowa Hill divide, Placer county, has been in a state of decadence for some time, but lately people have been investigating the mines and there is a prospect of a revival. The famous Big Dipper remains closed down. The Morning Star drift mine, which paid consecutive monthly dividends for nine years, is worked out. Those working and still producing more or less are the Booth River claim, Dewey Consolidated, Gleason, Gould, Hazelroth, Independence, Indian Cañon, McGeachin, Schwab Cañon tailings, Truro, Washington, and a few smaller ones. These are all drift mines, and there still remain four miles of known gravel channel as yet undeveloped.

The 25-ton electric smelter at the Pitt River iron fields, in Shasta county, has been put in operation with Dr. Heroult, the inventor of the process, in charge. While pronounced successful, only a few tons of pig iron have thus far been made, but already a 2000-ton smelter is planned. The plant was erected by H. H. Noble, of Heroult, Shasta county.

Several new discoveries of tungsten ore have lately been made in the Randsburg district, Kern county, and mines are being opened. The Winnie and Johnnie mines were first worked for gold and about \$80,000 extracted, but the properties are now

considered more valuable for tungsten. The ore has been sold to the Primos Chemical Company of Primos, Pennsylvania, but most of the ore is now shipped to Hamburg, Germany. The Pappoose and Churchill properties are owned by the firm of Geo. C. Blackwell's Sons & Co., of London, Eng., who ship a carload of concentrates monthly.

The arrival of the machinery for the new skipway of the Shasta King mine, owned by the Trinity Copper Company, is considered to dissipate the doubts as to that company operating the mine, which lies west of Kennett, Shasta county. At the mine 60 or 80 men have been at work for several months, getting it ready for steady shipment of ore to Coram as soon as the Balaklala smelter is completed. It is understood that the Trinity company has contracted to deliver 500 tons daily for five years.

Three machine drills have been set at work in the Hornet mine of the Mt. Copper Company, in Shasta county, and 1500 tons of ore daily are being shipped to the company's smelter, near Martinez, on San Francisco bay. These shipments will continue until all four furnaces of the Keswick plant are ready for operation. Only one is being run at present, and the others are being rebuilt.

The Blue Ledge Copper Company, of New York, is expected to make the final payment of \$200,000 due in September, for the Blue Ledge copper mine. Under the superintendency of J. W. Carnahan the company has done thousands of dollars' worth of development work. The Blue Ledge is 27 miles from Oak Bar, Siskiyou county. Supervisors are now considering the proposition of building a good wagon road from Oak Bar to the mine.

The old gold mining section of Happy Camp, in Siskiyou county is coming to the front as a copper region. A great many locations have been made of copper claims in the immediate vicinity, and also to some distance down the Klamath river. The larger part of the country for many miles in every direction from Happy Camp is said to carry surface evidence of being mineralized, copper being the principal ore. A number of claims have been bonded and are to be prospected. Thus far no production whatever has been made.

The Sierra Buttes mine, Sierra City, has been started up by the Hayes Bros., of San José, who bought it from the English corporation, which ran it for 40 years or more. The mine is one of the oldest in the State, and has yielded altogether

about \$12,000,000. It now has 80 stamps crushing ore.

The old El Dorado Water and Deep Gravel Mining Company, with an extensive ditch system and water right, in El Dorado county, has been sold to San Francisco men. The company was formed in 1873, and at one time it carried on extensive hydraulic mining operations. The property is now mainly valuable for its ditch and water rights.

Another mine supposed to be the famous lost Breyfogle, has been found in southern California, this time in the Funeral range, back of Greenwater, Inyo county. The recent find is on one of the highest peaks of the range, and it has caused a stampede from Greenwater and the surrounding country.

Salt Lake City

July 12—The American Smelting and Refining Company has its new bag house in commission at its Murray smelter, which was erected at a cost of approximately \$150,000. It is the largest in the world and the management of the company believes it will prove entirely efficient in the collection of flue dust and the suppression of fumes. Suspended in this house are 4160 bags, 30 ft. long and 18 in. in diameter. This material, if spread out in one piece, would cover an area of 15 acres. The building is 100x216 ft., and contains four compartments with valves so arranged that any compartment may be opened or closed as desired. In the construction of the plant, 2,400,000 brick were used; also, 350 tons of steel. The smoke coming from the reverberatories is forced into the bag house by means of a huge fan, handling 250,000 cu. ft. of gas per minute. The size of the fan is 16x6 ft., and requires 125 h.p. of electrical energy to operate it. The bag house is large enough to take care of the fumes from 16 reverberatory furnaces, or just twice the number the company is now operating at Murray. It is the intention of the smelting company to ship the arsenical dust collected to Everett, Washington, for re-treatment and final disposition.

The Ontario Silver Mining Company has begun draining its mine by means of pumps, and the management is confident that within a short time work can be resumed in the drain adit tunnel, which has been closed by caves for more than two years. The company has experienced a great deal of difficulty in getting men willing to work in the face of the tunnel, not knowing how soon the pent-up waters might break loose. For several months

the company paid its employees \$4.50 per day of eight hours, and when the demand for an additional 50c. a day was refused, the men struck and the matter was never settled. It was after this that the management decided to use pumps.

Dividends were declared during the week ending July 6 by the following Utah companies: Newhouse Mines and Smelters, \$300,000; Lower Mammoth, \$9500; May Day, \$8000.

The ore and bullion settlements reported by Salt Lake banks for the first half of the year, aggregated a little more than \$14,000,000.

The Centennial Eureka Mining Company has filed suit against the Bullion Beck & Champion Mining Company, to confirm title to the Solid Muldoon and two other lode-mining claims.

Denver

July 12—After long litigation the executors of the Stratton estate have announced that they have decided not to ask for a rehearing in the Supreme Court in the matter of the payment of the inheritance tax and to pay into the State treasury the sum of \$384,000, which includes the accrued interest.

The directors of the Portland Gold Mining Company have declared a quarterly dividend of \$120,000, bringing the total disbursed by the company to \$7,507,080.

Arguments in the case of James F. Burns against the officers of the Portland Gold Mining Company, on the latter's motion that they be not compelled to show the records of the corporation to Mr. Burns, who alleges incompetency and mismanagement, were heard at Cheyenne yesterday before Judge Matson, in the District Court, and the matter was taken under advisement.

A syndicate of New York men and local capitalists has organized the Hydro-Electric Company for the purpose of constructing a plant to supply power and light to the Montezuma and Argentine mining districts. Although the main object of the enterprise is for the benefit of the Pennsylvania mines, power will also be furnished in the surrounding districts.

In consequence of a cloudburst in Clear Creek cañon the track of the Colorado & Southern railroad has suffered serious damage, and for several days the ore supply from Clear Creek and Gilpin counties to the smelters will be cut off.

Several conferences have been held here during the past few days between Deputy State Labor Commissioner Swanson and W. Z. Kinney, and Frank L. Ross, of the San Juan Mine Owners' Association, in regard to the settlement of the labor trouble in the Silverton district, and it is still hoped that the matter will be arranged without a strike.

The ore-testing works of Henry E. Wood & Co., at Denver, were completely destroyed by fire July 7. They were fully insured. A new plant will probably be built.

Duluth

July 14—The program of the meeting of the Lake Superior Mining Institute, which will be held at Duluth and the Minnesota iron ranges July 24 to 27, will begin with a visit to the power plant of the Great Northern Power Company, which will then have in motion the largest water-power unit in existence, 10,000 h.p., and will be installing two more of the same capacity. At that evening's meeting in the Commercial Club rooms at Duluth one leading paper will be by the chief engineer of this power works.

There is some danger of trouble with dockmen on all ore-shipping piers of the Minnesota district; they are unwilling to maintain the agreement they entered into with the railways at the beginning of the season. There is also some talk of a strike of members of the Western Federation of Labor on the Mesabi next week, but the Federation is rather weak and one steam shovel additional would almost make up for any loss from the withdrawal of its members. Dockmen were settled with for the season on a basis of \$2.25 and \$2.50, the latter for night men, for the season until cold weather,; but the men do not seem to care to maintain their side of the agreement, and want an advance of 25c. per day.

Another model town, though on a smaller scale, is to be built at Princeton in the Marquette district, by the Cleveland Cliffs Iron Company. A tract of 300 acres is to be cleared immediately, seven miles of streets built and the same length of sewers, water mains, etc., to be laid, and six miles of fences erected, all before a single dwelling is to be permitted. A number of houses will be erected by the company and will be sold on long time and at practically cost to those employed, or going into business at the town.

Scranton

July 11—Officials of the Pennsylvania Coal Company are fearful that their collieries in the vicinity of Pittston, Penn., may be flooded, owing to the great amount of surface water which finds its way into the workings since the extensive cave-in which occurred in that section. To prevent such a disaster the roof of the Grand tunnel is being propped. There is danger that the immense volume of water which drains a number of the mines might be dammed, with serious results.

A conference of the mine inspectors of the anthracite region was held in Hazleton on July 5, when a number of subjects incident to the department were discussed and some prominence was given to the frequency of fatal accidents in the region and the best method of reducing fatalities. It was the general opinion that greater care should be exercised with regard to pillar robbing and the construction of more adequate air courses in gaseous mines. Those attending the conference

were: Chief Inspector James E. Roderick, John Curran, Pottsville; C. J. Price, Lykens; L. M. Evans, H. D. Johnson, H. O. Prytherch and David T. Williams, Scranton; Thomas H. Price, Wilkes-Barre; James J. Walsh, Wilkes-Barre; H. MacDonald, Pittston; A. B. Lamp, Pittston; P. J. Moore, Carbondale; D. T. Davies, Wilkes-Barre; L. O. O'Donnell, Centralia; J. W. McLaughlin, Shamokin; P. M. Boyle, Kingston; David Roderick, Hazleton; Isaac Davies, Lansford.

Toronto, Ont.

July 13—Since the strike of miners at Cobalt on July 8 it is estimated that 1500 miners have left the camp, many of them having gone out of the country. F. A. Acland, of the Labor Department at Ottawa, has been endeavoring to effect a settlement and urged the men to return to work as provided by the conciliation law, which, however, they refused to do. The law as passed last session renders it a criminal offense for miners to go out on strike without first submitting the case to the officials and endeavoring to obtain a settlement, but in this as in other instances, this feature of the law has proved a failure. Nearly all the mines have been closed during the week. The Timiskaming mine has accepted the union's terms and the men have returned to work. Everything has been peaceful and orderly and the Government has prohibited the sale of liquor in the camp.

London

July 6—The shareholders of Stratton's Independence, Ltd., have approved of Philip Argall's scheme for treating the dump of ore. Mr. Argall estimates that the dump, which, by the way, is really an ore-house dump, contains 600,000 tons of ore and averages \$3.60 per ton. The cost of roasting at Cripple Creek precludes its adoption on this dump ore in bulk. The treatment of the ore by raw cyaniding yields only 50 to 60 per cent. of the gold contents. Mr. Argall's plan is to crush to 1/30 in. aperture and concentrate. In this way about a third of the gold contents of the ore can be obtained in concentrates averaging \$25. This concentrate it will pay to roast. The remainder after concentration consists of 20 to 30 per cent. of slimes and 60 to 70 per cent. of sands. It is well known that in these ores the slimes contain far more gold than the sands. In a specific sample of 100 tons of dump ore, about 5 per cent. was obtained as concentrates averaging \$25, 23 per cent. as slime at \$5.50, and 73 per cent. as sand at about \$1.60. All through, the resulting extraction is over 70 per cent. The recovery of \$3.60 ore is about \$2.52. It is estimated that the operating cost will be \$1.50 per ton, so that the profit obtainable will be \$1 per ton. Mr. Argall also gives details of the vast bodies of low-grade ore still in the mine.

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

Alabama

BIBB COUNTY

Cahaba Southern Coal Company—Mining has been begun on a seam opened by a new slope which is down 300 ft. Shipments are expected to be made within a few weeks. T. Y. Scoggins is the engineer in charge.

Roden Coal Company—This new company will develop 4200 acres of coal lands. It is reported that a plant will be erected at a cost of \$225,000 to produce 4000 tons of steam coal per day. B. F. Roden, of Birmingham, is president.

Arizona

GRAHAM COUNTY

Arizona Copper Company, Ltd.—This company reports the production of its mines at Clifton for the month of June at 1321 short tons of copper.

Arkansas

NEWTON COUNTY

Spanish Lamar Mining Company—Organization of this company has been effected at Harrison, with the following officers: A. Kibbs, president; E. R. Springer, vice-president and general manager, and John Bunch, secretary and treasurer. The company will develop zinc properties in Newton county.

California

AMADOR COUNTY

Kennedy Mining and Milling Company—At this property, Jackson, good ore at the 300-ft. level is a matter of encouragement for other mines on the Mother Lode.

BUTTE COUNTY

'49 and '56—These old claims at Yankee Hill, owned by the Hearst estate, which have been idle many years, are being reopened.

CALAVERAS COUNTY

Nuner Tunnel—This tunnel, near Moke-lumne Hill, is in 2000 ft. and rich gravel is being taken out. A new engine with hoist has been installed at the end of the tunnel to bring the gravel up the 40-ft. incline and to hoist the water. The gravel is cemented and is milled. J. C. Rodder is superintendent.

EL DORADO COUNTY

Cooley—At this mine, Brazil, Giga & Co. have opened a fine body of gravel. The

dump bins, sluices, etc., are nearly completed.

Golden Hatchet—This gravel mine has been bonded and development work has been begun.

Taylor—This mine, formerly the Idle-wild, is being reopened and will be unwatered to the 200 level, from which point operations will be carried on north of the shaft.

Vivian—The mill building is nearly ready to receive the machinery at this mine, Georgetown.

KERN COUNTY

Gwynne—At this mine, Piute mountain, a large force of men is cutting timbers for the new tunnel.

Silver—Dunbar Miller and Rainey have made another find on the divide between Indian creek and Back cañon. The ore runs high in silver and considerable is being taken out.

NEVADA COUNTY

Birchville—Operations have been resumed at this mine, near Graniteville, with Fred Medlin as superintendent. The machinery and pumping plant will be improved.

Mountain View—At this mine, at Washington, E. B. Miller, superintendent, the small mill is again running steadily.

Murchie Extension—At this mine, near Nevada City, the upraise from the 300 level shows a high-grade ledge.

Olla—This mine, formerly the McPherrin, M. A. Spotswood, superintendent, now has its tunnel in 500 ft., but there are still 700 ft. to be run to cut the ledge.

Olympus Mining Company—This Spokane, Washington, company has taken over the Gold Mound mine at Deadman's Flat, near Nevada City.

Posey—This mine, J. Goodwin, superintendent, is being examined by Oakland men, who will incorporate a company and place it on the market if they are satisfied.

SAN BERNARDINO COUNTY

American Group—This property, near Amboy, has been bonded for \$135,000 by H. M. Glidden, of Spokane, Washington.

Crackerjack Bonanza Gold Mining Company—In the tunnel of this company a 2½-ft. ledge of high-grade ore has been found.

Dry Lake Mining Company—At this mine, north of Victor, A. P. Preciado,

superintendent, the main shaft is down 250 ft., and a gasolene hoist and mill are to be put in.

Lytle Creek—On the south fork of this creek, while driving a water tunnel, Dickey & Shephard have found gold and copper ore.

SAN DIEGO COUNTY

Mesa Grande Gold and Gem Mining Company—It is reported that this Los Angeles company has received the largest shipment of gems ever made from its mines.

SHASTA COUNTY

Union Hill—After the surface deposits had been sluiced off, some rich pockets of gold have been found in the gravel banks of this mine.

White Oak—F. H. Griffith has bought this mine in Lower Springs district.

Yankee John—At this mine, eight miles west of Redding, some very high-grade gold ore is being taken out.

SIERRA COUNTY

Thornburg—The strike in this mine at Forest City is arousing much interest in the district. The ledge is 3 ft. wide and shows free gold. It will be drifted upon both ways.

SISKIYOU COUNTY

Nordheimer—This old mine on the Salmon river has been sold to men from Palo Alto, Santa Clara county. The mine was owned by Wm. Lord, C. W. Lord and N. W. Carter.

Sheba—This mine in Scott valley will soon have its mill running on quartz from the fourth level.

Colorado

LAKE COUNTY—LEADVILLE

The present year is conceded to be one of the most active in Lake county in several years. Among the new shafts being sunk are the new Alhambra placer shaft on Rock hill where good ore leaders have been found, and the shaft on the Delaware property on Rock hill which has reached a depth of 270 ft. in porphyry. Electric machinery is used in the Delaware shaft.

June Tonnage—The production of the Leadville district for the month of June was about 77,000 tons including the dump material handled by the mills. The approximate value of the ore shipped is \$14

per ton. In addition to this is the gold sent to the mint from the Ibx mine.

Carbonate Hill—The Little Nell property has reached a body of carbonates and 50 tons are being shipped daily. From the various Star leases, shipments of several hundred tons of manganese are being made daily to the Pueblo steel works.

The Garbutt—About 300 tons of copper sulphide are being shipped per month from this property. The veins are found in porphyry.

Sugar Loaf—Mineral which accumulated during the winter months in the Virginius mine is now being hauled to the smelters. The Dinero tunnel is being pushed by machine drills and is in 800 ft.

TELLER COUNTY—CRIPPLE CREEK

Stratton's Independence—This company has decided to build a cyanide works of 6500 tons capacity per month at Cripple Creek. Work will be begun immediately under the direction of Philip Argall, consulting engineer for the company. Mr. Argall is still in England, but will return shortly.

Idaho

LEMHI COUNTY

New Copper District—About 25 claims have been located in what is believed to be a new mineral belt on the borders of Custer and Lemhi counties. Copper sulphides have been found near the surface.

SHOSHONE COUNTY

Eldorado Mining Company—This company has been incorporated to develop a group of four claims known as the Mother Lode, Mother Lode Fraction, Copper King and Copper Crown Fraction, all situated about a mile east of Kellogg.

Indiana

CLAY COUNTY

Coal Cars—The Chicago & Eastern Illinois Railroad, penetrating the heart of the Indiana block coalfield, has ordered 2000 drop-bottom coal cars, each of 50 tons capacity, in order to take care of the increasing traffic for the summer months.

PIKE COUNTY

Patoka Valley Coal and Coke Company—The mines and property of this company in the county have been transferred to George H. Hurst, assignee, subject to a mortgage held by the Binghamton Trust Company, of New York. The mines are among the largest and best equipped in southern Indiana, being lighted and operated by electricity. The mines will be operated for the time being by the assignee.

Kentucky

Coal Production—State Geologist C. J. Norwood, in his report for 1906, shows a production of 9,598,527 tons of coal, an in-

crease of 4,577,854 tons, or 90.12 per cent as compared with the production of 1900, and more than three times the output of 1896.

Michigan

HOUGHTON COUNTY

Centennial—The new hoisting plant at No. 2 shaft has gone into commission.

Isle Royal—This property has taken over the Hussey-Howe tract of land—the consideration being \$220,000. This property adjoins the Superior.

Montana

BUTTE DISTRICT

Anaconda—The company has begun enlarging the Belmont shaft from a two-compartment to a three-compartment and will retimber it as soon as practicable.

Coalition—Fire in a stope between the 600- and 700-ft. levels about 125 yd. west of the shaft of the Minnie Healey caused a temporary suspension of mining in the Minnie Healey, West Colusa and Leonard mines last week, but work has been resumed in all of the properties except the Minnie Healey, the shaft of which is used as an outlet for the gas generated by the fire. Boston & Montana, Butte & Boston and Coalition are fighting the fire together, as it concerns all of them. The origin of the fire is not known, but is said to be due to spontaneous combustion of material used to fill the stope. It has been burning about seven weeks, but was not definitely located until a week ago. The gas is drawn up the shaft by means of fans placed near the mouth of the opening, this being the only method of handling it, as the shaft is a downcast.

La France—This company, the only asset of United Copper in Butte, is mining an average of 96 tons of ore a day and developing its lower levels. The old drifts and crosscuts, driven by the Lexington Company years ago, have not been extended far enough to show ore. The lower level, at 1450 ft., contains a 14-in. vein of pyritic copper ore on which little drifting has been done. All of the ore mined now is coming from the upper levels.

North Butte—The drift in the Edith May vein west of the crosscut at the 1800 has been extended 300 ft. the full width of the vein and stoping will begin this week. The drift east of the crosscut is 50 ft. long, but does not show such good ore as the west drift. The larger part of the shoots are west. The company is mining between 1200 and 1300 tons of ore a day and driving its two crosscuts north, the face of the one on the 1600 being in Berlin ground and that of the other, 1800, being close to the Jessie vein.

Pittsburg & Montana—The company has begun crosscutting for its veins on the 1400, but will not reach them from

the main shaft, No. 2, for a little time. It is mining at this depth through a series of winzes from the 1200 and is therefore positive as to the mineral possibilities of that level. The quantity of ore mined and shipped each day varies, but will probably average 150 tons.

Nevada

NYE COUNTY—TONOPAH

Ore Shipments—Shipments of ore over the Tonopah Railroad for the week ending July 4 were: Tonopah Company, 982 tons; Belmont, 237; Tonopah Extension, 190; Midway, 85; Montana-Tonopah, 36; Jim Butler, 36; total, 1566 tons. Shipments from Goldfield were 1550 tons, making a total of 3116 tons. The Tonopah Company, in addition, sent 2810 tons and Belmont 780 tons of ore to the mills.

WHITE PINE COUNTY—ELY

Boston Ely—The company has made the final payment of the purchase money and has completed arrangements for prospecting. Work will be resumed in the mine within a few days.

Butte Ely—The Bee Hive shaft has been sunk 290 ft.—the last 100 ft. being in ore. The Westphalia shaft is 220 ft. in depth and is in good sulphide ore. It is proposed to start a drift at the 270-ft. level and connect with the Bee Hive shaft. The company's surveyors are surveying a route for the pipe line for water from Water cañon, about 18 miles distant.

Chainman—Mining has been resumed on this property. The title to the claims has been perfected by the purchase of the whole of the interests of Mrs. Mary McGill in the Aultman, Johanna, Johanna No. 2 and Great Western claims. The directors have also secured several other adjoining claims.

Ely Central—A body of copper sulphide ore has been cut in the Weber shaft at a depth of 400 ft., believed to be a continuation of the Eureka lode of the Nevada Consolidated mine.

Ely Consolidated—The shaft has been sunk to a depth of 560 ft. and is in a body of iron sulphide carrying a little copper. Ore is being developed in the Rising Sun claim at the 40-ft. level.

Ely National—This property embraces the claims formerly owned by the Anaconda, Mizpah Verde and Ely Jumbo companies. Work will be resumed under new management shortly.

Giroux Consolidated—Ore is being regularly shipped to Salt Lake smelters from the Alpha claim. The ore carries gold and silver in addition to the copper. The chief workings are at the 1000-ft. level.

McDonald—The shaft has been sunk to the 270-ft. level and is in a body of ore showing copper and gold. A new air compressor and a set of six machine drills have been installed. Plans are being prepared for a new 50-h.p. hoisting plant.

North Carolina

ROWAN COUNTY

Union Copper—This property is paying well under the careful management of Captain Griswold, of Gold Hill. One or two carloads are shipped daily to the American Smelting and Refining Company at Perth Amboy, N. J., yielding $3\frac{1}{2}$ to 4 per cent. copper and some gold and silver. The manager has done away with the use of all smelting and concentrating machinery now on the property. The ore from the mine is hand-picked and put directly into cars. The mine is opening up large reserves, at the same time keeping up its rate of shipment.

Oregon

DOUGLAS COUNTY

Copper Quarry—This copper mine has been sold to a Mr. Carl, of Los Angeles, Cal., by the owners, Richardson & Cook. The mine is situated a few miles east of Yoncalla, and ore from the property won both silver and bronze medals for exhibits of copper ore at Lewis & Clark fair, 1905.

LANE COUNTY

Combination—Rich silver ore has been struck in this property operated by Clark brothers.

Twin Rocks—The crosscut is now in 140 ft. W. H. Winings, of Illinois, a director of the company, will direct work this summer with the manager, Lewis Hartley.

West Coast Mines Company—This company, which has taken over the property, debts, etc., of the Oregon Securities Company, recently shipped 20 tons of concentrates to the Tacoma smelter, and returns received give values of \$50 per ton.

Pennsylvania

ANTHRACITE COAL

Delaware & Hudson—This company has established headquarters for its engineers in Pottsville, in the territory where during the past two years it has purchased valuable coal lands. The engineers will immediately make surveys to locate the coal seams. The company acquired a total of 3300 acres of coal land at less than $1\frac{1}{2}$ c. per ton and at the same time acquired 2 per cent. of all the unmined anthracite in Pennsylvania. All of the tracts, with one exception, will require deep mining. It is estimated that mining at the rate of 3,000,000 tons a year, the company has sufficient coal for 65 years.

Delaware, Lackawanna & Western—This company on July 8 began developing the great coalfield in Hanover township, near Wilkes-Barre, which has the richest deposits of coal in the anthracite region. Two new shafts are to be sunk and the work will occupy two years. The shafts

will be the largest in the system of the company and the breaker to be erected will be larger than the Truesdale breaker, at present the largest in the world. The coal is of an aggregate thickness of 92 ft. One of the shafts will be upon the site of the old Dundee shaft, which was sunk in 1851 and which soon after its completion was abandoned, owing to the gaseous nature of the mine. The old shaft was 10x16 ft. and it will be widened to 12x48 ft., while a similar shaft will be sunk about 100 ft. distant. The second shaft will really be an air course and supply shaft, so that there will virtually be but one colliery.

Lehigh & Wilkes-Barre—This company is also sinking a shaft in Hanover township and will develop the valuable lands it owns in this vicinity.

Honey Brook Colliery—Mine Inspector John Curran states that the recent explosion in the Honey Brook mine was one of the saddest in the history of the anthracite industry. Nine men lost their lives owing to the "white damp." The accident took place in the old slope which was flooded 15 years ago and abandoned because of a fire. Recently the water lowered 225 ft. and about two years ago the operators took steps to drain it out. A tunnel was driven from the Buck Mountain to the Gamma vein and three holes were drilled from the face to the water. The men have been engaged in taking daily measurements of the water making trips into the slope to ascertain the progress made. July 12 two of them made the usual trip and not returning within a reasonable time, two others were sent to investigate the cause of the delay. They did not come back either but four lights were seen burning in the distance. Presuming that some slight accident had occurred two more men were sent to assist them but no response was received from them, whereupon the fourth set was hurriedly despatched and failed to send any tidings. James Laffendo, foreman, and a companion then set out and had gone to within 100 ft. of the body of water when Laffendo pitched forward and fell upon his face, his companion, who was a few feet in the rear, escaping and running quickly to daylight where he gave warning. None of the men were rescued alive. This is the first accident that has occurred in the anthracite mines which will come under the operation of the new employers' liability act.

BITUMINOUS COAL

A. R. Sackett Coal and Coke Company—The plant of this company at Uniontown, consisting of 30 ovens, 30 or 40 acres of coal lands, coke crusher and other machinery, has been purchased by the Iron City Coal and Coke Company, of Pittsburg. The plant will be known as the Dorothea works of the purchasing company.

South Dakota

CUSTER COUNTY

Catawasa—A steam hoist has been installed. The vein of ore is 4 ft. wide.

Chicago Mica Company—A long lease has been given parties in Sioux City, Iowa, on the mica mine owned by this company, work to be started this week. The company was formerly the Black Hills Porcelain, Clay and Marble Company.

Globe—This property, adjoining the Saginaw mine, has been purchased by some of the stockholders of the Saginaw company and is to be developed thoroughly.

New Strike—A. T. Feay and William and George Schenk have discovered a vein of high-grade ore on the Goldfield group, near the ranch of Ernest Bellemore. Dell Dickson is also interested in the new field.

Saginaw Gold Mining Company—This company has its mill building inclosed and machinery for a 100-ton mill is being installed. The process will be amalgamation, concentration and cyaniding. A new shaft has been started on the north end of the ground in ore.

LAWRENCE COUNTY

Cleopatra Company—R. B. Hughes, general manager, at Spearfish, states that the crosscutting on quartzite has encountered a large amount of ore. The company proposes to explore further and resume operations in the mill.

Globe Gold Mining Company—This company has recently cut through a ledge of porphyry ore 35 ft. thick. The company is building a mill to use the Ogden process. Recently 57 acres of additional ground have been secured, which gives dumping space for tailings and also carries ore.

Homestake—The mine has been unwatered to the 600-ft. level. Five of the six stamp mills have resumed, with 800 out of 1000 stamps. The sixth, the 200-stamp Homestake mill, will resume shortly. About 800 miners are at work in the open cuts and in the upper workings.

Imperial Company—This company will begin sinking the Dakota shaft to quartzite, having acquired the control of the Dakota stock. The shaft will develop several surrounding properties.

Mills in Operation—Nearly all of the cyanide mills in the county have resumed since the strike was settled. The Lundburg-Dorr, Imperial, Golden Reward, Mogul and Wasp No. 2 mills are in operation. The Dakota mill will not resume for the present, all of the Dakota properties having been consolidated with the Imperial company. Repairs are being made on the Gilt Edge-Maid mill and the Golden Crest mill is to be increased to 200 tons capacity before resuming. The Golden Crest Company is issuing \$200,000 bonds at Detroit, Mich.

Pluma Mining Company—The company has recently sunk a shaft in the east side

of Lead 180 ft. deep, following a vein of ore supposed to be a leader to the Homestake Caledonia vein. The shaft is 150 ft. east of the hanging wall of the Caledonia vein. Repair work is in progress in the old workings in the conglomerates and quartzite, where over 200,000 tons of ore are blocked out. An electric hoist of 1000 ft. capacity has been ordered. The company proposes to install a cyanide annex to the 40-stamp mill. The ore will be crushed to 10 mesh, passed through the stamps and thence to Chilean mills, which will give a daily capacity of 300 tons.

Tennessee

MAURY COUNTY

Standard Phosphate and Chemical Company—This company has been organized in Chicago, Ill., to develop phosphate lands in Hickman and Maury counties. The following officers have been elected: W. E. Pierce, president; J. O. Griffith, vice-president, and E. Nicodemus, secretary. Operations are in charge of Eugene Worley, of Centerville, Tenn.

Utah

JUAB COUNTY

Tintic Ore Shipments—Ore shipments for the week ending July 6 amounted to 135 carloads: Ajax, 1; Beck Tunnel, 8; Bullion Beck, 8; Carisa, 8; Centennial Eureka, 41; Colorado, 7; Eagle & Blue Bell, 5; Gemini, 5; Godiva, 2; Grand Central, 3; Lower Mammoth, 8; Mammoth, 2; May Day, 4; Scranton, 6; Tintic Iron, 9; Yankee Consolidated, 5; miscellaneous mines, 7 cars.

Centennial Eureka—A new steel building is being erected over the hoisting plant at this property.

East Crown Point Mining Company—This company has been organized to operate in the Tintic district. J. A. Jensen, of Eureka, is president.

Ibapah Gold Mining Company—This new company will operate in Spring Creek. E. F. Hall, of Salt Lake City, is president and J. W. Rooklidge, vice-president.

Scranton—This company is shipping lead and zinc ores. The mine is the largest zinc producer in Utah. Several permanent mine buildings are to be built this year.

SALT LAKE COUNTY

Bingham Mary—The company is putting in a tramway which will be operated between the mine and the Rio Grande & Western Railroad.

South Columbus—This Alta company will shortly install a large compressor plant, which has already been ordered. Regular ore shipments are to begin soon.

SUMMIT COUNTY

Iowa Copper—This company has resumed development work after a cessation of operations of two months, due to difficulties with water.

Vallejo—Leasers are shipping high-grade silver ore.

UTAH COUNTY

National Ozokerite Company—This company has started its mill, near Colton, and is turning out a mineral-wax product. The plant is built to handle 50 tons of material daily.

Virginia

TAZEWELL COUNTY

Pocahontas Consolidated Collieries Company, Inc.—This company has been formed by the union of the Pocahontas Collieries Company and the Pocahontas Consolidated Company. The capital of the new corporation is \$2,800,000 6 per cent. cumulative preferred, and \$5,000,000 common stock. A bond issue of \$20,000,000 has been authorized. The officers of the new company are: Isaac T. Mann, president; Charles S. Thorne, first vice-president; Jenkin Jones, second vice-president; James E. Jones, general manager; J. Walter Graybeal, secretary; and William S. Wood, treasurer.

Washington

WHATCOM COUNTY—SLATE CREEK DISTRICT

Bonita—The 10-stamp mill and the cyanide plant are in operation, and a 40-ton Bryan mill is to be put in.

Granite Creek Mining Company—This company has let its placer properties to a development company consisting of former stockholders, Jaques Brothers & Ferguson. Mr. Thomas Swansborough, of Placerville, Cal., is the pipe-man in charge and Clancey M. Lewis is consulting engineer.

Minnesota Mining Company—The company has purchased a four-stamp mill, and is building a dam across Cañon creek for power purposes, and continuing the wagon road from the North American camp to its mill site.

Wyoming

SWEETWATER COUNTY

Superior Coal Company—Three of the company's coal mines at Rock Springs have been closed down as the result of the suits recently filed by the Government against the Union Pacific Coal Company for the recovery of lands alleged to have been obtained by fraud.

Canada

ONTARIO—COBALT DISTRICT

Cobalt Ore Shipments—Shipments of Cobalt ore for the week ending July 6 were as follows: Buffalo, 120,000 lb.; Coniagas, 272,000; La Rose, 60,115; McKinley, 48,000; Nipissing, 102,170; Imperial Cobalt, 37,530; total 639,815 pounds.

Timiskaming—Superintendent Harmon

reports that nuggets were taken out recently weighing 1225 lb. At the 110-ft. level the vein is 3 ft. wide.

Mexico

CHIHUAHUA

Palmilla—The mill and other buildings at this mine in Parral, owned and operated by Pedro Alvarado, were destroyed by fire, July 8. The loss will be several thousand dollars.

GUANAJUATO

Pinguico—This mine of the Guanajuato Development Company is shipping to the smelter daily about 23 tons of ore, yielding \$150,000 monthly. A large quantity of lower-grade ore is being treated in local mills. The company's own mill is nearly complete.

Humboldt Mining Company—This company is sinking three shafts, one for the purpose of cutting the Pinguico bonanza vein, where it is supposed to pass into the Humboldt property.

Australia

WESTERN AUSTRALIA

The gold output in May is reported at 145,490 oz. fine, which is 15,450 oz. more than in April, but 11,531 oz. less than in May, 1906. For the five months ended May 31 the total was 761,604 oz. fine gold in 1906 and 701,731 oz., or \$14,504,780, in 1907; a decrease of 59,873 oz., or 8.5 per cent. Dividends paid by Western Australian companies are reported at £724,750 for the first five months this year.

Europe

SPAIN

Exports of minerals from Spain for the three months ended March 31 are reported as follows, in metric tons:

	1906.	1907.	Changes.
Iron ore.....	2,490,468	2,327,620	D. 162,848
Copper ore.....	290,907	356,025	I. 45,118
Manganese ore.....	23,415	21,646	D. 1,769
Zinc ore.....	35,446	44,574	I. 9,128
Lead ore.....	1,108	1,418	I. 300
Pyrites.....	239,111	315,835	I. 76,724
Salt.....	106,923	116,716	I. 10,693
Sulphur.....	545	1	D. 544

Exports of metals for the three months are reported as follows, in metric tons:

	1906.	1907.	Changes.
Iron and steel.....	10,927	11,054	I. 127
Copper precipitate.....	5,706	3,985	D. 1,721
Copper.....	2,015	2,401	I. 386
Zinc.....	63	379	I. 316
Lead.....	37,644	45,310	I. 7,666

Imports of chemicals this year were 7982 tons; of fertilizers, 33,140 tons of phosphates and 26,264 tons of basic slag.

South America

BRITISH GUIANA

Gold exports for the five months ended June 1 were 38,570 oz. bullion in 1906, and 24,912 oz. in 1907; a decrease of 13,658 oz. The bullion reported this year was equal to 21,067 oz. fine gold, or \$435,462. Exports of diamonds were 1050 carats, valued at \$8336, this year.

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 17—The general coal market is variable. In some sections of the country considerable activity is noticeable, while elsewhere a dull, uninteresting market has set in. In the Alabama field all the mines are producing to their full capacity and there is a demand for all the coal produced. Considerable new development is under way.

In the middle West business is dull, except in the harvester trade, which is absorbing considerable coal.

Along the Atlantic seaboard the scarcity of vessels and the unprecedented demand for coal has kept freight rates well up to the winter schedule. The situation is such that the shipping clerk should have a free hand in the matter of deliveries. With the increasing limitations of the railroads, as to cars standing at tide, and the scarcity of vessels on the other hand, it frequently happens that a matter of 5c. will determine whether or not a consumer will get shipments.

The anthracite market also has a variable tendency. In the East producers report a quiet demand, with plenty of coal of all sizes. The Chicago market is dull and with no demand.

COAL-TRAFFIC NOTES

Shipments of coal and coke originating on the Pennsylvania Railroad Company's lines east of Pittsburg for the year to July 6, were as follows, in short tons:

	1906.	1907.	Changes.
Anthracite.....	2,134,668	2,899,845	I. 765,177
Bituminous.....	15,959,107	19,269,270	I. 3,310,163
Coke.....	6,514,342	7,211,513	I. 697,171
Total.....	24,608,117	29,380,628	I. 4,772,511

The total increase this year was 19.5 per cent.

Shipments of Broad Top coal over the Huntingdon & Broad Top Railroad for the year to July 13 were 531,618 tons.

Shipments of bituminous coal and coke over various railroads in western Pennsylvania and West Virginia are reported as below, in short tons, for the five months ended May 31:

	Coal.	Coke.	Total.
Balt. & Ohio.....	10,477,320	2,406,994	12,884,314
Buff., Roch. & Pitts.	2,815,984	264,269	3,080,253
Beech C. N. Y. Cent.	3,352,419	36,278	3,388,697
Pitts. & L. Erie.....	4,140,668	2,228,674	6,369,342
Norfolk & Western..	4,703,815	1,100,810	5,804,625
Total.....	25,490,206	6,032,025	31,522,231
Total, 1906.....	24,927,595	5,683,987	30,611,582

The total increase was 910,649 tons, or 3 per cent. In addition to the tonnage given above the Baltimore & Ohio carried 320,529 tons of anthracite in 1906, and

461,484 tons in 1907; an increase of 140,955 tons.

Shipments of coal over the roads in the Ohio Coal Traffic Association for the five months ended May 31, are reported as below, in short tons:

	1906.	1907.	Changes.
Hocking Valley.....	1,432,740	1,448,839	I. 16,099
Toledo & Ohio Cent..	595,444	681,625	I. 86,081
Baltimore & Ohio....	643,814	862,371	I. 218,557
Wheeling & L. Erie..	962,403	1,414,308	I. 451,905
Cleve., Lorain & Wh.	781,276	1,073,318	I. 292,042
Zanesville & Western	404,733	625,374	I. 220,641
Toledo Div., Pen. Co.	939,785	1,032,828	I. 93,043
L. Erie, Alliance & Wh.	300,439	504,556	I. 204,117
Marionetta, Col. & Clev.	.....	8,920	I. 8,920
Total.....	6,060,694	7,652,739	I. 1,592,045

The total increase this year was 26.3 per cent. The shipments in 1906 were interrupted by the strike in April and May.

Tonnage originating on the Southern Railway for the four months ended April 30, is reported as follows, in short tons: Tennessee district, 475,095; Alabama district, 786,163; total, 1,261,358 tons.

Coal receipts at Boston for the six months ended June 30, are reported by the Chamber of Commerce as below:

	1906.	1907.	Changes.
Anthracite.....	785,970	1,027,672	I. 241,702
Bituminous.....	1,504,028	1,515,777	I. 11,749
Total domestic....	2,289,998	2,543,449	I. 253,451
Foreign coal.....	368,787	175,105	D. 193,682
Total.....	2,658,785	2,818,554	I. 159,769

Most of the foreign coal comes from Nova Scotia, but some is also received from Great Britain.

Coal receipts at St. Louis for the five months ended May 31 were 3,050,941 tons in 1906, and 3,107,946 tons in 1907; an increase of 57,005 tons.

Coastwise shipments of coal from the leading Atlantic ports for the five months ending May 31 are reported as follows:

	Anthracite.	Bituminous.	Total.
New York.....	7,279,722	5,530,388	12,810,110
Philadelphia....	959,493	1,917,928	2,877,421
Baltimore.....	103,410	1,469,775	1,573,185
Newport News..	.....	1,114,574	1,114,574
Norfolk.....	.....	657,971	657,971
Total.....	8,342,625	10,690,636	19,033,261
Total, 1906....	6,406,632	9,233,203	15,639,835

The total increase this year was 3,394,326 tons, or 21.7 per cent. New York includes all of the New York harbor shipping ports.

New York

ANTHRACITE

July 17—The local market for hard coal shows little strength and differs materially from the conditions elsewhere, notably in the Middle West. Supplies are plentiful and small sizes are more abundant than they have been for a long time. Prices remain unchanged as follows: Broken, \$4.55; egg, stove and chestnut,

\$4.80; pea, \$3; buckwheat, \$2.50; rice and buckwheat No. 2, \$1.90@2; barley, \$1.50@1.60; all f.o.b. New York harbor.

BITUMINOUS

The Atlantic Seaboard soft-coal trade shows some signs of strength in that the market is absorbing without much trouble most of the coal coming forward. The demand for coal in the far East continues, but is still limited by water transportation facilities, and consumers in this territory who have figured on water freights dropping 30 or 40c. per ton, have been disappointed. Indeed the question is whether the present rates of freight will not advance materially when the fall pressure for coal sets in. If the rates advance much vessels will come from other lines of trade, which will tend to level the higher quotations to a certain extent.

Trade in the far East is calling for considerable coal, and in some instances coal has been purchased from the open market to keep things moving; where consumers are limiting freight to any extent they are apt to go short of coal, because shippers will give the preference to purchasers not limiting the rate. Trade along the Sound shows some demand for the specialties, although the market is inclined to be dull on the lower steam grades. Sound boats are not available as in previous years, at this season, and the shipper has to calculate several days ahead to relieve the coal standing.

New York harbor trade is dull on current business but contractors are taking fair amounts of coal. Good grades of steam coal can be bought for \$2.60 f.o.b. New York harbor shipping ports, while the lower grades sell at 25c. below this price.

Transportation from mines to tide is fairly regular although not quite up to schedule. Car supply is good in most cases. In the coastwise trade vessels are still scarce, and in demand. It has been noted that some vessels which are not regularly in this trade are being utilized. We quote current rate of freight from Philadelphia to Boston, Salem and Portland, \$1.10; to Lynn, Newburyport, Bath, Gardiner and Bangor, \$1.25; to Portsmouth, \$1.15; to the Sound, 90c.; with towages where usual.

Birmingham

July 15—Every ton of coal that can be mined in Alabama is in demand. Positively no interruption to the activity in the coal trade has taken place because of the warm weather and there appears to

be as much cause for a steady operation of the mines during the summer as in the winter. The work of developing in the coalfields of Alabama increases and much foreign capital is coming this way. Recent statements by H. F. De Bardeleben and others show that European capital is becoming interested in Alabama coal properties. The new mines being opened are being equipped in the best possible manner showing intentions of long and steady operations. The first explosion in some time in Alabama mines was experienced, during the past week, at the Palos Coal and Coke Company, one man being killed and five injured. The State mine inspectors are making an investigation. An examination for first- and second-class mine foremen is on this week. This is the first examination by the new board appointed by Governor Comer.

Chicago

July 15—The coal market continues quiet but fairly firm. It would be a dull market, but for the fact that sales are large for a summer season, and the usual demurrage evils, though threatening and appearing occasionally with regard to certain coals, are not general. The only activity is in the harvesting coal trade, which is becoming large, and is using somewhat higher grade coal than formerly. Fine coals are in active demand for steam purposes. Eastern coals in general are in light demand, and are not likely to become active before autumn.

Illinois and Indiana run-of-mine sells for \$1.65@2, on the great bulk of shipments; lump and egg for \$1.80@2.75, and screenings for \$1.30@1.60. The tendency of prices on these coals is downward, though no marked drop will come if consignments are as well restricted during the rest of the summer as they have been up to the present time.

Smokeless is in steady demand, though there has been considerable coal sold at low prices because of accumulations on track. Run-of-mine smokeless brings \$3.15, for Pocohontas and New River, with lump at \$3.65. Hocking Valley has been in somewhat larger supply than demand, and sells for \$3.15. Pittsburg and Youghiogeny are in light demand, 1¼-in. selling for \$2.90 for Pittsburg, and \$3.30 for Youghiogeny. Anthracite sales are in general very light.

Cleveland

July 16—Heavy shipments up-lake and grading of coal on docks have increased the supply of slack here. Prices are off 10c., with No. 8 quoted \$1.40 on track, ¾-lump \$1.80 and run-of-mine \$1.90. Demurrage coal is hurting values, owing to overplus in town.

The coke market is dull, with foundry grades selling at \$3@3.25 on last-half delivery, and furnace at \$2.10@2.25 per ton.

Francis L. Robbins, in company with J. W. Ellsworth & Co., M. A. Hanna & Co., and other large car owners, have called a convention to be held in Cleveland on Aug. 1 and 2 to devise a remedy for car-seizure and mishandling of cars by railroads when cars are under shipment. The meeting promises to be well attended, as Cleveland, Columbus, Wheeling and Pittsburg dealers are anxious to do away with the troubles that have so long prevailed in the coal trade, pertaining to the diversion of their privately owned cars.

Pittsburg

July 16—Conditions in the coal markets of this district remain practically the same as last week. Nearly all the mines are running, and there is no complaint of a shortage of railroad cars. The Pittsburg Coal Company is taking all the available tonnage of the independent concerns and shipping it to lake ports on its contracts for the northwestern markets. The shipments during the past week have been unusually large, and it now seems certain that all contracts for the lake trade will be filled this season. The rivers were again navigable for a few days, and the little tonnage that had accumulated since the shipments to Southern ports the previous week was sent out. Prices remain the same, and are firm on a basis of \$1.20 for mine-run coal at mine. Slack is again in good demand and is quoted at 85@90c. A fire broke out at the large Hazel mine of the Pittsburg-Buffalo Company, on July 14, and, despite energetic efforts to put it out, is still burning; considerable damage has already been done. It may be necessary to flood the mine. Fire also broke out at the Braznell mine, and the mine was flooded. Both mines will be out of commission for a week or two. The Hazel mine is one of the most important in the Pittsburg district.

Connellsville Coke—The coke market continues strong, and there has been no change in quotations. Standard Connellsville furnace coke for both spot and future shipment is quoted at \$2.50@2.65, and from the lower region at \$2.35@2.50. Foundry coke remains firm at \$3@3.25. The *Courier*, in its summary for the week, gives the production at 313,820 tons. The shipments aggregated 13,269 cars, distributed as follows: To Pittsburg, 4926 cars; to points west of Connellsville, 7491 cars; to points east of Connellsville, 852 cars.

Foreign Coal Trade

Imports of coal into Spain for the three months ended March 31 were 533,571 metric tons, a decrease of 16,765 tons as compared with the first quarter of 1906. Imports of coke were 62,759 tons, an increase of 14,761 tons.

The coal bunkered, or supplied to steamers engaged in foreign trade, at

United States ports for the five months ended May 31 was 2,566,802 tons. Adding this to the exports, previously reported, makes a total of 6,996,692 tons sold for consumption beyond the limits of the United States.

Iron Trade Review

New York, July 17—The dullness which is generally expected in the pig-iron trade at this time, has set in and few new orders are being booked. Active production, however, is still going on and shows no signs of letting up. The furnace companies are so well supplied with orders that they are glad of a chance to catch up with their back orders.

In the South, furnaces are rather short of ore and this, together with a weaker demand, will tend to decrease production. In the Pittsburg district business is quiet so far as new orders are concerned and other lines of iron and steel are similarly affected. The same state of affairs exists in Chicago, but the production does not seem to diminish to any extent.

In the Philadelphia market the makers, who have been wishing for a respite are having that wish gratified. The market is exceedingly quiet for all kinds of pig iron including basic.

Foreign iron is in light demand, amounting to a little more than 500 tons per day.

Pig Iron Production—The reports of the furnaces show that on July 1 there were 336 coke and anthracite furnaces in blast, having an aggregate weekly capacity of 257,800 tons; a slight increase over June 1, and the largest weekly capacity ever reported. Taking the estimate made by the *Iron Age* for coke and anthracite stacks and making allowance for the charcoal furnaces, the approximate production of pig iron in June was 2,266,000 tons. This would make the total for the half-year ended June 30 not far from 13,500,000 tons.

Lake Superior Iron Ore—Shipments of iron ore from the upper Lake ports for the season to July 1 are reported by the *Cleveland Marine Review* as follows, in long tons:

Port.	1906.	1907.	Changes
Escañaba.....	1,738,408	1,824,215	I. 85,807
Marquette.....	802,887	769,059	D. 33,828
Ashland.....	1,188,763	1,049,357	D. 139,406
Superior.....	1,753,775	2,318,911	I. 565,136
Duluth.....	3,181,235	4,094,046	I. 912,811
Two Harbors..	2,576,528	2,630,036	I. 53,508
Total.....	11,241,596	12,685,624	I. 1,444,028

The changes in the port statements show that the increase this year has come almost entirely from the Mesabi mines.

A press despatch from Duluth states that on July 16 the ore-handlers and other workmen on the Duluth docks went out on strike. Probably the trouble will be settled soon; if not, it will cause a serious delay in ore shipments, coming at the height of the season. The strike is for a general advance of 25c. per day in wages, and has been pending for some time.

Birmingham

July 15—The production of pig iron in Alabama will probably show a decrease for this month, several furnaces during the past week having lost much time because of the short ore supply. The demand is still a little quiet but manufacturers are showing no apprehension or intimating that there is any weakness in sight. A few sales are being made for delivery during the fourth quarter of the present year, \$21@21.50 per ton, No. 2 foundry, being the figures given out. Orders are also still coming in for delivery during the first half of 1908, this iron holding firm at \$18.50 per ton, No. 2 foundry. Practically no spot iron is being sold in this district, the greater number of furnaces having about as much as they can do to deliver on their old orders.

The Tennessee Coal, Iron and Railroad Company has leased the big brown-ore mines at Champion, in Blount county, a dozen or so miles north of Birmingham, and active preparations are in hand to operate the property. The ore is rich and the property valuable. The Sloss-Sheffield Steel and Iron Company and the Tennessee Company own the property jointly but ten years ago there was a dispute as to the operations and the ore has lain there without being disturbed. General Manager Ball, of the mining department of the Tennessee company, announced during the past week that the property had been leased and that extensive preparations were being made to operate the mines there again. The statement is also made that iron-ore mines in Wayne county, Tenn., will be developed. A railroad line will have to be built. This ore is to be used in furnaces around Sheffield.

Announcement is also made that the Tennessee company has decided to double the size of the new steel plant and material has been ordered for the additions, so that when the new mill is completed work will be under way on practically a third steel plant at Ensley. The old steel mill is doing fairly well and there is a strong demand for all the steel ingots and shapes that can be produced.

Baltimore

July 16—Receipts of spiegeleisen at this port for the week were 1150 tons; of ferromanganese, 1354 tons; of ferrosilicon, 783 tons. There was also 6349 tons of pig iron. Other arrivals included 50 casks of manganese ore and 744 tons chrome ore. Receipts of iron ore were 10,170 tons, from Cuba.

Chicago

July 15—The pig-iron market is very quiet, with no indications that activity will arise before the end of the month. Sales are almost wholly of small lots for quick delivery, and are few. Inquiries on contract requirements are reported good,

and selling agents assert that the market will continue firm as to prices, with large sales certain as soon as melters shall make up their minds generally that there is to be no slump. Every business indication argues continued heavy consumption of iron locally, and there is no pessimism to be found. The summer inactivity extends to much business in iron and steel products, though structural steel demands are promising.

Southern No. 2 foundry is held at \$20 for last-quarter delivery, Birmingham (\$24.35 Chicago), and \$21@21.50 for third-quarter delivery. Northern No. 2 is quoted at \$25@25.50 for the last half, the higher price for early, and the lower for late deliveries. Lake Superior charcoal is comparatively active at about \$27.50, small lots being in demand. Inquiries continue for 1908 iron, but little business is being done.

Coke is quiet, with Connellsville 72-hour a little lower, selling for \$5.75. West Virginia 72-hour brings \$5.40 per ton.

Cleveland

July 16—Shipments of iron ore from Lake Superior ports total 12,685,630 tons, so far this year. Of this amount June shipments aggregated 6,433,369 tons, an increase of 17.2 per cent. over June, 1906. Vessel tonnage is in great demand, and while railroads are offering good facilities here, better service could be had. Rates continue strong.

The pig-iron market is easier under increased supplies of ore and there is a falling off in late contracts. Prices for third and fourth quarter are: Bessemer \$24@24.40; No. 1 foundry Northern, \$23.75@24; No. 2, \$23.25@23.50; No. 3, \$22.75@23; No. 2 Southern, \$23.85@24.85; gray forge, \$22@22.25 per ton.

Philadelphia

July 17—The quiet which set in early in July continues and there is not the slightest disposition shown on either side to disturb the serenity of the pig-iron market. With the prospects of an additional capacity of over 5,000,000 tons from about 33 furnaces, built and building, there is a conservative feeling with reference to future demands, which may be mistaken for weakness. There is, of course, some little buying. Premium quotations are disappearing but this does not involve weakness. New and large requirements are in sight but they may not be covered soon. Foreign material is of slower movement and new orders are not being placed ahead. Local dealers in fact have slightly shaded prices on Middleboro. Basic pig is quiet for the present but it may create a disturbance at any time.

Low phosphorus is quoted at \$28; basic for last quarter, as low as \$22 and as high as \$23 for third quarter. No. 2 foundry is quoted at \$22.50 last quarter; forge, \$21.50@22.

Steel Billets—The conditions forbid any change for some time. The lack of demand makes no impression on prices. For rolling billets, business would be accepted at \$32.50.

Scrap—A collapse has befallen the scrap market within a few days. Scrap-dealers in anticipation of a heavy demand gathered everything available into their yards, or have it under control. Now they must get their money back on some lines.

Pittsburg

July 16—There is a fairly good run of small orders in almost all of the finished iron and steel lines, but the markets generally are dull so far as new business is concerned. All the mills on the operative list are running to capacity and seem to be catching up on deliveries, except in some lines where the mills are filled for the rest of the year. The exception is in merchant pipe and plates. The pressure for bessemer steel billets has eased up somewhat, as the Carnegie Steel Company has discontinued rail making at its Ohio works and the plant will be operated during the rest of the third quarter exclusively on billets. The demand for billets from the wire interest of the United States Steel Corporation is unusually heavy, owing to the backward spring. All the plants of the wire company are being operated to capacity and there will be no time for annual repairs until late in the fall. The Carnegie company has been forced to cancel a number of its outside obligations for billets as it cannot afford to close any of its finishing mills. The plants of the Republic Iron and Steel Company, which were closed for repairs, were started again on Monday, July 15, and it is not expected that there will be any interruption. The wage scale has been submitted to a board of conciliation as the final conference with representatives of the Amalgamated Association of Iron, Steel and Tin Workers failed to reach an agreement last week. Henry W. Heedy, of Youngstown, will represent the Republic company and the workers have selected Benjamin I. Davies, an attorney of Birmingham, Ala. These two will meet in a few days and select a third when the arguments of both sides will be heard. It may be decided to increase the board to five members. There will be no difficulty in completing the board as a list of names from which a selection may be made has already been approved by both sides. It is confidently expected that the board will decide in favor of a continuance of last year's scale. The award must be made before Aug. 10. Many of the independent interests have signed the Amalgamated scale, subject to the scale that will be adopted later by the Republic company. The union wage scales in all other lines have been settled. The demand for iron bars is light but prices remain firm at 1.75@1.80c. Pittsburg. There is a good demand for structural

material but it is confined to small orders. The most important contract lately was taken by the McClintic-Marshall Construction Company and calls for 1500 tons for the Chicago, Milwaukee & St. Paul Railroad. New business in wire products is heavier than at any time this year and an advance of \$2 a ton is expected to be ordered at an early date. No new steel rail business of any consequence is being booked. It is reported that the Carnegie Steel Company has sold its capacity for the year. The Edgar Thomson works are producing rails at the rate of 75,000 tons a month.

Pig Iron—The week has been the dull-est of the year in the pig-iron market. There were no transactions worth recording and no inquiries of any importance were received. While some consumers are not covered for the late months in the year they evidently prefer to wait, as there is a prospect that prices will decline. In all sales made during the past two weeks prices were lower. Basing quotations on sales of a few small lots, bessemer is being held around \$23.25, Valley furnaces; basic at about \$22.50; No. 2 foundry, \$23; gray forge at \$22.

Steel—The market is easier, owing to an increase in production. Bessemer billets are strong at \$30 and open-hearth billets at \$31.50@32. The Carnegie Steel Company has received the contract for plates, bars and shapes for another lake vessel, making the tenth this season, which calls for about 3000 tons. The Burlington is in the market for 2000 steel cars which will require about 20,000 tons of plates. Prices are firm at 1.70c. for plates and 1.60c. for steel bars.

Sheets—There is no change in the market. Black sheets are still quoted at 2.60c. and galvanized at 3.75c. for No. 28 gage.

Ferro-Manganese—For prompt shipment \$61 to \$62 is still quoted and for fourth quarter \$60 to \$61 is named.

Dusseldorf, Germany

June 30—The German Iron and Steel Union reports the production of the German blast furnaces in May at 1,094,314 metric tons of pig iron. For the five months ended May 31 the total output was, in metric tons:

	1906.		1907.	
	Tons.	Per Ct.	Tons.	Per Ct.
Foundry iron ...	869,804	17.1	905,274	17.0
Forge iron.....	359,846	7.0	334,559	6.3
Steel pig.....	374,539	7.3	421,198	7.9
Bessemer pig... ..	200,314	4.0	200,838	3.8
Thomas pig.....	3,290,808	64.6	3,449,748	65.0
Total.....	5,095,311	100.0	5,311,617	100.0

This shows increases in foundry iron of 35,470 tons; steel pig—which includes spiegeleisen, ferromanganese, ferrosilicon and all similar alloys—46,659; bessemer pig, 524; Thomas or basic pig, 158,940. There was a decrease of 25,287 tons in forge iron, leaving the total gain 216,306 tons, or 4.2 per cent.

Sault Ste. Marie

July 13—The movement of freight through the Salut Ste. Marie canals during June was extremely heavy, being 8,865,442 tons. This places the commerce to July 1 of the present year greatly in excess of any year since the canal was opened. For the season to July 1 the total traffic was, in net tons:

	1906.	1907.	Changes.
East-bound.....	12,112,667	13,649,105	I. 1,536,438
West-bound.....	2,765,113	4,139,214	I. 1,374,101
Total.....	14,877,780	17,788,319	I. 2,910,539

The larger increase this year was in west-bound freight, the proportion of which to the total was 18.6 per cent. in 1906, and 23.3 per cent. in 1907. The mineral freight included in the totals was, in net tons, except salt, which is in barrels:

	1906.	1907.	Changes.
Anthracite.....	192,083	435,940	I. 243,857
Bituminous.....	2,111,114	3,305,572	I. 1,194,458
Total coal.....	2,303,197	3,741,512	I. 1,438,315
Iron ore.....	10,366,948	11,840,412	I. 1,473,464
Pig & manu. iron	129,558	102,618	D. 26,940
Copper.....	34,301	22,100	D. 12,201
Salt, bbl.....	151,183	157,085	I. 5,902

The number of vessel passages this year was 6372, showing an average cargo of 2792 net tons.

Metal Market

NEW YORK, July 17.

Gold and Silver Exports and Imports

At all United States Ports in May and year.

Metal.	Exports.	Imports.	Excess.
Gold:			
May 1907..	\$4,505,444	\$2,641,879	Exp. \$1,863,565
" 1906..	5,722,148	34,911,028	Imp. 29,188,880
Year 1907..	12,410,407	20,216,984	Imp. 7,806,577
" 1906..	28,354,322	60,168,698	Imp. 31,814,376
Silver:			
May 1907..	4,326,216	3,496,458	Exp. 829,758
" 1906..	5,539,546	4,408,969	" 1,130,577
Year 1907..	23,859,610	18,803,468	" 5,056,142
" 1906..	28,918,841	19,916,816	" 9,002,025

These statements cover the total movement of gold and silver to and from the United States. These figures are furnished by the Bureau of Statistics of the Department of Commerce and Labor.

Gold and Silver Movement, New York

For week ending July 13, and years from Jan. 1

Period.	Gold.		Silver.	
	Exports.	Imports.	Exports.	Imports.
Week... ..	\$2,776,541	\$462,790	\$1,138,344	\$47,388
1907... ..	28,864,033	6,217,782	24,665,186	906,564
1906... ..	5,900,973	45,904,672	33,945,697	1,151,255
1905... ..	37,912,098	649,997	17,432,438	1,943,180

Exports of gold for the week were chiefly to Paris; of silver to London. Imports of gold for the week were from Paris and the West Indies; of silver from South America.

The joint statement of all the banks in the New York Clearing House for the week ending July 13 shows loans \$1,104,835,900, a decrease of \$10,888,400; deposits, \$1,070,759,800, a decrease of \$7,780,400, as compared with the previous week. Reserve accounts show:

	1906.	1907.
Specie.....	\$182,941,900	\$201,818,000
Legal tenders.	85,872,500	72,749,000
Total cash.....	\$268,813,800	\$274,567,000
Surplus.....	\$12,830,800	\$6,877,050

The surplus over legal requirements this year shows an increase of \$6,020,800, as compared with the previous week.

Specie holdings of the leading banks of the world, July 13, are reported as below, in dollars:

	Gold.	Silver.	Total.
Ass'd New York			\$201,818,000
England.....	\$177,808,270		177,808,270
France.....	559,666,295	\$197,588,335	757,254,630
Germany.....	157,870,000	52,625,000	210,495,000
Spain.....	77,815,000	128,290,000	206,105,000
Netherlands....	27,075,500	28,082,500	55,158,000
Belgium.....	16,156,665	8,078,335	24,235,000
Italy.....	162,540,000	23,882,500	186,422,500
Russia.....	582,300,000	33,085,000	615,385,000
Aust.-Hungary..	227,205,000	62,030,000	289,235,000
Sweden.....	20,690,000		20,690,000

The banks of England and Sweden report gold only. The New York banks do not separate gold and silver in their reports. The European statements are from the cables to the *Commercial and Financial Chronicle* of New York.

Shipments of silver from London to the East are reported by Messrs. Pixley & Abell as follows, for the year to July 4:

	1906.	1907.	Changes.
India.....	£9,580,863	£6,301,774	D. £3,279,089
China.....			
Straits.....	1,750	544,012	I. 542,262
Total.....	£9,582,613	£6,845,786	D. £2,736,827

Receipts for the week were £301,000 from New York. Exports were £251,850, all to India.

Indian exchange has been fairly steady, all the Council bills offered in London having been taken at an average of 16.04d. per rupee. The Indian bazars have been buying silver more freely.

The gold and silver movement in France for the four months ended April 30 was as follows:

	1906.	1907.
Gold:		
Imports.....	Fr. 307,891,000	Fr. 53,213,000
Exports.....	40,088,000	72,316,000
Excess.....	I. Fr. 267,803,000	E. Fr. 19,103,000
Silver:		
Imports.....	54,588,000	51,588,000
Exports.....	51,907,000	46,878,000
Excess imports....	Fr. 2,679,000	Fr. 4,710,000

Imports of copper and nickel coins were 36,000 fr. in 1906, and 32,000 fr. in 1907; exports were 106,000 fr. in 1906, and 125,000 fr. this year.

The Treasury Department estimate of the money in the United States on July 1 is as follows:

	In Treasury.	In Circul'n.
Gold coin (inc. bullion in Treasury).....	\$225,006,844	\$698,762,929
Gold certificates.....	75,271,370	602,973,499
Silver dollars.....	4,792,012	81,694,518
Silver certificates.....	5,401,738	470,375,262
Subsidiary silver.....	8,804,401	121,755,976
Treasury notes of 1890..	12,455	5,975,545
U. S. notes.....	3,967,324	342,713,692
Nat. Bank notes.....	13,697,855	590,090,835
Total.....	\$336,953,999	\$2,914,342,256

Population of the United States, July 1, 1907, estimated at 85,956,000; circulation per capita, \$34.20. For redemption of outstanding certificates an exact equivalent in amount of the appropriate kinds of money is held in the treasury, and is not included in the account of money held as

assets of the Government. This statement of money held in the treasury as assets of the Government does not include deposits of public money in national-bank depositaries to the credit of the treasurer of the United States, amounting to \$179,987,527. The amount in circulation July 1 showed a decrease of \$25,440,313 from June 1; but an increase of \$169,858,426 over July 1 last year.

Prices of Foreign Coins

	Bid.	Asked.
Mexican dollars.....	\$0.52½	\$0.54½
Peruvian soles and Chilean.....	0.47½	0.50½
Victoria sovereigns.....	4.85	4.87
Twenty francs.....	3.85	3.89
Spanish 25 pesetas.....	4.78½	4.80

SILVER AND STERLING EXCHANGE.

July.	Sterling Exchange.	Silver.		July.	Sterling Exchange.	Silver.	
		New York, Cents.	London, Pence.			New York, Cents.	London, Pence.
11	4.8660	67½	31½	15	4.8675	67½	31½
12	4.8650	67½	31½	16	4.8660	67½	31½
13	4.8660	67½	31½	17	4.8680	68½	31½

New York quotations are for fine silver, per ounce Troy. London prices are for sterling silver, 0.925 fine.

Other Metals

July.	Copper.			Tin.	Lead.	Spelter.	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	London, £ per ton.			New York, Cts. per lb.	St. Louis, Cts. per lb.
11	21¼ @22	21¼ @21½	97	41	5.25	6.10	5.95
12	21¼ @22	21¼ @21½	95½	41	5.25	6.10	5.95
13	21½ @22	21 @21½	.....	41	5.25	6.05 @5.10	5.90 @5.95
15	21½ @22	20¾ @21¼	93½	40¾	5.25	6.05 @6.10	5.90 @5.95
16	21½ @22	20¾ @21¼	91	40¾	5.25	6.05	5.90
17	21½ @22	20¾ @21¼	94	40¾	5.25	6.05	5.90

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 electrolytic copper are for cakes, ingots or wirebars, and represent the bulk of the transactions as made with consumers, basis, New York, cash. The price of cathodes is 0.125c. below that of electrolytic. The lead prices are those quoted by the American Smelting and Refining Company for near-by shipments of desilverized lead in 50-ton lots, or larger. The quotations on spelter are for ordinary western brands; special brands command a premium.

Copper—The market shows no appreciable change from our last report. The reduction in prices made by a leading seller has not resulted in any considerable business. Sales, both for home and export trade, have been of small quantities and chiefly for near-by deliveries, and no large consumers or manufacturers have

been in the market. Prices are therefore largely nominal, being based on small transactions. Evidently consumers have not yet made up their minds that present prices will prevail, and it is therefore not surprising that business should be of very small volume. Such orders as present themselves are eagerly competed for, and lower prices have been accepted from day to day. The market closes at 21½@22c. for Lake copper; 20¾@21¼ for electrolytic in ingots, cakes and wire-bars; 19¾@20¼c. for casting copper.

The present uncertainty has given the speculators in London a splendid opportunity to use their talents, and the fluctuations in the standard market have been accordingly violent. In the early part of the week the market declined from day to day, at one time dropping below £90 for spot and £86 for three months', but since then there has been a reaction under heavy covering by the bears, which set the market back at the close to £94 for spot, £88 10s. for three months'.

Refined and manufactured sorts we quote: English tough, £96; best selected, £100; strong sheets, £107.

Statistics for the first half of the current month show an increase in the visible supplies of 400 tons.

Exports of copper for the week from New York are reported at 1247 long tons. Our special correspondent gives the exports from Baltimore for the week at 552 long tons of fine copper.

Copper Sheets—The base price of copper sheets declined from 32c. to 28c. per lb., at which price they are now quoted.

Copper Wire—Quotations are variable, from 25¼c. to 24¼c. being named. The former price for No. 0000 to No. 8 was 27¼c.

Tin—The forecast of Banka sales to be made during next year, showing an increase of about 3000 tons over those to be made this year, had a weakening effect upon the London market, which declined abruptly to £184 5s. The domestic market followed suit immediately, but even at the lower prices established no inclination is shown by consumers to buy more freely. The weakness has become the more pronounced as it is reported that the chief consumer of tin in this country has turned seller of this commodity. The market closes at £183 for spot, £179 15s. for three months, in London, and at 40¼c. in New York.

Lead—The quotation for desilverized lead remains unchanged at 5.25c. New York. It is reported, however, that some of the smaller sellers who have lead on hand are willing to accept a material discount from the prices of the American Smelting and Refining Company.

The London market has weakened and closes lower at £20 for Spanish lead, £20 2s. 6d. for English lead.

The movement of foreign lead in the United States for the five months ended

May 31, is reported by the Bureau of Statistics as below; the figures given being in short tons:

	1906.	1907.	Changes.
In bond, Jan. 1.....	8,148	5,691	D. 2,457
Imports, five months.....	37,013	32,248	D. 4,765
Total supplies.....	45,161	37,939	D. 7,222
Re-exports, five months..	19,973	10,142	D. 9,831
In bond, June 1.....	11,252	8,058	D. 3,194
Total deductions.....	31,225	18,200	D. 13,025
Balance.....	13,936	19,739	1. 5,803

The balance has, presumably, entered into consumption in the United States.

St. Louis Lead Market—The John Wahl Commission Company reports as follows: Lead is dull at the late decline. Missouri brands are selling in a retail way only on a basis of about 5.12½c., East St. Louis. Buyers feel timid about futures, even at present low prices.

Spelter—The demand is still rather slack and the lower prices which have been held out by sellers have not, so far, stimulated business to any considerable degree. The close is easy at 6.05 New York, 5.90c. St. Louis.

The London market does not show any stamina either and has fallen back to £24 for good ordinaries, £24 5s. for specials.

Zinc Sheets—The base price is \$8.60 per 100 lb.—less discount of 8 per cent.—f.o.b. cars at Lasalle and Peru, in 60-lb. cases for gages No. 9 to 22, both inclusive; widths from 32 to 60 in., both inclusive; lengths from 84 to 96 in., both inclusive. The freight rate to New York is 27.50c. per 100 lb. The new classification, effective Aug. 1 next, will make the minimum weight on a carload of sheet zinc to all Eastern points 36,000 lb., equivalent to 60 cases of 600 lb. each.

Antimony—There has been some buying, in a small way, by consumers who believe that the bottom has been reached, and that prices will go up. Aside from these purchases the market has been featureless. Quotations are 12@12½c. for Cookson's; 10½@11c. for Hallett's; 9¼@11c. for ordinary brands.

Nickel—For large lots, New York or other parallel delivery, the chief producer quotes 45@50c. per lb., according to size and terms of order. For small quantities prices are 50@65c., same delivery.

Quicksilver—Current prices in New York are \$41 per flask of 75 lb. for large quantities and \$42 for smaller orders. San Francisco orders are \$38@39 per flask, according to quantities, for domestic orders, and \$37@37.50 for export. The London price is £7 per flask, but £6 16s. 3d. is quoted by jobbers.

Platinum—The market remains stationary and little change is expected by refiners for some time. There are not many inquiries for the metal and no abnormal conditions to affect the price. Quotations are as follows: Ordinary metal, \$26 per oz.; hard metal, \$28.50; scrap is quoted at \$20@21 per ounce.

Wisconsin Ore Market

Platteville, Wis., July 13—The price of 60 per cent. ore remained about the same as last week, selling for \$47@48. The tonnage is a little more brisk this week, owing to the fact that some of the mills which were shut down for repairs are again turning out ore. Mostly all of the ore produced was sold, leaving no surplus in the bins. The outlook for the coming week seems to be good, as most of the ore is already sold.

Lead is still descending, 80 per cent. selling for \$64, while 75 per cent. sold for \$58; the bins are becoming well filled, awaiting an advance in the market, the producers not wishing to sell at these prices.

Following is the shipment of the district, by camps, for the week ending July 13, 1907:

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	345,780		
Buncombe-Hazel Green	599,400		
Benton	405,190		
Highland	288,200		
Galena	146,300		
Linden	127,000		
Harker	122,900		
Livingston	85,000		
Cuba City	84,000		
Mineral Point	58,120		
Total for week	2,261,980		
Year to July 6	54,087,395	2,072,800	229,160

In reporting the tonnage for the Shullsburg camp for March 21 to June 25, in the issue of the JOURNAL for July 6, a stenographic error occurred. The correct figures should be 877,300 lb. zinc ore and 98,700 lb. lead ore.

Missouri Ore Market

Joplin, Mo., July 13—The highest price for zinc was reported at \$50 per ton, on an assay basis of \$46@48, but this does not reflect the true condition of the market, as a considerable quantity of medium-grade ore was advanced 50c. and \$1 per ton. The average price was \$45.26.

The highest price paid for lead ore was \$58 per ton, an increase of \$2 over the closing price of last week. Medium grades sold at \$55@57 per ton, and the average was \$56.94. Large quantities of this mineral are being held for an advance in price, it being the general opinion of producers that the metal will recover at least a part of the losses that have come with startling rapidity and depressing force upon the miners of this ore.

An option on the Cockerill smelters is said to be out, and much speculation is rife as to whether the New Jersey interests or the subsidiary companies of the United States Smelting, Refining and Mining Company are to become the owners. For the first time in the history of zinc mining in Missouri the zinc smelting business appears to be assuming a centralized ownership. It has been under more independent control than any of the metals in the past, but the time seems

approaching when the market will come under more united control.

Following are the shipments of zinc and of lead from the various camps of the district for the week ending July 13:

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	4,179,820	535,010	\$113,472
Joplin	2,472,290	239,280	66,153
Galena (Kans.)	1,289,800	210,570	36,311
Duenweg	1,264,000	103,100	32,042
Alba-Neck City	1,032,350		25,282
Granby	1,340,000	61,000	20,090
Oronogo	702,640		16,351
Prosperity	302,030	44,940	8,368
Aurora	355,020	11,240	6,736
Badger (Kans.)	267,250		6,431
Spurgeon	154,570	78,330	5,511
Baxter Springs (I. Ter.)	144,920		3,369
Carthage	123,690		3,029
Cave Springs	96,470		2,267
Sherwood	76,210	6,040	1,998
Carl Junction	41,220		1,814
Sarcoie	60,350		1,401
Reeds	41,820		961
Totals	13,935,050	1,289,510	\$352,146

28 weeks.....338,961,120 52,185,220 \$9,973,660
Zinc value, the week, \$315,372; 28 weeks, \$7,902,240
Lead value, the week, 36,774; 28 weeks, 2,071,420

Average prices for ore in the district, by months, are shown in the following table:

ZINC ORE AT JOPLIN.			LEAD ORE AT JOPLIN.		
Month.	1906.	1907.	Month.	1906.	1907.
January	47.38	45.84	January	75.20	83.53
February	47.37	47.11	February	72.83	84.58
March	42.68	48.66	March	73.73	82.75
April	44.63	48.24	April	75.13	79.76
May	40.51	45.98	May	78.40	79.56
June	43.83	44.82	June	80.96	73.66
July	43.25	.....	July	74.31	.....
August	43.56	.....	August	75.36	.....
September	42.58	.....	September	79.64	.....
October	41.55	.....	October	79.84	.....
November	44.13	.....	November	81.98	.....
December	43.68	.....	December	81.89	.....
Year	43.24	.....	Year	77.40	.....

Chemicals

New York, July 17—The general chemical trade is slightly reactionary and prices as a whole are easy. The bi-chromates have advanced and other competitive chemicals have increased in price. The metal salts are inclined to be easy and have a slightly lower tendency.

Copper Sulphate—The demand for this salt is fairly good and supplies seem to be plentiful. The price will depend upon the course of the copper metal market, but it is not expected that there will be a sudden or increased demand at this time. Prices have suffered a further decline, carload lots selling at \$7 and smaller amounts at \$7.25 per 100 pounds.

Nitrate of Soda—The market shows a firm tone with demands strong and supplies fairly good. We quote nitrate of soda for spot delivery at 2.45@2.50c. with next year's delivery quoted at 2.42½c. for the 95 per cent. and 2.50c. for 96 per cent. quality.

Mining Stocks

New York, July 17—Mining stocks showed little or no activity during the week, and the public does not seem to be interested to any extent at present. Amal-

gamated Copper fluctuated between narrow limits, and closed off a little lower than a week ago at \$90.25. American Smelting common was slightly stronger, closing at \$119¾. United States Steel common closed up \$1 to \$38, and the preferred closed at \$100¾.

During the week 100 shares of Homestake sold at \$73 per share. The directors of the Tennessee Copper Company have declared a semi-annual dividend of \$2 per share, payable August 15, which is an increase of 75c. over the last dividend, paid in January.

The curb market was irregular, and had little movement. The Cobalt silver stocks showed slight declines due to the general strike among the miners of that district. The copper stocks were a little stronger, Cumberland-Ely and British Columbia Copper being the leaders.

Boston

July 16—The market for copper shares clearly indicates that the recent sales of the metal have not clarified the situation. Toward the end of last week prices of stocks improved under the guidance of the trading element in the exchange, but as the situation seemed to darken, prices again worked lower and stocks are off materially from a week ago. However, a point to bear in mind is that the producing companies got but little more than 19c. on an average for their copper during 1906. Very few companies were able to obtain the high prices quoted the past few months.

Little or no talk has been heard of the Amalgamated dividend, to be declared July 18, so the belief is general that the usual rate will be declared. The stock has varied from \$87.37½ to \$91.75, with the final tonight slightly below a week ago, at \$90.50. Copper Range broke \$3 to \$79.50, closing a trifle above this, and North Butte broke \$5.25 to \$82, with the close \$83. Old Dominion showed a little strength and rose \$1.75 to \$49, Saturday, closing at \$47. This company has started its fifth furnace, which will give it increased production. Utah Consolidated has fared badly, marketwise, making a low price at \$45, with the last today at \$46.50, against \$53.25 a week ago. Report is persistent that there is a fault in the values, although there are those who believe that it is largely a market movement.

Boston Consolidated closed with a net decline of \$1.75 for the week at \$27, and Butte Coalition with a decline of \$1.62½ at \$25.37½; Calumet & Arizona is off \$7, to \$164; Greene-Cananea, \$1 to \$16.25; Isle Royale, \$1.50 to \$19.50; Michigan, \$1.50 to \$14.50; Mohawk, \$4.75 to \$87.50; Osceola, \$4 to \$128; Parrot, \$3.25 to \$19.50; Quincy, \$7 to \$115; Trinity, \$2.50 to \$23.50; U. S. Smelting, \$1.75 to \$48.50; and Wolverine is offered at \$163.

U. S. Coal and Oil spurted to \$11. This company's net earnings are showing con-

siderable increases. Balaklala is off to \$9.62½. The Guggenheims are reported to have disposed of their holdings in this company, and have relinquished their option on 100,000 shares of new stock at \$10 per share. Boston & Corbin has been the curb feature, and sold up \$2 to \$14.87½ on active trading.

Colorado Springs

July 13—The local mining stock market is still suffering from the attack of lethargy, which took hold of it some time ago. There has been little or no fluctuation in the prices of stocks the past week, except Elkton, which has advanced almost 2c., and closed strong on today's market.

STOCK QUOTATIONS

Table with columns: NEW YORK July 16, BOSTON July 16. Rows include Alaska Mine, Am. Nev. M. & P. Co., Amalgamated*, Anaconda*, Balaklala, British Col. Cop., Buffalo Cobalt, Butte & London, Butte Coalition, Butte Cop. & Zinc, Cobalt Contact, Colonial Silver, Cum. Ely Mining, Davis Daly, Dominion Cop., El Rayo, Foster Cobalt, Furnace Creek, Giroux Mine, Gold Hill, Granby, New, Greene Gold, Greene G. & S, Greenw'r & D. Val, Guanajuato, Guggen. Exp., Hanapah, McKinley Dar., Micmac, Mines Co. of Am., Mitchell Mining, Mont. Sho. C. (New), Nev. Utah M. & S., Newhouse M. & S., Nipissing Mines, Old Hundred, Silver Queen, Stewart, Tennessee Cop'1, Union Copper, Utah Apex, West Columbus.

N. Y. INDUSTRIAL

Table with columns: Name of Comp., Clg. Rows include Am. Agri. Chem., Am. Smelt. & Ref., Am. Sm. & Ref. pf, Bethlehem Steel, Colo. Fuel & Iron, Federal M. & S. pf, Inter. Salt, National Lead, National Lead, pf, Pittsburg Coal, Republic I. & S., Republic I. & S. pf, Bloss-Sheffield, Standard Oil, Tenn. C. & I., U. S. Red. & Ref., U. S. Steel, U. S. Steel, pf, Va. Car. Chem., Va. I. Coal & Coke.

ST. LOUIS July 13

Table with columns: N. of Com., High., Low. Rows include Adams, Am. Nettle, Center Crk, Cent. C. & C., C. C. & C. pd., Cent. Oil, Columbia, Con. Coal, Doe Run, Gra. Bimet, St. Joe.

*Ex. Div. †Ex. Rights.

BOSTON CURB

Table with columns: Name of Comp., Clg. Rows include Ahmeek, Ariz. Com., Black Mt., East Butte, Hancock Con., Keweenaw, Majestic, Raven, Shawmut, Superior, Superior & Pitts., Troy Man.

LONDON July 17

Table with columns: Name of Com., Clg. Rows include Dolores, Stratton's Ind., Camp Bird, Esperanza, Tomboy, El Oro, Oroville, Somera, Utah Apex, Ariz. Cop., pf, Ariz. Cop., def.

Cabled through Hayden, Stone & Co., N. Y.

S. FRANCISCO July 10

Table with columns: Name of Comp., Clg. Rows include COMSTOCK STOCKS, BELCHER, BEST & BELCHER, CALEDONIA, CHOLLAR, CON. CAL. & VA., CROWN POINT, EXCHEQUER, GOULD & CURRY, HALE & NORCROSS, MEXICAN, OPHIR, OVERMAN, POTOSI, SAVAGE, SIERRA NEVADA, UNION, UTAH, YELLOW JACKET, TONOPAH STOCKS, GOLDEN ANCHOR, MCNAMARA, MONTAR & PITTS EX, NORTH STAR, RESCUE, GOLDFIELD STOCKS, BLACK ANTS, BLUE BULL, COLUMBIA MT, COMB. FRAC, CONQUERER, DALSY, FLORENCE, FRANCES-MOHAWK, GOLDFIELD CON., GRANDMA, GREAT BEND, RED HILLS, ST. IVES, BULLFROG STOCKS, AMETHYST, BONNIE CLAIRE, MAYFLOWER CON., MONTGOMERY MT., ORIGINAL, MANHAT'N STOCKS, GOLD WEDGE, MANHATTAN MG., PINE NUT, RUBY WONDER, STRAY DOG, YELLOW HORSE.

NEVADA July 17

Table with columns: Name of Comp., Clg. Rows include TONOPAH STOCKS, TONO' H MINE OF N., TONOPAH EXTEN., MONTANA TONO' H, BELMONT, TONOPAH MIDWAY, WEST END CON., JIM BUTLER, GOLDFIELD STOCKS, SANDSTORM, KENDALL, RED TOP, JUMBO, GOLDFIELD MINING, DIA'FIELD B. B. C., ATLANTA, MOHAWK, SILVER PICK, LAGUNA, BULLFROG STOCKS, MONT. SHOSHONE C., TRAMP'S CON., GOLD BAR, BULLFROG MINING, BULLFROG NAT. B., HOMESTAKE CON., MANHAT'N STOCKS, MANHATTAN CON., MANHAT'N DEXTER, JUMPING JACK, STRAY DOG, INDIAN CAMP, COLO. SPRINGS July 13, Name of Comp., Clg., ACACIA, BLACK BELL, MANHAT'N DEXTER, DANTE, DOCTOR JACK POL., ELKTON, EL PASO, FINDLAY, GOLD DOLLAR, GOLD SOVEREIGN, ISABELLA, INDEX, JENNY SAMPLE, JERRY JOHNSON, MARY McKINNEY, PHARMACIST, PORTLAND, UN. GOLD MINES, VINDICATOR, WORK.

New Dividends

Table with columns: Company, Payable, Rate, Amt. Rows include Am. Zinc, Lead & Smg., Anaconda, Bunker Hill & Sullivan, Camp Bird, Ltd., Columbus Con., Doe Run, Esperanza, Ltd., Frances Mohawk, Jameson, Kendall, Monon R. C. & C., Newhouse, Nipissing, N. Y. & Hon. Rosari, Oroville, Osceola, Philadelphia Gas, Pitts. Lead & Zinc, Tamarack, Tenn. C. I. & R. R., com, Tenn. C. I. & R. R., pf, Tenn. Copper, Tonopah of Nev., United Copper.

Assessments

Table with columns: Company, Delinq, Sale, Amt. Rows include Bader, Cal., Birchville, Cal., Black Copper, Utah, Black Rock, Utah, Crown Point, Nev., Emerald, Utah, Exchequer, Nev., Giant, Utah, Jackson Butte, Cal., Little Chief, Utah, Loon Creek, Ida., Mexican, Nev., Norrison, Utah, Reindeer, Ida., Sheba G. & S., Utah, Tetro, Utah, Wabash, Utah, West'n Mines Co., N., Yellow Jacket, Nev., Zeibright, Cal.

Monthly Average Prices of Metals AVERAGE PRICE OF SILVER

Table with columns: Month, New York, London. Rows include January, February, March, April, May, June, July, August, September, October, November, December, Year.

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

AVERAGE PRICES OF COPPER

Table with columns: NEW YORK, LONDON, Electrolytic, Lake. Rows include January, February, March, April, May, June, July, August, September, October, November, December, Year.

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

AVERAGE PRICE OF TIN AT NEW YORK

Table with columns: Month, 1906, 1907. Rows include January, February, March, April, May, June, Year.

Prices are in cents per pound.

AVERAGE PRICE OF LEAD

Table with columns: Month, New York, London. Rows include January, February, March, April, May, June, July, August, September, October, November, December, Year.

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

AVERAGE PRICE OF SPELTER

Table with columns: MONTH, New York, St. Louis, London. Rows include January, February, March, April, May, June, July, August, September, October, November, December, Year.

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