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Contents

Page

Editorials:	
What Constitutes a Valid Mining Claim?	1163
The Cyanide Cleanup	1164
The Origin of Zinc Smelting	1164
Katanga Copper	1164
Correspondence and Discussion:	
On the Careless Use of Powder ... Physical Chemistry and Cyanidation... New Kink in Iodide Assay... Rapid Methods for Proximate Analyses	1165
East Tintic Claim Decision	1167
Sulphur Production in 1911	1168
Union Minière du Haut Katanga	1168
Geological Survey Appropriations	1168
Details of Practical Mining:	
*A Cripple Creek Ore and Waste Plant... Concrete Chute Bridging a Level... Hints for Prospectors... Shaft Station Safety Gates... Rope Capacity of Drums... Cartridges for Tamping Dynamite... Two Cores from One Borehole	1173
Details of Metallurgical Practice:	
Stationary Dewatering Screen... Steel Tray and Support for Hancock Jigs... Lacing Belts with Wire	1177
Work of the Bureau of Mines	1169
The Aluminum Trust Suit	1171
Ore Strike at Florence-Goldfield	1171
*The Abbé-Frenier Sand Pump	1172
Patricia District, Ontario	1172
Notes from Current Literature:	
Carnotite in Pennsylvania... Prevention of Mine Explosions... Platinum and Gold in the Urals... Cyanide Poisoning of Cattle... Determination of Oxygen in Copper... Concentration of Carnotite... Siberian Tin... Defective Concrete Sands... Disintegration of Cinder Concrete... Oxygen Additions to Iron Furnace Blast... Desulphurizing Zinc Sulphate... Clark Placer Mining Apparatus	1179
*The Sublevel Stopping Method. F. W. Sperr	1181
Henry Johns, an Early American Copper Refiner. Benjamin S. Johns	1183
Ore Separation by Decrepitation. Henry E. Wood	1184
*The Origin of Zinc Smelting. W. Hommel	1185
Iron-Ore Railroads at Lake Superior	1188
*Electric Furnace at Lluvia de Oro. H. R. Conklin	1189
New Publications	1193
Personal, Obituary	1194
Editorial Correspondence	1195
Mining News	1197
Markets	1203
*Illustrated.	

What Constitutes a Valid Mining Claim?

Mining men and prospectors in the West are manifesting alarm and openly criticising a recent ruling of the Department of the Interior relating to mining claims. The opinion, which is given in full upon another page of this issue, illustrates clearly the attitude of the government officials in their construction of the laws at present in force, and announces a policy widely and seriously at variance with that hitherto pursued in the granting of patents for mineral lands.

The first requirement in the initiation of title to a mining claim is that of discovery. Before a lode claim can be located there must be discovered a vein or lode in place, carrying gold, silver, cinnabar, lead, tin, copper or other valuable metal. Until recent years there had been no disposition on the part of the Land Department officials to inquire whether or not the lode so discovered could be worked at a profit. They deemed it their duty to grant a patent when such a lode had been discovered, staked, developed at a cost of at least \$500, surveyed and paid for at the rate of \$5 per acre. But, finding that mining claims were sometimes located for timber or some other non-mineral commodity, the agents of the government instituted the policy of inspection. At first when it was found, as in the case here referred to, that "the surface of the claims contains no timber of commercial value; that there is no water course through or upon said claims, and the land embraced is essentially mineral in character and useless for agricultural purposes" there did not seem to be any good reason for refusing patent and patent generally followed, or frequently at some indefinite and very much delayed date.

Now the prospector is confronted with a new interpretation of the law. The land may be worthless for any other

purpose than mining, but unless there is exposed "a vein or lode of mineral-bearing rock in place, possessing in and of itself a present or prospective value for mining purposes" patent will be withheld, and the government inspector is the individual upon whom is placed the burden of deciding whether or not the lode has a prospective value. The prospector himself, who has expended time and money in its discovery and development and who is willing to pay the government price for the land, is compelled to accept the verdict of whatever inspector happens to be called upon to render an opinion. If the inspector happens to have seen a mine developed in such a lode and under similar geological and working conditions or if he is in a good humor he finds that the vein has prospective value; otherwise his report is adverse.

The poor prospector can no longer expect to go out and locate and acquire for himself a valuable mining property. He must be financially able to develop to the point where it is certainly valuable, under the conditions where it is found or is forced to sell it for a fraction of its value to some one with capital enough to prove that it is a mine good enough for Uncle Sam to part with. The incentive to explore is largely withdrawn and the mineral wealth of the unexplored public domain will be conserved for the man who already has surplus money to spend.

Most modern nations offer liberal reward to the discoverer of new deposits of valuable ores. The United States has developed more rapidly than other countries in its mineral industry and in material prosperity largely because of its liberal policy for the disposal of its mineral and agricultural lands. Any future legislation or new interpretation of present statutes which has a tendency to curtail opportunity or lessen the reward for honest labor and enterprise is not

likely to result in the spread of prosperity or the settlement of untenanted regions, nor will it be received with approval by the public at large.

Here is another illustration of the crying need for rational revision of our mining laws. If the discovery provision were eliminated entirely and a prospector were permitted to stake his claim and hold it so long as he performed a reasonable amount of real development work, most of this particular variety of trouble and expense would be obviated.

The Cyanide Cleanup

Probably no branch of the cyanide process is more susceptible to the application of the principles of scientific management than the cleanup with its attendant operations. At one mill where the cleanup proper was spread over three days the time was reduced to one day by planning the work so there was practically "no lost motion." Under the new scheme, by the time the boxes were cleaned up and repacked, the acid treatment of short zinc was well under way, being completed soon enough to allow the product to be dried by morning, when the melt was started.

The acid-treatment part of the cleanup requires attention to determine the proper strength of acid to use. If too concentrated a solution is used, zinc-sulphate crystals will be formed, which are difficult to dissolve, giving trouble in subsequent smelting operations. Care must also be taken by the operator in working over the acid tank to avoid inhaling the gases given off, some of which may be poisonous. Sodium bisulphate is claimed by some to be cheaper, more efficient than sulphuric acid and is productive of practically no objectionable products. This salt is largely used on the Rand.

If, therefore, the necessity for the acid treatment of precipitate could be eliminated time and labor would be saved and one great source of trouble would be avoided. It was for this purpose that the Tavefner process was devised. This process consists essentially of smelting the partly dried precipitate with a litharge flux, and cupelling the resulting lead button for the gold and silver contained therein. This method was not entirely

successful and acid treatment is still the accepted intermediate step.

In this connection the description in this issue of the JOURNAL by H. R. Conklin of the use of the electric furnace for melting precipitate and smelting concentrate at Lluvia de Oro is of interest. It will be noted that the precipitate is melted without preliminary treatment, while the short zinc is merely roasted before being sent to the furnace. The ease with which a fairly good bullion is obtained from dirty precipitate is sufficient to make many cyaniders envious of Lluvia de Oro conditions, where power costs for this purpose are nil.

It is possible, however, that the electric furnace may find a field in those districts where high fuel costs now make it advisable to ship precipitate to refiners. In some of these districts electric power is comparatively cheap and may permit cyanide operators to handle their precipitates in this manner, with obvious advantages.

The Origin of Zinc Smelting

For many years the art of zinc smelting was supposed to be relatively modern among metallurgical processes and to be due to the invention of the Abbé Daniel Dony, a chemist of Liège, the story of whose accidental discovery in 1805 is classical. The particular type of Belgian furnace may indeed be credited to Dony, but it has long been doubtful whether he was entirely unacquainted with previous undertakings. Thus, it is well known that the manufacture of spelter was begun in Upper Silesia about 1798-1800 by Johann Ruhberg, who learned the art in England (where zinc smelting was then being carried on by the English process of distillation downward) and Bergrath Dillinger began zinc smelting in Carinthia in 1799. As remarked by Ingalls in "Production and Properties of Zinc:" "It is incomprehensible indeed that 10 years later there should have been no knowledge in Belgium of what was being done in this branch of metallurgy in England, the two countries being separated only by a narrow strip of water, while the news had previously penetrated eastward to the Polish frontier."

The first zinc smelting works in England were built about 1740 (authorities differ as to the precise date) at Bristol by John Champion. Such zinc as was

used in Europe previous to that time came from India and China, and there is reason to believe that Champion derived his ideas from the experience in the far East. The paper by W. Hommel, published elsewhere in this issue, is a valuable contribution to the history of this branch of metallurgy and establishes conclusively the eastern origin of zinc smelting and the great antiquity of the art. The Koschi apparatus used in India apparently developed into the English process of distillation *per d scensum*, which continued in use until about 1860.

Katanga Copper

The statements of M. Jadot, the chairman of the Union Minière du Haut Katanga, always give a different impression from the ever optimistic language of Mr. Robert Williams, of the Tanganyika company, which is largely interested in the Union Minière. We suppose that this is due to a difference in temperament.

According to a recent statement to his stockholders by M. Jadot, things have not been going very well in Katanga. It is considered to be necessary to open the Etoile du Congo mine below water level. It is difficult to secure sufficient labor and it may be necessary to import Chinamen. In smelting, the fuel difficulty is serious. It is hoped that Wankie coke at £5 10s. per ton may be forthcoming, but it may be necessary to import coke from Europe. Anyway, the furnace, which made intermittent campaigns from Aug. 20, 1911, to Apr. 11, 1912, producing 2000 tons of copper, is not to be started again until next October.

Nothing has ever been said about the metallizing process since the plant for it was ditched in a railway accident. In the meanwhile, experiments with electric smelting are being carried on in Europe. We should be the last to deprecate research, but it does not look well that the company should be so strenuously casting for a new process. New processes and new mines do not go well together.

The record of copper mining in Katanga up to date has been just what we prophesied. It is now generally recognized that no considerable quantity of copper from this source will figure in the market for a long time to come.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

On the Careless Use of Powder

When I was a boy I was taught that the world was becoming weaker and wiser. But even at that time it was said that some miners had such good judgment in charging a hole that they would bite a grain of powder in two rather than give the hole too much. Of course, that was a long time ago, 40 or 50 years. But if the world is getting wiser, the miner is not, or if he is, he is very wasteful, according to C. B. Hanson's experience.

Mr. Hanson, in the JOURNAL of Apr. 29, 1912, said that it is invariably the case in underground work for the most experienced men, and in ground with which they are all perfectly familiar, to load a hole with twice too much powder. Now I have had 30 or 40 years' experience in mining and I supposed I knew something about mining and miners, but I find I know little or nothing after reading Mr. Hanson's article. I have charged hundreds of holes with the old kind of black powder, and while I have never bitten a grain in two, I believed I could tell within 2 or 3 in. of powder in a hole how much it required to break it. That was before the machine drill was in use.

But I have also charged thousands of machine-drill holes and I presume hundreds of times have broken a stick of powder in two, believing to give it the full stick would be too heavy a charge. And I never learned until I read Mr. Hanson's article that I did any differently from other miners, as I have worked with several miners and always consulted my partner in charging a hole. If Mr. Hanson had worked as I have for 20 years on a machine drill on contract and had to pay from \$15 to \$20 per case for powder, I think he would see the wisdom in not wasting powder as he thinks the miners do. And what about the management of the mines where the powder is wasted that way? It must be interesting to the powder companies to have it wasted, but to a mining company that is running 100 drills it means from \$50,000 to \$75,000 per year.

I presume there is some careless management, but not so bad as that. I think it makes little difference where the primer is, whether in the bottom, middle or top of the powder or which way the cap is in the powder; if the cap and powder are good they will do the same work. It is the custom to make a hole in the side of the stick of powder, put the cap in,

and bend the fuse back so that the closed end of the cap is toward the collar of the hole. And in some ground there is considerable slip, and when there is danger of leaving what miners call "bull rings," pieces of wood about 6 in. long are placed between the sticks of powder, and the powder explodes just the same.

JOSEPH HOCKING.

Osceola, Mich., May 10, 1912.

Physical Chemistry and Cyanidation

Among the recent articles in the JOURNAL there are none more stimulating to thought than those of Prof. H. C. Jones. As it is editorially expressed in the issue of Apr. 20, 1912, these are of "special interest to cyanide workers of the old school." I am confessedly not altogether abreast of modern physical concepts and all the contributions to cyanide chemistry of recent years. Recently however, I had occasion to read an article by Dr. Samuel Sloan, of Glasgow in the February *Medical Brief* of St. Louis, on electrolysis applied to therapeutics, containing for the benefit of his professional colleagues a brief summary of the dissociation theory. This paper also contained a table which I quote, the last column of which I calculated, showing the effect of dilution on the passage of an electric current of 50-volts potential through an electrolyte of common salt solution.

NaCl Strength of Solution Per Cent	Milliamperes	Milliamperes Calculated to 1 Per Cent NaCl
36.0	600	16.6
18.0	575	32.0
9.0	500	55.5
4.5	350	77.7
2.25	240	106.6
1.125	140	124.4
0.56	80	142.8
0.28	45	160.7
0.14	24	171.4
0.07	13	185.7

You will observe that the amount of current measured in milliamperes diminishes with the dilution of the solution. This fact I observed in certain experiments made in Glasgow in 1894, in connection with the Pillsticker patent suit, which results I contemplated, but did not use, in the suit as a contention that Pillsticker's electric process could not take advantage of the dilute solutions which practice had shown to be essential for good work, since his electrolyte would then be too dilute to receive benefit from his electricity. But on reading Dr. Sloan's

article, which I will quote in part later, I thought I saw the reason underlying the use of the dilute solution, in the increased relative ionization of solutions by dilution. When I plotted a curve using as ordinates the percentage of NaCl, and as abscissas the milliamperes per 1% of NaCl, the curve was regular, something like the logarithmic cooling curve, so a definite law was apparently indicated. I had observed and had published (ENG. AND MIN. JOURN., Dec. 28, 1888), in the initial paper on cyanide as a means of ore treatment, that metallic silver was more soluble in a dilute than in a strong solution. To this day I have never seen a satisfactory theory accounting for this but when we come to consider the dissociation theory we have one at last. In the ENGINEERING AND MINING JOURNAL of Apr. 20, 1912, Professor Jones says, p. 802: "The way to test whether ions are the active chemical agents is to increase the number of ions present and see whether chemical activity increases. This has, of course, been done with the general result that chemical activity was found to increase, and proportionally to the number of ions taking part in the reaction."

To a cyanide worker of the old school this would not indicate that the dilution of a solution would increase its efficiency though the interpolation of *relative before number* would cover that ground also. It may be that Arrhenius' researches have made the matter so plain and the adoption of his theories has made the circumstance so elementary that it has been accepted by all. Yet I have seen no mention of it in such cyanide literature as has been available to me in the last few years. Acting then on the supposition that the matter is as new to others as to me I will quote Doctor Sloan at greater length. He says:

Observe from the table what I have found to be the results of continued dilution in this case. You will see that each solution gives the indication of containing more free ions than would be expected from the amount of the dilution; especially this is the case in more concentrated solutions. This relation diminishes, however, as the dilutions increase, you will observe, till the dilution of about 1% has been reached. By this time practically all the molecules have become dissociated, and with further dilutions the amount of the current is practically directly proportioned to the amount of concentration.

Suppose in the strong solution there were 100 original molecules, 20 dissociated, then the total number of particles for each 100 molecules would be

20 (sod-ions) plus 20 (chlor-ions) plus 80 molecules of NaCl, or 120 particles in all. If this be diluted with an equal quantity of water then for each original 100 there will be left in the diluted liquid 20 separated ions and 40 molecules. Suppose by the further dilution 10 of these molecules become dissociated, this will give of separate particles 20 plus 10 plus 10 plus 30 equal 70, and of these 70, 40 will be ions. Thus to influence the osmotic pressure there will be 10 more particles than were in half of the original solution; while there will be the same number of ions as there were in the more concentrated solution; and so the same currents can be obtained from the weaker solution as was obtained from the stronger if the same voltage were used.

This relative increase in the number of free ions, by further dilution continues, as I have just remarked, till we reach the stage where there is about 1% of the saline solution, when practically all the molecules have evidently been dissociated [I shall note here that Doctor Sloan has considered the amperage only quantitatively, and not in relation to a unit such as 1% as the third column of the table has done]. They are not permanently so, though at no time can there be more than the merest fraction of the molecules undissociated, since there will be occasional reunion, but the free flight space has so much increased that these are less likely to occur. These reformed molecules, however, will be almost immediately broken up owing to conflict with some flying ions.

You will see now how the conclusion is forced upon us that a saline solution contains even in its most concentrated form, a large number of ions; and that by dilution the number of these has become relatively increased.

It is admitted, I believe, that it is the ion which is the chemical agent as well as the carrier of electricity, so in applying this theory to the solution of precious metal in potassium-cyanide solution there is only one hypothetical step, that is, the assumption that kal-ions and cyan-ions will act as sod-ions and chlor-ions. As to the point that might be raised, that in dissolving silver chloride by hot concentrated brine, concentrated solutions were necessary, it may be submitted that the character of these latter solutions is materially different as their formation does not involve a chemical change but the brine in the Augustin process envelopes the uncharged chloride-of-silver molecules. To draw upon physiology for an illustration it may be said that dilute salt solutions such as accompany food are undoubtedly more efficacious in causing the secretion of ptyalin from the salivary gland than more concentrated ones, but what reactions are at the base of this I am not prepared to suggest. A metallurgist can do no better than apply the discoveries of the experimental physicists to matters within his knowledge and I have attempted to do this in this case. It will remain for better equipped men to elaborate such views if they are worth while and are considered correct. Any light which may be

given as to the causes underlying such primary reactions as the solutions of gold and silver may be of considerable practical benefit as well as theoretical interest.

LOUIS JANIN, JR.

California, May 15, 1912.

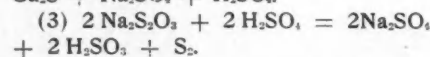
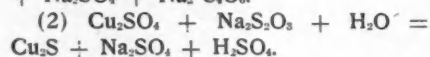
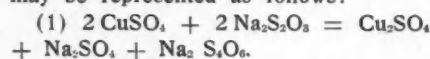
New Kink in Iodide Assay

The use of hyposulphite (sodium thio-sulphate) in the iodide method for copper, described by Mr. Popper (*ENG. AND MIN. JOURN.*, May 25, 1912, p. 1021), is the first appearance in print, to my knowledge, of this modification of the iodide method, which, as he says, is largely used in Western laboratories and also by assayers in Mexico.

The use of hypo to replace aluminum foil in this assay has the advantages of requiring less boiling during precipitation, more convenient manipulation and no danger of copper loss due to oxidation. When a muffle is at hand, I am confident any assayer will find this modification more satisfactory than the use of aluminum.

With over three years' perfectly satisfactory use of this modification, I believe that a more complete consideration of the reactions than is contained in Mr. Popper's article will be interesting; and a modification of his details, while not necessarily affecting the accuracy, will expedite the work.

The principal reactions which occur may be represented as follows:



Arsenic, antimony, bismuth and other sulphides are also precipitated, though in the original treatment of the ore, the amount of antimony and bismuth which will remain in solution after evaporation to SO₂ fumes is limited. The removal of arsenic and antimony, though quite unnecessary, can be readily effected by washing the precipitate with sodium sulphide. If not removed at this point they are largely driven off during ignition of the sulphides, particularly the arsenic.

The main objection to Mr. Popper's procedure, which is duplicated by many other assayers, is the large amount of hypo used. According to the above reactions, 100 mg. of copper require 580 mg. of Na₂S₂O₃ + 5 H₂O. More than this is required, but one gram is sufficient. Na₂S₂O₃ in excess of this is decomposed by acid according to the reaction (3) with liberation of sulphur. Thirty cubic centimeters of a saturated solution of hypo, as recommended by Mr. Popper, will contain at ordinary temperatures about 20 grams of Na₂S₂O₃ + 5 H₂O (at 68° F., 100 c.c. of water will dissolve

108 grams of the salt). This hypo is apt to be completely decomposed by the sulphuric acid present (5 c.c. H₂SO₄ will decompose 23 grams of Na₂S₂O₃ + 5 H₂O), giving a large amount of free sulphur. This large amount of free sulphur requires long boiling, 15 to 25 min., to obtain a good coagulation of the precipitate and rapid filtration, has a tendency to cause bumping, interferes with washing, particularly if arsenic and antimony are to be removed, and melts on ignition, increasing the chances of residue adhering to container and also hindering the conversion to oxide.

The procedure recommended is as follows: The filtrate from the decomposed ore after evaporation to SO₂ fumes should be about 50 c.c. and contain approximately 5 c.c. of sulphuric acid. For every 100 mg. of copper add 1 gram of hypo in solution—a 20% solution is convenient. The addition may be made either hot or cold, then boil for two to five minutes. If this boiling is performed on a moderately hot stove, there is no trouble from bumping.

The filtration and washing of this precipitate is remarkably rapid and the copper sulphide differs from that thrown down with H₂S in that there is no danger of its oxidizing and running through the paper, even on long standing between washing, which washing is performed with hot water.

The ignition should be done at a bare red heat, preferably in a muffle, and if the furnace has a strong draft clay annealing cups are more desirable than scorifiers. If the ignition has been properly carried out, the residue will be completely oxidized and will readily dissolve in two to three cubic centimeters of 1:1 nitric acid without the production of red fumes. The regular iodide method is applied from this point.

E. J. HALL.

New York, June 8, 1912.

Rapid Methods for Proximate Analyses

In regard to the copper-oxalate determination, given in the *JOURNAL* of June 8, 1912, in French's article, it should be noted that this precipitation is quantitative only under certain conditions. The volume of the liquid must not be too great, and the copper must exceed a certain minimum. Favorable conditions are brought about by freezing the solution, or by making it consist of 50% of alcohol, or by adding 2 grams of oxalic acid per 50 c.c. of solution to be tested, after making said solution carry at least 50% of glacial acetic acid and 5 to 10% HNO₃. (Cf. H. L. Ward, in *Am. Journ. Sci.*, May, 1912.)

C. C.

Newark, N. J., June 10, 1912.

East Tintic Claim Decision

To constitute a valid discovery upon a lode-mining claim for which patent is sought there must be actually and physically exposed within the limits thereof a vein or lode of mineral-bearing rock in place, possessing in and of itself a present or prospective value for mining purposes.

The exposure of substantially worthless deposits on the surface of a lode-mining claim; the finding of mere surface indications of mineral within its limits; the discovery of valuable mineral deposits outside the claim; or deductions from established geological facts relating to it; one or all of which matters may reasonably give rise to a hope or belief, however strong it may be, that a valuable mineral deposit exists within the claim, will neither suffice as a discovery thereon, nor be entitled to be accepted as the equivalent thereof.

ADAMS, First Assistant Secretary:

On Apr. 12, 1909, the East Tintic Consolidated Mining Co., filed application for patent, serial No. 03220, to the Great Eastern Nos. 1 to 8, inclusive, Great Eastern Fraction No. 1, Snowbird, September, East Fraction, Kidnapping, Sunbeam Nos. 1 to 4, inclusive, Great Irish Change, and September Fraction lode mining claims, surveys Nos. 5740 and 5883, situate in T. 10 S., R. 2 W., S. L. P. M. M., Salt Lake City land district, Utah. After due publication and posting of the notice of said application, mineral entry was allowed for all of these claims except the Great Eastern Fraction No. 1, Sunbeam No. 4, Great Eastern No. 8, East Fraction and Kidnapping.

Upon consideration of the case, the commissioner of the General Land Office, by decision of Mar. 20, 1911, found that the only showing as to discovery of mineral upon any of the claims embraced in the entry consisted of a statement in the application to the effect that the claims bore "gold, silver and other precious metals." and deeming this insufficient to establish discovery within the limits of each of the claims, directed attention to the concluding portion of paragraph 41 of the Mining Regulations, and instructed the local officers to inform the claimant that compliance therewith would be required.

He also held that two Keystone drill holes situated upon the Great Eastern No. 6 claim, an undivided one-seventh of whose total cost (given as \$3527) was sought to be accredited in satisfaction of the \$500 expenditure for patent purposes required by law, to that and the September, September Fraction, Great Irish Change, and Great Eastern Nos. 1, 2 and 7 claims, were not acceptable as common improvements for their benefit, and directed that the claimant be notified that he would be required to show that other and satisfactory improvements had been made upon or for the benefit of the September, September Fraction, and

In view of its importance with relation to the patenting of mining claims, the decision of the General Land Office in the case of the East Tintic Consolidated Co., of Utah, is reprinted in full, with introductory excerpts from the mining code relative to "discovery" on lode claims.

Note—Decided by the General Land Office on Sept. 11, 1911. Comment is made in the editorial columns of this issue.

Great Eastern Nos. 1, 2 and 7 claims, the remaining two of the seven locations having otherwise sufficient available patent expenditures. Thirty days from notice was allowed claimant within which to make the showing required, and it was stated by the commissioner that to the extent default should be made in complying with the requirements, or to appeal, the entry would be canceled.

Notice of this decision was duly served upon the claimant. From so much thereof as challenged the availability and sufficiency of the drill holes as common improvements for the benefit of the claims to which their cost was sought to be accredited, the company appealed. At the same time, and apparently with a view to showing a valid and sufficient discovery upon each of the several claims of the group, the claimant submitted the affidavit of B. F. Tibby. This affidavit, omitting the formal portions thereof, reads as follows:

Benjamin F. Tibby, whose post office address is Salt Lake City, Utah, being first duly sworn according to law, deposes and says that he is by occupation a civil and mining engineer.

That at the instance and request of the East Tintic Consolidated Mining Co. he surveyed for patent and made an examination of the ground embraced within the Great Eastern Nos. 1, 2, 3, 4, 5, 6, 7, Sunbeam Nos. 1, 2 and 3, Great Irish Change, September, September Fraction, and Snowbird lodes, surveys Nos. 5740 and 5883, known as mineral application No. 03220, and situate in unorganized mining district, Utah County, State of Utah.

That each and every one of said claims is based upon a discovery of mineral-bearing rock in place, in iron-stained rhyolite or in quartz or iron croppings, such as in this locality is recognized as being indicative of pay mineral, and that with development may lead to a pay mine of gold, silver, lead, iron, or copper; said indications being of the same general character as are found on adjoining mining claims throughout said district that are producing ore of such values as to justify a prudent person in the expenditure of money in the actual development of these claims by reason of such showing.

That small quartz veins, stringers or seams, due to fissuring of the rhyolite capping, are disclosed on the surface of each of said locations, and assays taken

from these seams or veins show values varying from a trace to \$10 per ton in gold, silver and iron.

A few tons of ore have been shipped from the tunnel on the Great Irish Change lode to test for fluxing purposes, bringing, however, only a small return, the exact figures of which are not available, otherwise no ore has been marketed, and ore in shipping quantities and quality is not now being produced, but the affiant believes from the showing of these seams and croppings, due apparently to the fissuring of the rhyolite, and from his knowledge of the geological conditions of the district, that with development into the ore-bearing limestone beneath, ore will be found in commercial quantities.

The surface of the said claims contains no timber of commercial value. There is no water course through or upon said claims, and the land embraced is essentially mineral in character and useless for agricultural purposes.

In a report by a special agent of the General Land Office it is stated that on the Sunbeam No. 2 there are some deposits of iron ore of good quality, which had been worked to some extent in the past, and that iron float and iron ledges are frequently encountered on the ground embraced in the entry.

The foregoing, together with the formal statement made in the notice of location of each of the several claims, to the effect that the location is made on a "lode, vein, or deposit, bearing gold, silver and other precious metals," comprises all that is contained in the record relating to this entry, which is regularly before the department, and presumably complete, that tends in any degree to show a discovery of mineral upon any of the claims.

To entitle an applicant to enter and receive patent for a location made under the lode-mining laws, it is required by paragraph 41 of the Mining Regulations, approved Mar. 29, 1909 (37 L. D., 728-766), that:

The vein or lode must be fully described, the description to include a statement as to the kind and character of mineral, the extent thereof, whether ore has been extracted and of what amount and value, and such other facts as will support the applicant's allegation that the claim contains a valuable mineral deposit.

To the same effect, also, is the decision of the department in Silver Jennie lode (7 L. D., 6), wherein it was held (syllabus) that:

Evidence as to the discovery of the alleged vein or lode should be furnished showing the place where and when such discovery was made, the general direction of the lode or vein, and all the material facts in relation thereto; and such evidence should be clear and positive and based on actual knowledge and the witnesses' means of information be clearly set forth.

By the term "vein or lode," as used in the foregoing, the department is not to be

understood as having had in mind merely a typical fissure or contact vein, but, rather, any fairly well defined zone or belt of mineral-bearing rock in place.

It is evident from the record before the department that the deposits alleged to have been exposed on these claims are regarded by the applicant as possessing practically no economic value, but that, on the other hand, title to the claims is sought essentially on account of their possible value for certain unexposed deposits supposed to exist at considerable depth beneath the surface, and having no connection, so far as shown, with any deposits appearing on the surface.

The exposure, however, of substantially worthless deposits on the surface of a claim; the finding of mere surface indications of mineral within its limits; the discovery of valuable mineral deposits outside the claim; or deductions from established geological facts relating to it; one or all of which matters may reasonably give rise to a hope or belief, however strong it may be, that a valuable mineral deposit exists within the claim, will neither suffice as a discovery thereon, nor be entitled to be accepted as the equivalent thereof.

To constitute a valid discovery upon a claim for which patent is sought there must be actually and physically exposed within the limits thereof a vein or lode of mineral-bearing rock in place, possessing in and of itself a present or prospective value for mining purposes; and before patent can properly be issued or entry allowed thereon, that fact must be shown in the manner above stated.

The showing made by the claimant in the present case, even if it be regarded as supplemented by the report of the special agent, above referred to, is manifestly too vague, general and indefinite to warrant its being accepted as fulfilling the requirements above set forth, or as establishing the existence of a valid discovery of mineral upon any particular one or more of the claims embraced in the entry. For this reason, therefore, and aside from any other consideration, the entry, in its entirety, will be canceled.

Sulphur Production in 1911

The production of sulphur in the United States in 1911, came from Louisiana, Utah and Wyoming, all three states showing an increase over 1910. The output of the first, of course, far exceeds that of the last two. The total production was 265,664 long tons. Imports amounted to 29,144 long tons, and exports to 28,103 long tons.

In spite of byproduct sulphuric-acid recovery by copper smelteries and the use of blende, low-grade copper ores, and other such materials for acid production, pyrite mining has been on a steady increase, and the production for 1911 reached the record output for the United

States of 299,904 tons. The importations of pyrites also exceeded all previous records, amounting in 1911 to 1,006,310 tons. The output of sulphuric acid, calculated to 50° Be., amounted to 2,688,456 tons.

Union Miniere du Haut Katanga

At the recent meeting of the Union Miniere du Haut Katanga, at Brussels, M. J. Jadot outlined the policy to be pursued at the mines. At the Star of the Congo mine there had been originally between 180,000 and 270,000 tons of 11% ore, of which about 20,000 had already been worked. The directors were now convinced the mine must be opened below water level. Meanwhile the labor question was a difficult one, the supply still remained insufficient, and it would probably eventually be necessary to import Chinese labor. They were looking forward to the arrival of the railroad at Kambove at the end of the year, to begin vigorous work there.

Lack of fuel was the chief cause of low output. The water-jacket furnace (blown in on June 30, 1911) ran 88 days up to Nov. 19, producing 996 tons of 90% ingots. It was blown in again on Dec. 17, but an explosion in the dust chamber again shut it down. It then operated from Jan. 3 to Mar. 4, and from Mar. 23 to Apr. 11, 1912, when it blew out for lack of coke. In the second period of 73 working days there were 1002 tons of 95% ingots produced.

A five-year contract had been entered into with the Wankie colliery, the latter to begin furnishing 1200 tons of coke monthly within seven months at about \$27 per ton. The Union also purposed erecting its own ovens, to be completed about the middle of 1913, at which time they expected coke to cost about \$22 per ton.

On this basis, they expected to begin smelting again in October, on Wankie coke, but if necessary, some coke could be shipped in from Europe for the purpose. A second water-jacketed furnace was to be ordered in a few days, to be ready in a year's time, when the new ovens would also be in position. A briquetting plant must be ordered. The experimental work with the small furnace has not been altogether satisfactory, but better fuel supply will, it is hoped, eliminate many of the troubles.

Experiments in electric smelting have been carried on at Ugines on 50 tons of Katanga ores, in a steel-refining furnace. The experiments were to be continued in a specially designed furnace on 500 tons of material, and if the furnace worked satisfactorily it would be sent to Katanga.

A sub-company will be organized to

finance these electrical experiments. Another new plan is to work a tin mine at Kinsangi, after the railroad to Kambove is completed.

Geological Survey Appropriations

WASHINGTON CORRESPONDENCE

The House Appropriations Committee, on June 4, reported to the House the following appropriations for the Geological Survey. They are expected to pass the House in substantially this form, and there is at present no reason to expect serious modification in the Senate.

Office of the director of the geological survey: For director, \$6000; chief clerk, \$2500; chief disbursing clerk, \$2500; librarian, \$2000; photographer, \$2000; assistant photographers—one at \$900, one at \$720; clerks—one at \$1000, four at \$900 each; four copyists, at \$720 each; watchmen—one at \$840, four at \$720 each; janitor, \$600; four messenger boys, at \$480 each; \$35,340 in all.

Scientific assistants of the Geological Survey: For geologists—two at \$4000 each, one at \$3000, one at \$2700; two paleontologists, at \$2000 each; one chemist, \$3000; geographers—one at \$2700, one at \$2500; two topographers, at \$2000 each; \$29,900 in all.

General expenses of the Geological Survey: For every expenditure of the Geological Survey, including personal services in the District of Columbia and in the field, to be expended under the regulations from time to time prescribed by the Secretary of the Interior, and under the following heads, namely:

For pay of skilled laborers and various temporary employees, \$20,000; for topographic surveys in various portions of the United States, \$350,000; for geologic surveys in the various portions of the United States, \$300,000; for continuation of the investigation of the mineral resources of Alaska, \$90,000; for chemical and physical researches relating to the geology of the United States, including researches with a view of determining geological conditions favorable to the presence of deposits of potash salts, \$40,000.

For the preparation of the illustrations of the Geological Survey, \$18,280; for the preparation of the report of the mineral resources of the United States, \$75,000; for gaging the streams and determining the water supply of the United States, and for the investigation of underground currents and artesian wells, and the preparation of reports upon the best methods of utilizing the water resources, \$150,000.

For the purchase of necessary books for the library, including directories and professional and scientific periodicals needed for statistical purposes, including payment in advance for subscriptions to publications, \$2000; for engraving and printing the geologic maps, \$110,000; for continuation of the topographic surveys of the public lands designated as national forests, \$75,000, to be immediately available; in all, \$1,295,520 for the U. S. Geological Survey.

The production of metallic tin from Bolivian ore in 1911 was 22,200 metric tons against 23,129 metric tons in 1910.

Work of the Bureau of Mines

In response to the Senate resolution of Mar. 25, 1912, asking for information with respect to the operations in the Bureau of Mines in the Western states, Walter L. Fisher, Secretary of the Interior, has just sent to the Senate the following statement of the work of the bureau:

METAL MINES INVESTIGATIONS LIMITED

The Bureau of Mines has not yet been able to undertake any extensive inquiries or investigations in connection with the metal-mining industries of the public-land states. Its activities in these states have been limited to the following:

(1) Two mine-rescue cars engaged in demonstrating mine-rescue and first-aid methods at coal mines of the Rocky Mountain and Washington coal fields have incidentally given safety and first-aid demonstrations at a few of the larger metal-mining camps of that region. It has not been possible, however, to follow up these demonstrations by giving to the miners the training necessary for a continuance of the work, nor are the men with the cars familiar with metal-mining methods, nor has all the equipment of the cars been especially adapted to metal-mining conditions.

(2) In coöperation with the Department of Justice, a limited investigation has been undertaken concerning the conditions under which smeltery fumes are given off in a few of the Western states where government property was reported as being injured or destroyed.

(3) The bureau has inaugurated an inquiry concerning methods and safety appliances used in driving tunnels, in which kind of work a number of lives have been lost, and concerning mineral waste and accidents in lead mines, and an inquiry has been made concerning the nature and extent of metal-mining accidents. But this work has been preliminary in character and limited in extent.

(4) In coöperation with the Public Health and Marine-Hospital Service the Bureau of Mines has made a preliminary examination of the larger metal-mining camps of Colorado and the conditions producing lung trouble among the miners, and has found in several such camps conditions seriously in need of improvement.

(5) Through the aid of a committee of eminent mining engineers an effort has been made to bring together a digest of existing laws and regulations relative to safety in metal-mining operations.

BUREAU CRITICIZED

This department and the Bureau of Mines have been criticized frequently because of the seeming neglect of the metal-mining industry. And this criticism

In response to a Senate resolution Secretary Fisher reported on the work of the Bureau of Mines. Its investigations have been devoted chiefly to coal-mine disasters and their prevention. Measures to increase efficiency and safety in metal mines are urgently needed and a plan is outlined aiming to accomplish this without competing with private assayers or discouraging state and private investigations.

has been strengthened by the fact that for many years prior to the creation of the bureau the demand for Federal recognition and aid for the mining industry came mainly from the Western metal-mining states. But this delay in undertaking needed investigations in behalf of the metal-mining industry does not appear to indicate a lack of interest or favorable intent in the matter with either this department or with Congress.

In establishing the Bureau of Mines, Congress transferred to it the then existing appropriation of \$100,000 for the investigation of fuels belonging to or for the use of the Government, and, with widened scope, the appropriation of \$150,000 for the investigation of mine explosions; and it increased this latter appropriation to \$310,000, with the evident intent that the \$160,000 added should be used mainly, if not exclusively, for the establishment and maintenance of the much-needed rescue work in connection with the coal-mine disasters. * * *

METAL-MINING INVESTIGATIONS TO BE UNDERTAKEN

The department has endeavored to carry out the evident intent of Congress that this work in relation to coal-mine disasters should first be well organized; and it has been able to carry on only such other limited technologic investigations as came over from the Geological Survey or were incidental to the mine-safety work. Meanwhile, the need of investigations relative to safety and efficient development in behalf of the metal-mining industries is now fully recognized, and I feel sure these needs will be provided for by Congress without further delay.

The serious need for inquiries and investigations in behalf of the metal-mining industries is shown by the fact that in many parts of the West their progress has not kept pace with agriculture, which has been so largely stimulated by the governmental researches. Meanwhile, the mining journals have been discussing the "causes of paralysis" in Western mining camps; and the loss of life in

the metal mines during the past several years has been proportionately almost as large, and in many metal-mining regions larger, than in the coal mines of the country.

Another condition which has proved a source of widespread criticism and embarrassment to the Bureau of Mines is the fact that while the demands upon it from all parts of the country for information concerning all branches of the mining industry—demands coming from the mine workers even more than from those interested in the ownership or operation of the mines—have increased rapidly and largely, the appropriations available for actual investigation, instead of increasing, are in reality smaller than were the appropriations for investigations under the technologic branch of the Geological Survey four years ago.

INVESTIGATIONS RECOMMENDED FOR 1913

The inquiries and investigations in behalf of metal mining in the public-land states, which I deem it important that Congress should authorize at this time, may be properly grouped under the following wording: "Inquiries and investigations into the mining and treatment of ores and other mineral substances."

Under an appropriation item so worded it is expected that the bureau would take up these subjects with special reference to the prevention of waste, problems of safety, and the improvement of conditions in the mining industries other than the mining of coal, within the public-land states.

It was mainly with a view to inaugurating such investigations in the metal-mining states that the department included in its estimates for the work of the Bureau of Mines during the fiscal year 1913 an item of \$100,000 for "the treatment of ores and other mineral substances," as authorized in the existing organic act. The incorporation in the item of an investigation of coking coals, gas, petroleum, and miscellaneous minerals was based on the recognized importance of such investigations in the wise development of the mining industry in the public-land states, and also in the prevention of the enormous waste now taking place under the system of handling and developing the Government's own property.

GREAT WASTE OF NATURAL GAS

In fact, the money value of the natural gas wasted unnecessarily in the public-land states largely from land still under government control was, during the past year, more than ten times greater than were the total appropriations for the Bureau of Mines for that year.

In that estimate special emphasis was

given to the problem of waste, just as in the coal-mining investigations special emphasis has been given to the problems of safety, because of the extensive coal-mine disasters; but both in the coal-mining and metal-mining industries the fact is clearly established that the problems of safety and waste are inseparably associated.

The primary purpose of such investigations as are here proposed for the Bureau of Mines will be to make careful researches into the nature of the different types of ores and other mineral substances found in the public-land states, and to obtain in this way such fundamental data concerning them as will be helpful in their efficient mining, treatment, and economic development, will reduce mineral waste, will facilitate the rational sampling and preparation of such materials, and will make possible the prevention or control of poisonous gases, unwholesome dust, or liquids developed in their treatment, and thus lead to an improvement in mining and metallurgical conditions. These investigations meet with the approval of experienced mining men as being of fundamental importance to the industry.

The scope of the proposed investigations, as outlined also in the estimates for the fiscal year 1913, includes:

(a) An examination into the coking and gas industries with special reference to the coking qualities of the coals found in the public-land states, and their utilization in connection with the development of the metallurgical industries; (b) petroleum and natural-gas industries, with special reference to their waste in the public-land states, and their utilization for metallurgical operations; (c) miscellaneous mineral industries, especially as to waste, and with reference to their utilization and development.

HOW WORK CAN BEST BE DONE

In answering the inquiry as to how this work in behalf of mining in the public-land states can best be conducted, I may add that in the investigations concerning the treatment of ores and other mineral substances it is not proposed that the Bureau of Mines make assays or analyses of such materials for private parties, nor that it should determine for private parties by what processes their particular ores or minerals may best be treated. For work of this character there are numerous well equipped private laboratories in the country, and the effect of the investigations conducted by the Bureau of Mines should increase rather than diminish the work of these private laboratories.

It is believed that such work as is here recommended can, for the most part, be best conducted within the limits of the metal-mining states under consideration, where those carrying on the investigations will have every opportunity and in-

centive to keep in close touch with the practical phases of the industry; and by combining the investigations in the laboratory with carefully made examinations in the field.

The investigations of the Bureau of Mines will be limited to problems of general importance and interest, leaving to the states and private corporations problems of local or private interest. They should and will be conducted in such manner as will stimulate rather than discourage these local inquiries and investigations on the part of private companies and the states.

Through the adoption of such a policy the Bureau of Mines will avoid competition with the private laboratories of the country, and at the same time will do much to foster and develop the industry through the accumulation and dissemination of such general and fundamental data as will prove useful to the miners, to the mine operators, and to the states, as well as to the government in connection with the wise development and uses of the mining industry.

INVESTIGATIONS WILL STIMULATE PRIVATE AND STATE EFFORT

There is no foundation for the fear sometimes expressed that if such investigations as are here recommended be undertaken by the government private corporations will unload their local problems on the government laboratories. The result of recent experience has been just the reverse. When, in 1904, the Federal Government began the testing and analyzing of coals, and later took up similar investigations of explosives, mine accidents, and mine-rescue work, similar objections were raised in each case; but in every such case private corporations and private laboratories have been stimulated to greater activities in the investigation of new problems at their own expense. * * *

Since the establishment of the U. S. Geological Survey the number as well as the activities of the state geological surveys has largely increased. The testing of coals by the Federal Government has stimulated to similar activity at their own expense not only many private mining companies but many states, municipalities, private institutions, and private manufacturing corporations.

And so it will be with the investigations of the Bureau of Mines in behalf of the mining industry; they will stimulate inquiries and investigations by both the state and private corporations; they will neither compete with nor interfere with but will rather increase the work of the private laboratories.

OTHER IMPORTANT INVESTIGATIONS

The few lines of investigation above described have been recommended as deserving immediate action by Congress, not because of their being more import-

ant, but because of their being more urgent than other necessary lines of investigation for which, I believe, provision should be made at an early date. But I take it that the purpose of the present inquiry on the part of the Senate is to determine what work should be provided for at this time.

No less in need of investigation on behalf of both safety and efficiency in the metal-mining industry are the problems of ventilation; mine timbering; mining, quarrying, and metallurgical equipment with special reference to safety appliances; explosives; electricity, fire protection; and the collection and dissemination of data relative to safety; and the improvement of mining conditions. Such problems can be made the subject of helpful inquiries and investigations without in any way encroaching upon the work of private laboratories or lessening the individual initiative and enterprise of private mine operators. These are problems which have no state or other local boundaries; and there is no reason, therefore, why the cost of their investigation should devolve upon any one individual, community, or state. They are general in their character and application; and in the interest of both economy and efficiency they should be conducted by the Bureau of Mines for the benefit of the industry in the country, under proper congressional authorization. * * *

With the increasing complexity of the conditions controlling the mining industry, and its growing importance as a basis of our national welfare, it is becoming, not only more appropriate, but more necessary that the government, through its inquiries and investigations, aid the miners in much the same way that it has with such generosity and success aided the farmers of the country. The failure of the government to do this in the past is to be explained only by the fact that the conditions have not been adequately understood.

GOVERNMENT LARGEST MINERAL-LAND OWNER

There are special reasons why the Federal Government should aid the mining industry in the public-land states. The Government is still the largest owner of mineral lands in those states. Even were these states sufficiently wealthy to grant appropriations without reserve there would be, if the work were all done by these states, costly duplication in effort and expenditures, as for the most part the problems are common to all of them.

No better illustration can be given of the extent to which the mining industry has been relatively neglected and the agricultural industries fostered in the general plans for industrial development than the fact that during the past 10 years not only has the Federal Government expended large sums from the Public Treasury in behalf of investigations

looking to agricultural development, but it has expended in behalf of the reclamation of arid lands for farm purposes in the public-land states the proceeds of the sale of all public lands (\$65,000,000), including even the proceeds of the sale of mineral lands, the latter aggregating nearly \$7,000,000. It would certainly have been reasonable and fair if during this period the proceeds of the sale of mineral lands in these states had been devoted to investigations looking to the upbuilding of the lagging mining industry there.

Meanwhile, during this period, stimulated by this aid from the Federal Government, the agricultural products of the public-land states have increased from an average annual valuation of \$966,000,000 during the five years from 1901 to 1905, to an average annual valuation of \$1,365,000,000 for the five years from 1906 to 1910. During similar periods the average annual valuation of the mineral products in the public-land states (including the precious metals, copper, lead, zinc, coal and petroleum) increased from \$287,000,000 during the first period to \$358,000,000 during the second period; while in the production of the precious metals there has been a decrease from an average annual valuation of \$136,000,000 during the first period to an average annual valuation of \$127,000,000 during the second period.

COST OF INVESTIGATIONS

The following is an estimate of the cost of the work it is recommended that Congress authorize to be carried on by the Bureau of Mines in the public-land states west of the Mississippi River during the fiscal year 1913:

For inquiries and investigations into the mining and treatment of ores and other mineral substances, and for equipment, supplies, travel, and other expenses incident thereto, \$100,000. The more important items of expenditure under this appropriation are estimated to be as follows:

Salaries, \$55,580; traveling expenses, freight, express, rent, etc., \$15,800; equipment, including instruments, and supplies for field and laboratory work, \$28,620.

An itemized statement in detail of the estimated expenditures under the above proposed authorization has been prepared by the department. The reply to the Senate inquiry has been delayed until ample opportunity could be given for conference with men thoroughly acquainted with Western mining conditions.

The Bunker Hill & Sullivan Mining & Concentrating Co. has just paid its 177th dividend. The total return to stockholders has been \$13,519,350, on a capitalization of \$327,000, or 413 per cent.

The Aluminum Trust Suit

In the United States Court, at Pittsburgh, June 7, a decree was entered against the Aluminum Co. of America. Following the government's civil suit, filed a few weeks ago, charging the corporation with monopolizing the industry, the decree abrogates alleged unlawful contracts and restrains the defendant company from negotiating similar undertakings or pursuing unfair methods toward competitors.

The decree was accepted by the Aluminum company as a result of protracted negotiations with Attorney General Wickersham prior to the filing of the suit. The mandate was drawn and accepted by both the government and the defendant before the suit was initiated. This is the first time a decree has been agreed upon under the Sherman law before court proceedings had been started.

The company is forbidden to participate in any combination or agreement to control the output or prices of aluminum. It is enjoined from combining, by stock ownership or otherwise, with other manufacturers for this purpose. The decree places a long list of specified unfair methods of competitors under the ban of the court.

Provisions of alleged agreements to suppress competition between the Aluminum company and the so called Swiss, or Neuhausen, Co. of Europe; the General Chemical Co., the Norton Co., the Pennsylvania Salt Manufacturing Co., Gustave A. Kruttschnitt and James C. Coleman, both of Newark, N. J., are abrogated by the decree.

Whenever it is shown that substantial competition has arisen in the aluminum industry, the decree may be modified upon the production of evidence that it is working an injustice. Application for modification cannot be made oftener than once in every three years.

Molybdenum in Steel

The Primos Chemical Co., of Primos, Penn., has written as follows in response to an inquiry regarding the use of molybdenum in steel:

"There is a little more demand for molybdenum now than there has been for the last seven years. From 1900 to 1905, the consumption was at its greatest, our firm alone producing upward of 50 tons of metallic molybdenum per year. Consumption then dropped to a few tons per year, but is now gradually coming up again to an average of two tons per month in the United States. Both molybdenum and ferro-molybdenum are now used little in straight molybdenum tool steels, but are used in connection with tungsten in most of the high-class tool steels; also in connection with vanadium. In certain steel castings and

other railroad work, molybdenum is also used up to 1%. Some of the European armor plates contain up to 2% of molybdenum.

"The Primos Chemical Co. is also manufacturing an alloy known as ferro-molybdenum-tungsten, containing molybdenum and tungsten in the proportions of 3:1; vanadium is sometimes added in amounts ranging from 1 to 7%, according to specifications. The price of ferro-molybdenum is about \$1.60 per lb. of molybdenum contained in the alloy. Ore prices vary from 25c. to 40c. per lb. of molybdenum sulphide, depending on the composition of the ore."

Ore Strike at Florence-Goldfield

Press dispatches accredit R. Dewey, manager of the Florence mine, at Goldfield, Nev., with having made statements in regard to the strike of rich ore in that mine substantially as follows: The strike was made on the 250-ft. level in extending a crosscut to the east. At a distance of about 1600 ft. from the shaft and in virgin ground, a high-grade streak $3\frac{1}{2}$ ft. wide was cut, but no particular attention was paid to it, as a wider streak of milling ore appeared against it on the far side. The milling-ore streak is about eight feet wide; assays of the samples show that the ore contains between \$20 and \$30 in gold per ton.

The narrower streak has been drifted upon for a distance of 15 ft. to the south and a like distance to the north. Samples from the north face assay about \$26 per ton; those from the south face about \$10. The oreshoots dip slightly to the east and trend northward, between walls of altered dacite.

Mr. Dewey entertains the opinion that the newly discovered ore is in the same vein that the owners of the Zinn lease on the Jumbo worked, as apparently it comes directly from those workings into Florence ground. Between 75 and 80 tons of ore have been broken, which will be shipped to the Western Ore Purchasing Co. It is said that this ore contains between \$200 and \$500 in gold per ton.

Geology between Porcupine and Gowganda

SPECIAL CORRESPONDENCE

J. G. McMillan, who was commissioned to examine the territory along the line of the proposed extension of the Porcupine branch of the Temiskaming & Northern Ontario Ry. to Gowganda, a distance of about 60 miles, reports that the country does not present any important agricultural possibilities, but that gold has been found in places and the rocks would probably repay careful pros-

pecting. In the vicinity and northeast of the Height of Land, the Keewatin formation is overlain by areas of Huronian sediments, which dip at small angles to the east and southeast. These form ridges resembling those in the Cobalt district. Diabase occurs in the Huronian, as dikes less than 100 ft. in width, but the intrusions are unimportant as compared with those of Cobalt or Gowganda. Small quartz veins occur in the Keewatin schists in many parts and in the vicinity of the granitic intrusions veins of good size have been found. Gold has been discovered in some of these and in associated porphyry dikes, but development has not been sufficient to determine if it exists in paying quantities. The iron formation, so far discovered, is not regarded as of economic importance.

The Abbe-Frenier Sand Pump

The sand pump shown in the accompanying illustration differs from the old type Frenier pump chiefly in that no inclosing box is required, and the pump wheel, made of $\frac{1}{2}$ -in. steel, is divided by a diaphragm wall into two equal compartments. The wheel overhangs from the main bearing, no outboard bearing being required. The compartment on the bearing side of the wheel is occupied by a spiral similar to the spiral of the older Frenier pump, and which terminates at the hollow trunnion, through which the pulp is discharged. The outer compartment is simply a receiving chamber; connection with this and the outer coil of the spiral in the other compartment is effected by an opening in the diaphragm.

Pulp is delivered to the pump by the launder that leads into the central opening in the side of the receiving compartment of the wheel. From the receiving chamber a quantity of the pulp passes through the opening in the diaphragm at

pulp in the pump and discharge pipe will have drained into the tank before the pump is stopped. Of course, the supply of pulp is stopped by a gate in the inlet launder before stopping the pump. When the pump is restarted the trap valve U is opened, allowing the pulp stored in the tank to flow into the inlet launder, joining the main supply to the pump.

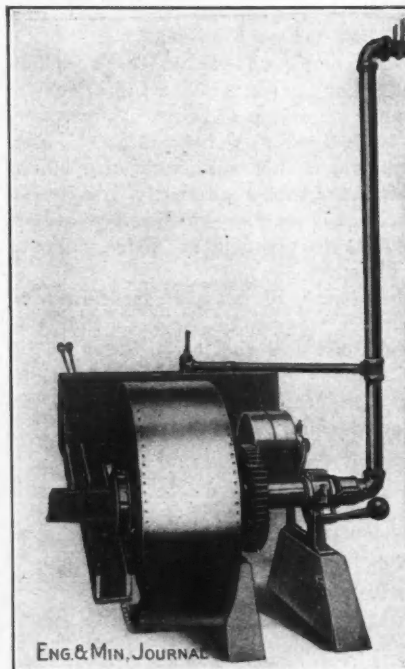
The pump is driven preferably by a countershaft with pinion and gear for the larger sizes, or by a pulley on the main shaft for the smaller sizes, but they may also be driven by chain and sprocket. The maximum speed of the countershaft is 90 r.p.m. for the 14x25- and 20x55-in. pumps, and 100 r.p.m. for the 14x47- and 20x47-in. sizes; 18-in. pulleys are used on all sizes. As the pump is not obliged to cut through the pulp, as in

higher elevations, deduct 4 in. per 1000 ft. The pump is furnished complete, except the foundations, launders, tanks and pipe. It is advisable to have on hand an extra packing joint, pinion and elbow.

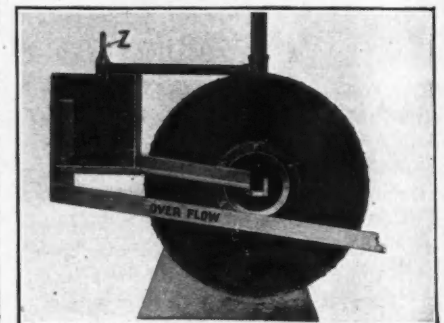
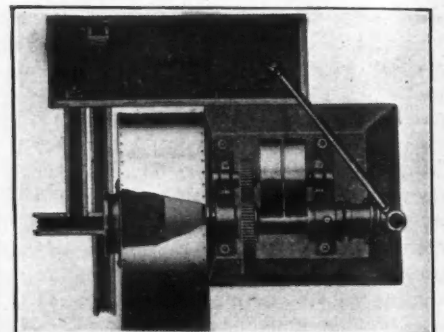
Patricia District, Ontario

TORONTO CORRESPONDENCE

Prof. W. G. Miller, provincial geologist, has issued a preliminary report on the new district of Patricia that was added to Ontario during the last session of the Dominion Parliament. That portion of the old district of Keewatin, now belonging to Ontario, embraces an area of approximately 156,000 square miles. The characteristics of the new district are much the same as the older northern parts of the province; the elevation, the presence of numerous lakes and water



ENG. & MIN. JOURNAL



ABBE-FRENIER SAND PUMP

ABBE-FRENIER SAND PUMP DATA

No.	Size in.	Capacity gal. per min.	Max. Lift ft.	Shipping wt. lb.	Discharge in.	Price f.o.b. Rutland
1	20x55	60-90	22	2150	3½	\$260
2	20x47	50-80	15	1850	3½	240
3	14x55	30-60	22	1800	3	220
4	14x47	25-50	15	1650	3	200

each revolution, thence through the spiral and trunnion and up the discharge pipe. An overflow launder is provided, which disposes of excess pulp that may overflow from the receiving compartment of the wheel. This launder extends up to the receiving tank R , and into it the contents of the tank can be drained by opening valve U . A horizontal pipe from the vertical discharge pipe is equipped with a valve Z , which should be opened before the pump is stopped and after valves U and U have been closed, so that all the

case of the older type, coarser material can be raised and less power is required for its operation; the manufacturers specify between 1 and 2 hp.; 15 to 20 r.p.m. is the proper speed of revolution for the pump wheel.

The sizes, capacities and other data regarding these pumps are given in an accompanying table, taken from the catalog of the manufacturers, J. H. Frenier & Son, Rutland, Vt. The lifts given in the table are calculated for altitudes of 1000 ft. or less above sea level; for

courses, the nature of the rocks and vegetation, throughout a part of the district, at least, being similar. The pre-Cambrian rocks predominate, but along the coast of James and Hudson Bay, from the mouth of the Albany River to the Manitoba boundary, the rocks are similar to those along the northern shores of Lakes Ontario and Erie. Little detailed work has been done, but judging from what is known of the geology, the district should contain important mineral deposits. There are large areas underlain by rocks, similar to those which, in the older northern districts, contain deposits of gold, iron and other ores. There are also rocks which are similar to those in which occur the nickel deposits of Sudbury and the silver deposits of Cobalt. Limestone and other rocks along the coast may contain deposits of petroleum, natural gas, gypsum, salt and other valuable minerals.

Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

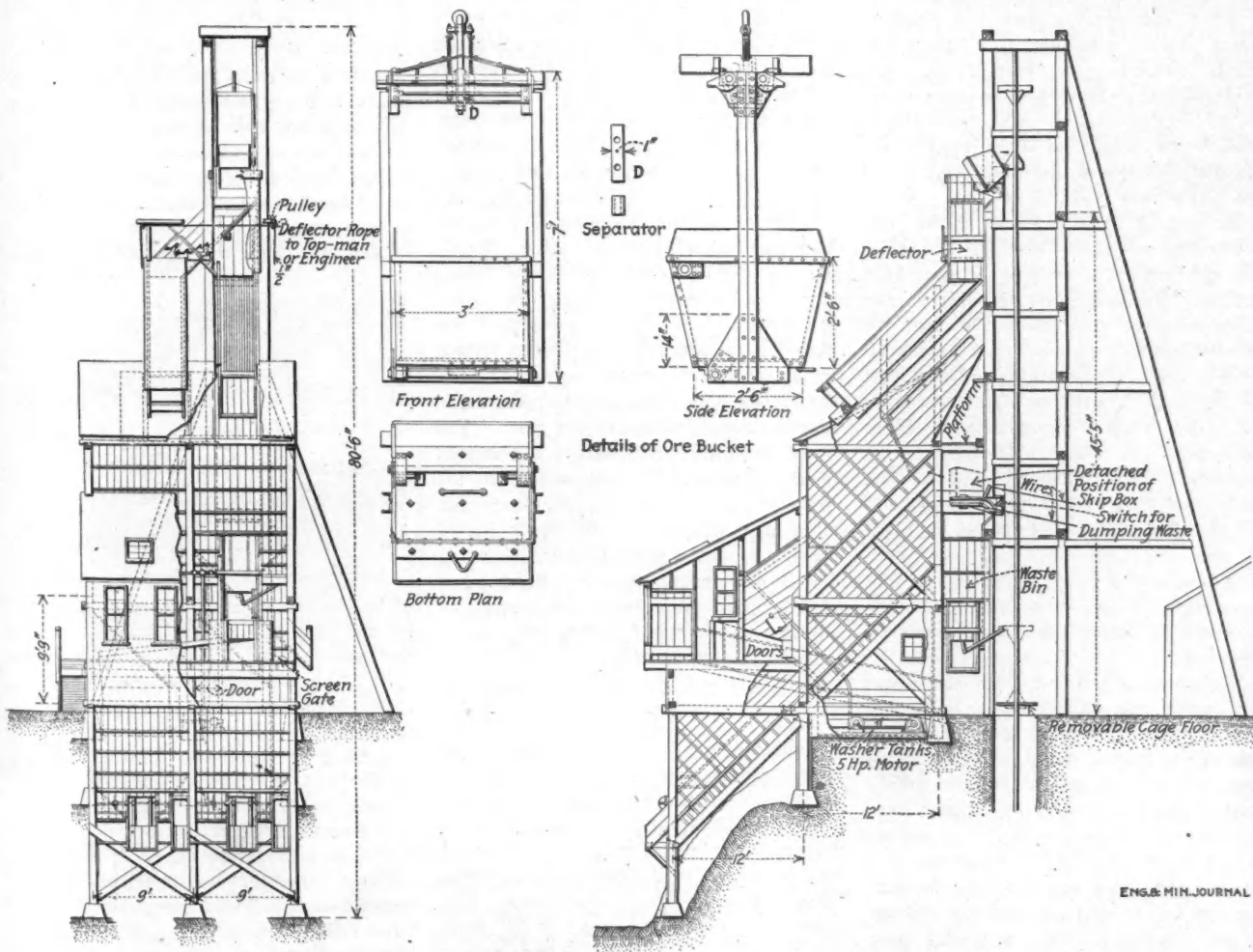
A Cripple Creek Ore and Waste Plant

By S. A. WORCESTER*

The plant shown in the accompanying drawings was designed by me with the intention of adding later a third unit of bins, screen and washer, if the mine production justifies it; the addition to be

endwise the pin that holds the cap. The pins are normally held in place by spring cotters which also prevent them from being dropped and lost. The skip-box is easily removed from the frame and hung out of the way over the waste bin in the position shown by the dotted lines in the general drawing of the plant. The hanger rod is hooked into the loop

ing the outside of the guide shoes, so as to prevent the dogs from rotating further than they should when engaging the wooden guides. A number of accidents are on record where ordinary dogs of nearly round shape have turned completely over, breaking the chains which held them, and allowing the cage or skip to fall to the bottom of the shaft. An-



FRONT AND SIDE ELEVATIONS OF AN ORE HOUSE, AND DETAILS OF HOISTING BUCKET

made on the southwest side. Ore and waste are hoisted in the skip, which is shown in detail. Its capacity exceeds that of one mine car (1800 lb.) so as to avoid spilling when the car is dumped from the mine level directly into the skip without the use of chutes or aprons. The caps of the cast-iron boxes on the bottom of the skip-body are hinged so that they can be swung open by sliding

or eye at the bottom edge of the skip-box and supports the box, with its rollers resting in the dumping guides. The removable floor is then placed on the crossbars of the skip-frame, quickly converting it into a cage for hoisting men and timbers, or making repairs in the shaft.

Among the features of the skip may be mentioned the safety dogs or catches which have long projections for engag-

other feature of this skip is the "Champion mower" spring, which I use frequently in my machine designs because of its reliability. It is made by spring manufacturers who test every spring with a special testing machine, extending its length from 13 to 18 in., after which test the spring must return to its original shape, retaining an initial tension of 400 lb. This spring can be duplicated at small cost at any agency of the In-

*Mechanical engineer, Victor, Colo.

ternational Harvester Co. Most manufacturers do not make such a reliable and powerful spring for occasional orders for skips and cages, as I know from several unsatisfactory experiences. The situation of these springs, between the top cross-bars of the skip frame, where they are protected from accidental injury, and the ease with which they are removed, replaced and adjusted are desirable features. I believe this arrangement of safety catches has important advantages, in simplicity and reliability, over the more common arrangement of chains, flat springs and eccentric dogs, and my belief is well supported by the operating record of 8 or 10 skips of my design on which these safety devices are now used.

When the skip is used for hoisting waste, which goes direct to the waste dump without being sorted, the steel guide switch, or the lower dumping guide in the illustration is slid horizontally toward the hoist, so as to engage the dumping rollers of the skip, and throw the load into the waste bin. When crude ore is being hoisted to the ore-house for screening, washing and sorting, the switch, consisting of one right and one left hand dumping guide, is slid away from the hoist so as the clear the skip rollers and the skip then passes up to the stationary dumping guides near the top of the headframe. Here it dumps into a main spout on which is a deflector that directs the ore to one grizzly or the other. This deflector is operated by ropes guided by pulleys to the engineer's station. The skip switch is also operated by the engineer, who uses a lever placed near the hoist, connected to the switch guides by wires equipped with eye-rods by which the tension can be adjusted.

The crude ore drops from the spout into which, the skip dumps, upon the grizzly, the coarser material passing over to the crude-ore bin, while the fines pass through to the wire-cloth screen having about one-inch openings. Rejections or middlings from the screen join the crude ore; screenings fall through the large spout to the screenings bin below, and are shipped without further treatment. The inclination may be adjusted by raising or lowering the upper ends of the screens. The slope is thus made to suit the character of the ore, whether dry or sticky.

The washers at the open mouths of the crude-ore bins, are chutes or troughs 36 in. deep and wide and 6 ft. 3 in. horizontal length, with perforated plate bottoms inclined at 30°. At the lower ends or mouths of the washers are gates operated by hand levers, opening on the sorting tables which are covered by perforated plates. A centrifugal pump, driven by an induction motor, forces

water through the parallel spray pipes above the washers. The water issues from these perforated pipes in jets of considerable force, striking the ore as it lies in the washer. The slime adhering to the ore is washed off, and passing through the perforated bottom of the washer is carried by launders to a tank in which the slime is deposited and the water is partially clarified. The tank is provided with baffles at the inlet and outlet for reducing the disturbance caused by ingoing and outgoing currents as much as possible and promoting rapid and effective settling. The same water is used repeatedly. The tank is a cheap and simple structure made of boards that are not tongued and grooved, being nailed and spiked together. On one side is a steel-plate liner so arranged as to form an exhaust-steam heater, using the exhaust from the hoist in cold weather.

For sorting ore, a mine car is run under the projecting edge of the sorting-table and the waste rock is scraped into the car, while the ore is scraped into one or the other of the vertical spouts and drops to the shipping bin below. Two men can work at each table. Washing has the effect of making the colors of the rock distinct and rendering accurate sorting easy. In the corners of the bins for shipping ore are closed spouts which carry the screenings from the screenings bins and deliver at the same level as the shipping-ore bin gates. The waste from the sorting-tables is trammed to the dump north and south of the sorting-room and the waste from the mine is trammed from the waste bin to the dump. For a plant of small size this one is economical, the only hand labor of any importance being the sorting of ore and tramping of waste.

Concrete Chute Bridging a Level

Concentrating hoisting at a few levels is a practice that is growing in favor at many large mines. At the Osceola, No. 13 shaft of the Calumet & Hecla company, the ore from five levels, each 100 ft. apart, is delivered at the level through a chute in the shaft pillar. This chute is inclined at an angle of 40° from the horizontal. The ore is drawn from it into a car of 7½ tons capacity, the flow of ore being controlled by a chute gate of the hinged type.

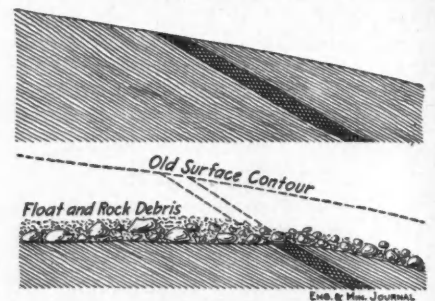
As this chute was cut after the levels were driven, it was necessary to continue it from the opening in the roof of the drift diagonally across to the similar opening in the floor, near the opposite wall. This was done by bridging the gap with a long, reinforced-concrete box without ends. The bottom of the box was made 24 in. thick, and was reinforced with old 30- and 40-lb. rails. Large blocks of rock from the vein walls, some

of which were 16 to 18 in. diameter, were imbedded in the concrete in making the bottom, as it was believed that this material would withstand abrasion by the ore better than concrete alone; a 1:2:5 concrete mixture was used. The sides of the box were made 12 in. thick at the floor and tapered to a thickness of 6 in. at the roof. The cover or top of the box was made of concrete 12 in. thick, and it, as well as the sides, was reinforced with old rails. An opening in one side of the box at the floor on each level afforded means of dumping ore into the chute. A grizzly was placed over the opening, and was held in place by a 12x12-in. timber, to which the grizzly bars were screwed.

Hints for Prospectors

By E. M. WESTON*

It is almost always assumed in textbooks offering the prospector advice in searching for new deposits of ore, that the outcrop of a vein is always to be sought for on higher ground than that from which the float came. This is not always true. Whether it is true or not in a specific case depends upon the nature



ORIGINAL AND ERODED OUTCROP OF VEIN of the denuding agencies, the character of the vein and of the inclosing rock, and above all on the dip of the vein itself. The high veldt of South Africa offers some interesting examples of exceptions.

Take for example a quartz vein or banket bed in slate in country where denudation is gradually taking place by the removal of decomposed rock by rain falling on a moderate slope. It is at once evident from the accompanying sketch that the float and boulders from the vein have fallen over *in situ*, perhaps a few having rolled down hill from the outcrop. Should the prospector carry on his operations in the time-honored manner of searching up-hill from the float, he would waste time and money in sinking and trenching and might fail to discover the orebody. From the examples I have seen I believe that in the case of flat veins this occurs more often than is supposed and may account in some American districts for failures to discover the source of float. It is a fact well worth bearing in mind.

*Union Club of South Africa, Johannesburg, Transvaal.

Shaft Station Safety Gates

BY F. L. FISHER*

In several of the Anaconda company's mines at Butte, where ore is hoisted in skips, it has been found necessary to protect the openings from the shaft to the stations from occasional falls of small quantities of ore which are often spilled in loading. It is impossible to catch every piece of ore as it flows from the skip chutes; some of it bounds over the edge of the skips, or the momentary sticking of an unusually large piece in the jaws of the sliding door of the chute when the skip is about full causes an overflow before the obstruction can be loosened and the door closed. Although these escaping fragments are in the majority of cases small, yet in falling several hundred feet they attain a velocity which makes them a menace to safety regardless of size, and often they zigzag from side to side of the shaft and bound into the station with great force. There is a record of one man being struck and killed by such a piece of ore

hinges *J*, so that the doors can be swung in and out of the shaft, to facilitate the unloading of long timbers from the cages; the doors being simply swung up away from the shaft as the timbers are dragged through. The bottoms of the upper doors are 12 in. above the tops of the lower, and 22 in. back toward the shaft. They are made of $\frac{1}{8}$ -in. iron sheeting, strengthened by two vertical strips of $\frac{3}{8}$ -in. iron *K*, and of their own weight they tend to deflect downward any falling pieces of ore to the turnsheet below, where the lower gates prevent them from bounding into the station. The opening between the gates, and the wire screens on the lower gates are for the purpose of admitting light to the shaft.

Cartridges for Tamping Dynamite

By JOHN T. FULLER*

The articles recently published in the JOURNAL describing the cartridges used for tamping dynamite in the Lake

The dynamite used in these mines is packed in 50-lb. cases containing the sticks in bundles or packets of about 20 sticks each, and each packet is wrapped in paraffin paper. The pickaninies collect this paper and each with a pile of mud, much resembling a big batch of black dough, deftly balanced on top of his head retires to some cool spot, preferably near an air-pass and proceeds to make cartridges.

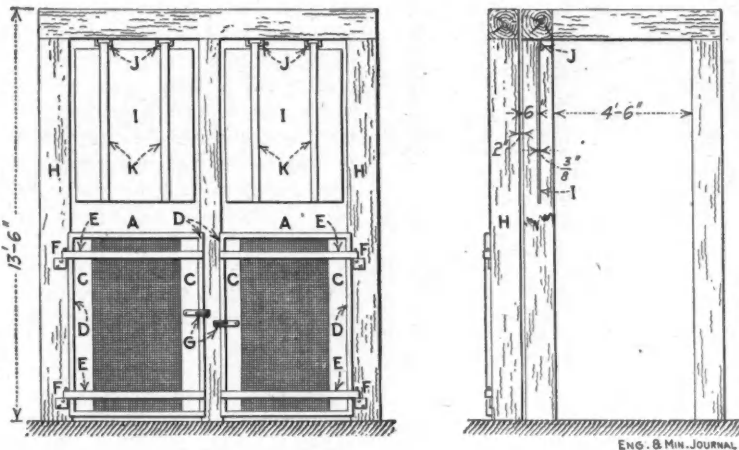
This they do, first by taking a handful of mud and rolling it out on a board until they have formed a rough cylinder of mud six to eight inches long, and an inch or more in diameter. After having rolled sufficient mud cylinders to make the required number of cartridges they cut the paraffin paper to the required size in the form of rough squares and roll the papers about the mud cylinders; sometimes square across and sometimes on the bias. One end is then turned over and the cartridges struck one or two light taps on the board to compact the mud; the other end is then turned over and the cartridge is formed. I have sometimes seen these boys form cartridges in the same way as is in the Lake Superior practice, by forming a paper cylinder around a piece of old shovel handle and then thrusting the mud inside. The paraffin paper sticks closely to the mud cylinder and no fastening other than the turned-over ends is required. The cartridges retain their shape and withstand handling before tamping. In loading the holes one or two of these mud cartridges are tamped tightly down on the charge.

In my opinion these Kafir-made cartridges are better for the intended purpose than a cartridge wrapped in several layers of newspaper, as described in the JOURNAL, as the very rigidity mentioned tends to destroy the purpose of the cartridge, which is to form an air-tight tamping for the charge. With the thin paraffin paper the cartridge after being placed in the hole, bursts under the pressure of the tamping stick and the mud is thus forced into every crack.

In connection with this similar practice in two such widely separated districts it would be interesting to know who is responsible for its introduction. I strongly suspect that the Cornish miners are responsible as there are many in both districts.

Rope Capacity of Drums

The rule used by the A. Leschen & Sons Rope Co., for computing the rope capacity of any size of drum, is as follows: Add the depth of flange in inches to the diameter of the drum, and multiply this result by the out to out width of the drum. This product is then multiplied by



STATION GATES IN A BUTTE MINE

while standing about 20 or 30 ft. away, and several lesser accidents have occurred. To insure against repetitions of these accidents swinging gates have been devised.

The main gates *A*, are made of two wide vertical strips of $\frac{1}{8}$ -in. iron sheeting *C*, and a central screen of 1-in. mesh, No. 8 iron wire, all bordered by a 2-in. angle iron *D*, and crossed horizontally by two strips of $\frac{3}{8}$ -in. iron *E*. The doors are hung on hinges *F*, and locked with lift-latch *G*, which can be operated from either side. They are attached to the outward faces of the first station sets *H*, which are separated from the shaft timbers by a space of two inches. Above and back of these doors is a second set of doors *I*, hung from the center of the cap at the top of the shaft-station sets by

Superior and other mines, recall to mind the similar practice in the diamond mines at Kimberley, South Africa.

As is well known, the diamond-bearing rock or "blue ground" is comparatively hard and compact, but it disintegrates upon exposure to the atmosphere. There is always a plentiful supply of finely pulverized rock, and dust to be found on the floors of the tunnels, which, when mixed with water in the right proportions forms a plastic mud.

During a shift while the "drill boys" are drilling the holes two or three "pickaninies"—native boys from 14 to 18 years old—are delegated either to collect this mud from the wet places on the level or to form enough by mixing the dust with water to make tamping cartridges.

*Mining engineer, 513 Hennessy Building, Butte, Mont.

*Consulting engineer, 505 Park St., Honesdale, Penn.

the figure below corresponding to the size of the rope used:

1 in.	4.16	1 1/2 in.	0.138
1 1/4 in.	1.86	1 3/4 in.	0.116
1 1/2 in.	1.37	1 7/8 in.	0.099
1 3/4 in.	1.05	2 in.	0.085
1 7/8 in.	0.828	2 1/8 in.	0.074
2 in.	0.672	2 1/4 in.	0.066
2 1/4 in.	0.465	2 3/4 in.	0.058
2 3/4 in.	0.342	3 in.	0.052
3 in.	0.262	3 1/4 in.	0.046
3 1/4 in.	0.207	3 1/2 in.	0.042
3 1/2 in.	0.167		

This rule applies, of course, to a drum on which the rope is to be wound in successive layers up to the full height of the flange.

Two Cores from One Borehole*

BY JOHN I. HOFFMANN†

Two deep boreholes were sunk a few years ago in South Africa, one by the Lace Proprietary Mines on the farm Vlakfontein, in the Heidelberg district of the Transvaal, and the other south of the Brakpan Mines property, on the portion of Witpoort No. 162, belonging to the South African Lands & Exploration Co. The idea of taking another core from the vein from the same borehole was conceived by Mr. Welldon, at one time foreman driller on the Apex borehole. Because the expense of drilling these deep boreholes and only getting one core was great, the proposed method was favorably received and was improved upon and carried out by A. Payne-Gallwey, of Johannesburg, so that another core could be taken in any desired direction by means of a deflecting wedge. This contrivance consists of a pilot wedge, a guide wedge and a main deflecting wedge, and the method of procedure is as follows:

In the case of a Sullivan "B" hole, 2 1/4 in. diameter, a pilot wedge, Fig. 1, is made of round iron, 2 in. in diameter and 18 in. long over all, the wedge face being 6 in. long. The end opposite the wedge face is threaded to fit a piece of 1 1/2-in., inside diameter, black pipe. A 3/4-in. hole is drilled in the face of the wedge and tapped, and a nick *a* is made with a chisel on the top of the wedge along its longitudinal axis. This nick is for surveying purposes, as will be explained later. This wedge is screwed into a piece of 1 1/2-in. piping about 3 ft. long, Fig. 2, the piping being toothed at the opposite end, to which this wedge is screwed. The borehole is then filled with water and the pilot wedge and piping are dropped down the hole, wedge face upward. The main rods are then lowered to find out whether the pilot wedge and pipe are resting on the bottom of the hole. If not, the wedge has to be lifted by means of the tapped hole

referred to above and again dropped, until it is found that the wedge and pipe are resting on a solid bottom, or at any rate are fast and rigid somewhere near the bottom of the hole.

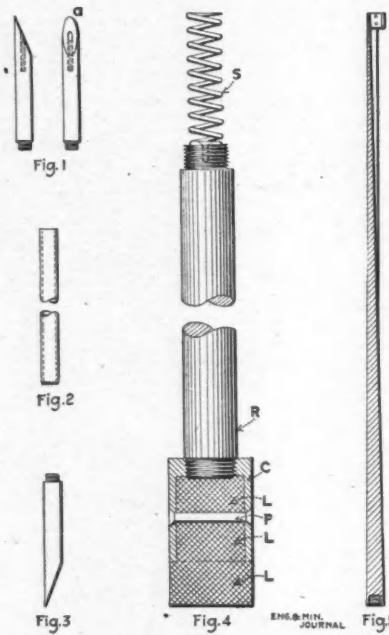
The position of the wedge is surveyed by the device shown in Fig. 4, which consists, for a "B" hole, of a brass rod *R*, about 1 1/8 in. diameter and 3 ft. long, threaded at both ends. To one end is fixed a spiral spring *S*, similar to that fixed at the bottom of the surveying instrument described in the JOURNAL of May 18, 1912. To the other end a brass cup *C*, 2 in. in diameter, is screwed, in which a brass pin *P*, 1/4 in. in diameter, is riveted across the diameter of the cup. This cup is filled with lead, which projects 1 in. beyond the edge of the cup and which is turned to the same diameter, 2 in. The end of the rod with the

and the direction of the wedge calculated.

The guide wedge, Fig. 3, is an exact counterpart of the pilot wedge, and the butt end of this is screwed into the butt end or bottom of the main deflecting wedge. The main deflecting wedge, Fig. 5, is made of a solid piece of 2-in. round steel 7 ft. long. The bottom end is drilled and tapped to receive the butt end of the guide wedge. The top end is drilled with a 1 3/4-in. bit to a depth of 2 in., thus leaving a ring of metal 1/2 in. thick. The solid portion of the 7-ft. steel is then planed, commencing from the under side of the metal ring down to about 1 ft. from the bottom, in such a manner that a wedge is formed with a concave face with a radius of 1 in., and having a thickness of 1/8 in. at the top and 2 in. at the bottom end.

For surveying purposes, a chisel cut is made in the top of the ring along its diameter coincident with the longitudinal center line of the wedge, as shown in Fig. 5. The direction of the face of the pilot wedge now being known from the survey, the guide wedge is screwed into the main deflecting wedge in such a way that when the faces of the pilot and guide wedges are together, the main deflecting wedge is facing in any predetermined direction.

The end of a "C" rod, 1 5/8 in. diameter, is now placed in the metal ring at the top of the main deflecting wedge and riveted thereto with two 1/4-in. copper rivets. To the other end of the "C" rod is attached a 10-ft. length of "B" rod, 1 1/8 in. diameter, on the top end of which is screwed a ball-bearing swivel, and the main drill rods are connected to the top of the swivel. The whole contrivance is then lowered in the hole, and, as soon as the point of the guide wedge touches the face of the pilot wedge, the swivel allows the guide wedge, and with it the deflecting wedge, to revolve until the faces of the guide and pilot wedges are coincident, the top one sliding on the bottom one until they jamb. If the weight of the rods is not sufficient to shear the rivets, hydraulic pressure is put on the piston of the drilling machine and the copper rivets sheared off, leaving the main deflecting wedge in position at the bottom of the hole. The main rod, together with the "C" rod, which was riveted to the top of the main deflecting wedge, are now withdrawn from the hole, and the direction of the main deflecting wedge is surveyed to ascertain if it is in the required position. If the position of the main deflecting wedge is correct, "C" rods with a "C" bit are now attached to the main rods, and these are lowered in the hole, entering the ring at the top of the main deflecting wedge, which acts as a guide. Drilling is commenced with the "C" bit and continuing along the face of the main deflecting wedge, the bit is thrown over into solid rock.



BOREHOLE DEFLECTING WEDGES AND SURVEYING DEVICE

spiral spring is screwed to the bottom of the instrument, in place of the bottom plug. The survey is made as follows:

The relative position of the pin point on the gimbals to the guide inside the case of the instrument described in the JOURNAL of May 18, 1912, being known, the position is marked on the outside of the case, and the line continued along the brass rod, cup and projecting lead. The top end of the instrument is screwed into a brass tube 10 ft. long and that again screwed to the end of the drill rods. The whole device is lowered in the hole until the lead is resting on the top of the wedge, which, with its chisel cut, makes an impression on the lead, a photograph of the magnetic needle being taken at the same time. On raising the rod, the disk of lead with the impression is sawed off

*Excerpt from a paper entitled "Recent Practice in Diamond Drilling and Borehole Surveying," Bull. 91, I. M. M.
 †Mining engineer, 216 Moorgate Station Chambers, London, England.

Details of Metallurgical Practice

Records of Experience in Ore Dressing, Cyaniding and Smelting

Stationary Dewatering Screen

BY CLAUDE T. RICE

Four stationary screens inclined at an angle slightly greater than the angle of repose of the material are used in the Leadwood mill of the St. Joseph Lead Co., in the Flat River district of Missouri, for dewatering the tailing from Hancock jigs before it is discharged upon a conveyor belt.

Each screen is 24 in. wide by 28½ in.

each, last 20 days and screen 17,500 tons.

The screen may be set at an angle as low as 26° and the tailing will move over it. The observation has been made that these screens, if movably supported and given a slight jerking motion in a forward direction by an eccentric, could be set at a much lower angle, and the capacity and possibly the life be increased at a nominal expense for the power required. Shaking screens of this type have been used successfully in other mining dis-

Steel Tray and Support for Hancock Jigs

A steel tray and steel support are used in the Hancock jigs in the No. 3 mill of the Doe Run Lead Co., near Rivermine in the Flat River district of southeastern Missouri. The steel supports are shown in detail in Fig. 1, and are said to be preferable to wooden supports.

The steel tray that carries the jig

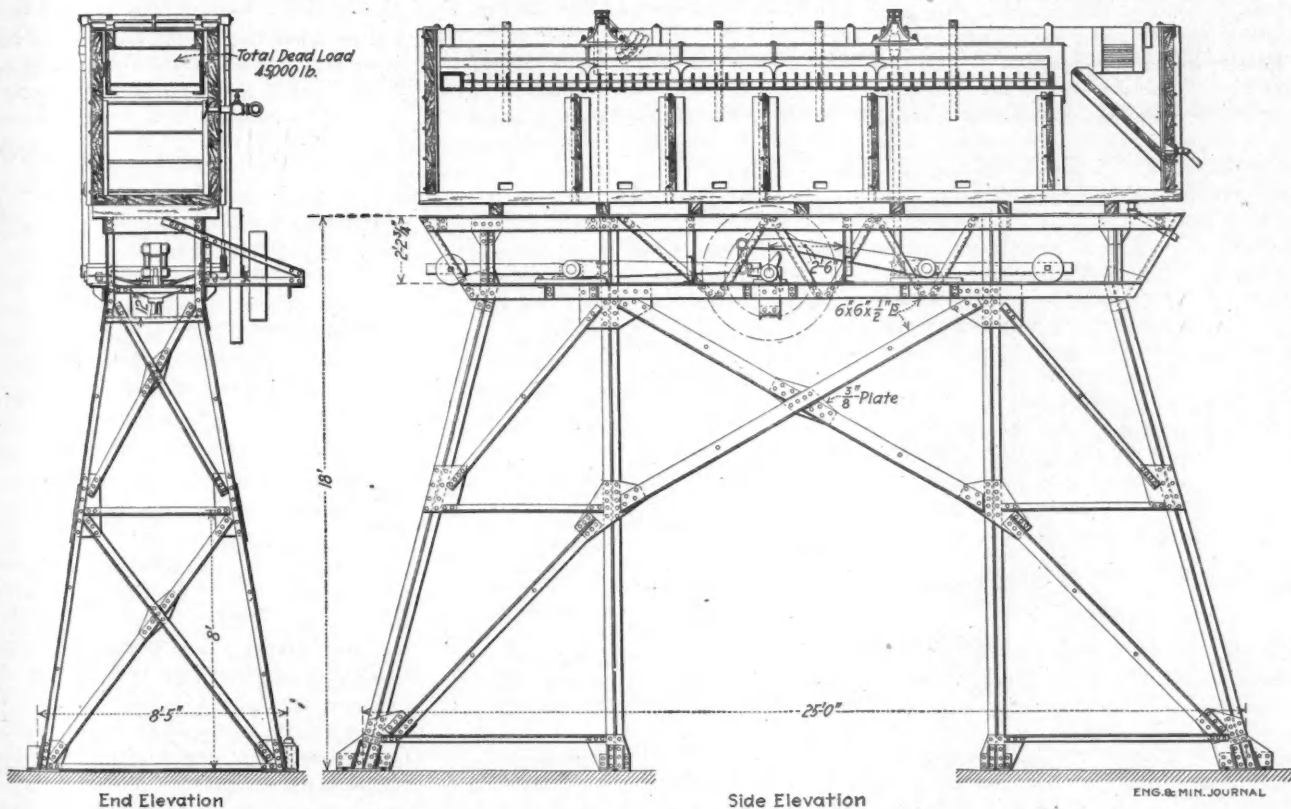


FIG. 1. HANCOCK JIG AND STEEL SUPPORT USED IN DOE RUN NO. 3 MILL, SOUTHEASTERN MISSOURI

long and is held in place in a stationary frame by 1-in. cleats on each side. Across the lower end and on the upper surface of the screen a cleat is nailed that holds a thin layer of tailing on the screen's surface, which layer protects the wire cloth from excessive wear. The capacity of each screen is about 875 tons per 24 hr. Tyler No. 58 woven-wire, or No. 18 cold-rolled, hand-punched, staggered long-slot, steel screens are used. The slots of the latter are 0.058 in. wide by 1½ in. long. The wire screens cost \$1.94 each, last 14 days and screen 12,250 tons of tailing, while the punched screens cost \$1.65

tricts, but only for sizing dry ore. When used for dewatering thin pulp the motion should prevent blinding.

The efficiency of a Frenier sand pump decreases rapidly as the height of the discharge pipe is increased. When two or more pumps are to be used in series, one discharging into the other next above, the height of discharge pipe for the upper pumps should be slightly less than that of the lowest, then there will be little possibility of stoppage by the lowest pump supplying more material than the others can lift.

screens is shown in detail in Figs. 1 and 2. The screening surface of a steel tray is 4-in. longer and wider than the surface of a wooden tray. To the sides of the tray auxiliary angle irons are riveted to which the hangers are attached, for it has been found that if the hangers are attached directly to the tray and no angle irons are used, the sides of the frame may be distorted when the connecting bolts are drawn tight. The auxiliary angles are separated from the upper angle iron of the frame by using spreaders of 1-in. pipe over the hanger bolts.

The steel frame of the tray is tied together by cross braces at the top, but no braces are required at the bottom because the slats that are used on the top of the screens to prevent the bed from creeping and to reinforce the screen against vibration, affords all the bracing necessary. The screens are tacked to wooden frames which are made in 5-ft. sections as shown in Fig. 3, each consisting of two end pieces of 2x3-in. oak. The end pieces are notched at 5-in. intervals to take the 1x3-in. oak cross slats, which are put in with the greater dimension vertical. These frames, are supported in the bot-

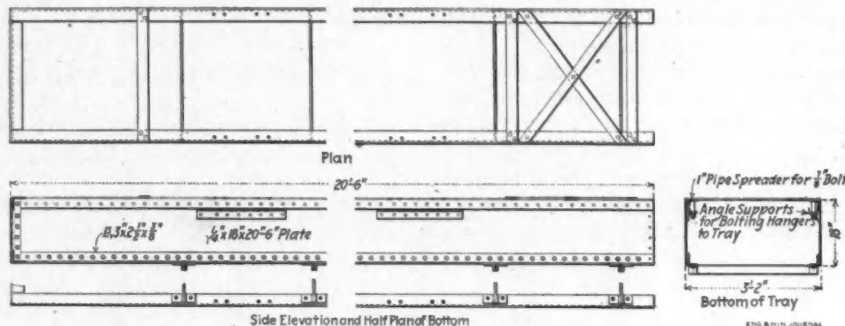
screwed to the back side of the slat and by a 1x1x1/8-in. angle iron on the top and front side. The sections of slats are held in place by keyboards or pieces of 2-in. pine 8-in. high that are placed on top of the slats at the ends and parallel with the long side of the tray. The keyboards are wedged into place by a series of double wedges about 10-in. long sawed from 2-in. pine boards; the wedges being used between the top of the keyboard and the bottom of the upper angle of the tray. This system of keying facilitates removal of the upper slats when screens have to be changed.

The type of gate used to control the

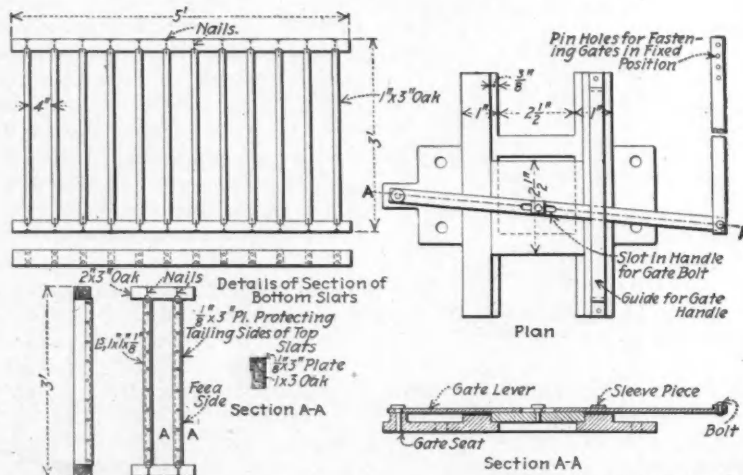
the Leadwood mill of the St. Joseph Lead Co., by a float in the tailing discharge compartment which acts upon a butterfly valve in the feed-water pipe.

Lacing Belts with Wire

To lace a belt with wire so that the joint will not produce a tendency to throw the end of belt out of line, particularly when subjected to sudden stress, use a piece of lacing wire the length of which is about ten times the width of the belt, and find the middle point of the wire. With the end of the belt squared and the holes marked, begin by drawing the wire up through C, as shown in the accompanying illustration, and down through H, pulling the wire until the middle point is between C and H; then carry the end of the upper section of the wire up through G, down B, up F, down A, up F again, down A again, up G, down B and up H. This will complete half of the joint. With the other end follow the same plan in holes D, E, J and K, thus completing the opera-



STEEL TRAY FOR HANCOCK JIGS



SLATS AND HUTCH GATE USED IN HANCOCK JIGS OF THE DOE RUN MILL

tom of the tray by the lower longitudinal angle iron.

The top slats which rest upon the tops of the screens and prevent the bedding or "ragging" from creeping are made of oak in sections of two slats as shown in Fig. 3, the greater dimension of which is, vertical as is the case with the lower slats. The end pieces of each section extend out beyond the sides of the slats for two inches or half the width of the opening between slats. The slats are protected from wear from the rubbing of the ragging and the movement of the pulp by a piece of iron plate 1/8-in. thick that is

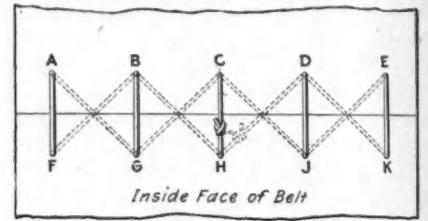
discharge of middlings and concentrates from the hutches of the jigs used in the Doe Run and St. Joseph mills is shown in Fig. 4. These jigs are operated with constant discharge of middlings through the partly opened hutch gate.

The Hancock jig is usually supplied with clean feed water that enters at the hutches and flows upward thus introducing the classifying power of a stream of water as a factor in jigging. This upward flowing stream has the effect of partly offsetting or neutralizing the strength of the suction. The supply of feed water is automatically controlled at

tion. The two ends will now be at holes C and H of the outside face of the belt: They should be twisted together and pounded into the leather with the rest of the lacing.

To those who have never made a wire joint, states W. J. Hawley in *Power*, I would say that after the ends of the belt are squared, a line should be drawn parallel to the end edge and about 1/16 in. more than the thickness of the belt back from the edge. Such a line would join A and E of the illustration. The holes should be marked off on the line with a pencil; the ends of the wire may be filed to a point to facilitate their entrance into the hole. It is better to make the holes as they are needed rather than make all of them before starting because the holes will close up some as the belt is handled, thus making it difficult to push the ends of the wire through the holes.

An awl for punching holes may be made by taking a 4-in. piece of round steel wire tempered and ground to a point and inserting it in a handle. A wire-faced joint can be made quickly and when made properly it will run as smoothly over the pulleys as any other part of the belt.



SHOWING METHOD OF LACING A BELT WITH WIRE

Notes from Current Literature

Concerning Mining, Metallurgy and Industrial Chemistry

Carnotite in Pennsylvania

Carnotite has been discovered by Edgar T. Wherry near Mauch Chunk, Carbon County, Penn. (*Am. Journ. of Sci.*, June, 1912). He summarizes his conclusions about it thus:

The material agrees in composition with material from Colorado and South Australia, and these agree among themselves better than has usually been supposed, hence carnotite is entitled to be classed as a distinct mineral species, with the formula $(Ca,K_2)(UO_2)_2(VO_4)_2$, belonging to the uranite group.

The vanadium and probably the uranium also have been extracted by circulating surface waters from black shales, which have been formed in the midst of conglomerates by mechanical concentration of dark minerals from the crystalline rocks to the south and east, following the change from arid to moist climatic conditions at the beginning of Pennsylvanian time. As the Colorado deposits occur in a similar position, their origin may have been the same, and it is suggested that the frequent association of these elements with coal may also be connected with such a climatic change.

Prevention of Mine Explosions

A novel idea for the prevention of mine explosions was advanced by Dr. John Harger, at a meeting of the Manchester Geological and Mining Society, Feb. 27, 1912. He stated that apparently the worst explosions occurred in the best ventilated coal mines, so that he had been led to believe that there could be such a thing as over-ventilation. By experiment, he had shown that methane would not burn in an atmosphere containing only 17½% of oxygen. At this figure acetylene lights still burn, while a man has no difficulty in respiring. This last postulate he claimed could immediately be seen to be true for sea-level elevations, because air at that altitude containing 17½% of oxygen would still contain as great a weight of oxygen per cubic foot as would free air at 5000-ft. elevation containing 21% of oxygen. Consequently he deduces that if the percentage of oxygen in the air could be artificially reduced to about 17½%, danger of explosions would immediately disappear.

However, his proposal that this lowering of the oxygen content of the atmos-

phere should be brought about by diverting combustion products down the shaft, does not sound practical, owing to danger from carbon monoxide.

Platinum and Gold in the Urals

The decrease from 260,760 to 250,240 oz. in the gold production of the Urals from 1910 to 1911 is attributed by E. de Hautpick (*Min. Journ.*, May 25, 1912), to the proposed state platinum monopoly, the fear of which produced an increased activity in the platinum industry, in order to export the metal promptly. This took away the gold miners in the busiest season, and completely stopped gold production. With the high price of platinum, the free workman could do much better with a poor platinum yield, than with a good gold yield.

Five of the 11 gold-mining districts in the Urals slightly increased their production, five showed small decreases, while in the Miassk district a decline from 82,763 oz. to 72,548 oz. took place, a falling off almost exactly equal to the entire decline in the Ural fields.

Cyanide Poisoning of Cattle

In a communication to the Mexican Institute of Mines and Metallurgy, Samuel J. Lewis, consulting engineer of the Amparo Mining Co., reviews the danger of stock poisoning by cyanide discharge. When the Los Jimenez mill was first started, it discharged from 40 to 50 tons of unfiltered slime per day. After two months' working, poisoning of cattle took place below the mill. When the tailings were impounded and allowed to go down the stream during the rainy season, poisoning took place as much as 14 km. from the mill. Discharging in this way during the rainy season, the creek itself seemed safe, but pools were invariably formed which resulted in poisoning some cattle. During eight months of storage, no decomposition of cyanide took place in the impounded slime.

The treatment of the residues with sulphate of iron seems impractical except in a limited degree. In the first place, the lime must be exactly neutralized with sulphuric acid; otherwise, the ferrous sulphate added is acted upon by the lime, forming ferrous hydrate and calcium sulphate, and although this ferrous hydrate will precipitate potassium cyanide as

potassium ferrocyanide, when freshly precipitated it rapidly absorbs oxygen, forming ferric hydrate. Consequently, much of it is lost.

Moreover, the reaction between the potassium cyanide and ferrous sulphate does not take place unless the exact proportions of the chemicals are present. When the cyanide solutions can be exposed to the sun and air, which, of course, is not the case with that solution held entrained in the slime, the potassium cyanide is completely decomposed, and it is also decomposed by heat. In regard to this, it is stated that dogs eating poisoned animals died of the poison, whereas poisoned cattle were immediately cooked for eating by the laborers in the vicinity with no ill effects observable, which seems to indicate that the heat breaks up the cyanide. In this particular mill, filtration and storage of the slime is to be the future treatment, but it is expected, in case the filters cannot be worked, to neutralize partially with sulphate of iron and then conduct the solutions over a series of launders of good width with sufficient fall between them to allow of some aëration, finally allowing the treated solution to flow over level ground where the effect of the sun will be at a maximum. It has been found that 0.008% potassium-cyanide solution will kill cattle.

Determination of Oxygen in Copper

The determination of oxygen in copper, as ordinarily performed, is an inexact process, consisting only of reducing the filings in hydrogen. This results in driving off a certain amount of occluded gas and moisture with the oxygen, producing a plus error, if the determination be made by differential weighing of the drillings. There is, in addition, a minus error, due to absorption and retention of hydrogen by the copper drillings. The original occluded gases can be driven out of the copper by heating in carbon dioxide, as can also the hydrogen retained after driving off the oxygen (George L. Heath, *Journ. Ind. and Eng. Chem.*, June, 1912).

It is recommended that carbon dioxide for analytical purposes be generated by Bradley & Hale's method (sodium-bicarbonate paste), rather than with marble, and a most complicated purifying train is advised, consisting of: (1) Saturated, neutral $KMnO_4$; (2) glass-stoppered U-

tube, sealed at the bottom with silver sulphate; (3) a Bowen's potash bulb, filled with strong sulphuric acid, followed by a short tube of anhydrous calcium chloride; (4) a tube of dry chromous chloride; (5) a tube of stick phosphorus; (6) two tubes of phosphorus pentoxide; (7) short tube of dry calcium chloride. The expensive chromous chloride can be regenerated by passing pure hydrogen through it as long as HCl or H₂O is given off.

The purifying train for hydrogen is scarcely less complicated. The one recommended is: (1) A bulb carrying 10% KOH, saturated with KMnO₄; (2) a Bowen's bulb, carrying concentrated sulphuric acid; (3) a palladium-asbestos tube, heated by an alcohol lamp, after the air is expelled; (4) an Allihn 250-c.c. washing bottle, containing 100 c.c. of water, 100 grams KOH (alcohol free), and 5 to 10 grams pyrogallic acid; (5) two tubes of dry calcium chloride.

The ignition is conducted in a hard-glass tube about 30 cm. long and 6 mm. in diameter, with one long or two round bulbs in the center. About a 50-gram sample is introduced into this. To determine absorbed gases, pass carbon dioxide through the system for 30 min., to sweep out the air, then light the burner and keep at full red heat for 20 min., cool, and wash out with air.

For total oxygen and sulphur, pass in hydrogen for 15 min., then keep at a red heat for one or two hours, dependent on whether the sample is filings or drillings. Pass the exhaust gases through a U-tube containing 10 c.c. of a solution of ammoniacal cadmium chloride (20 grams per liter), to absorb the sulphur.

Then by means of a three-way cock turn in carbon dioxide again, and pass for 20 min., to drive out the occluded hydrogen, cool the tube with an air blast until the copper is only slightly warm, and replace the CO₂ with air before weighing. The cadmium solution is titrated with standard iodine (2 grams per liter) after dilution and addition of hydrochloric acid.

Concentration of Carnotite

It is claimed by Siegfried Fischer (*Met. and Chem. Eng.*, June, 1912) that carnotite occurs only as a coating on other minerals. As a consequence, if these minerals can be ground with abrasion, the carnotite can then be floated off as a slime, obtaining in this way a concentration of about 3:1. A flow sheet of a mill operating along these lines is given. The ore first goes through three sets of rolls in series, after which the ground material enters a Dorr classifier. It is stated that the metal shoes which convey the tailings out of the classifier serve to abrade the ore sufficiently, while the movement of the rabbles is sufficient to suspend the valuable mineral. The overflow then enters a Dorr slime thickener,

where the slime settles, and is freed from part of its water content. From the thickener it goes to a dryer and is then ready for shipment. [While the description is given as though the process were in actual operation, there is nothing else to show that it is more than a process in the laboratory stage.—EDITOR.]

Siberian Tin

A group of German capitalists of Berlin and Hamburg, with the coöperation of the St. Petersburg International Bank, has formed a company for the exploitation of tin mines in the Neichinsk district of Transbaikalia, 3½ miles from Olovyanka, on the Transbaikal Ry., says the *Mining Journal*, May 25, 1912. Tin ore has been known to exist here since 1811. Recently investigations were made, and it was seen that the veins are of considerable extent and of great number. They do not pinch out, and their content is 1 to 2%. In the neighborhood of the Pervonachalny placer there are sandy strata with stanniferous ore 2/3 to 2½ ft. thick. In this district there are also the known Kulundinsky, Sharanaisky, and Zavitinsky tin placers. The Transbaikal Tin Smelting Works will be the pioneer of the tin industry in Russia, which imports all it requires of this metal. This year the importation will amount to £1,000,000 sterling.

Defective Concrete Sands

In a symposium in *Engineering News*, May 20, 1912, attention is called to the fact that often concretes mixed with certain sands have only one-third or less the strength which they should show. This seems to be due to some modification of the grains of sand due to tannic acid, or to some form of albuminoid ammonia, apparently through these substances existing in a colloidal solution which coats the particles of the sand. The fact that such sands exist is a reason why a seven-day test should be made with any sand which it is intended to use for concrete. Furthermore, the mere fact that a sand gives a concrete of no strength with one kind of cement is not proof positive that it will not give good results with another, so the cement used in the seven-day tests should be those which it is purposed to use in the actual work, while if a sand gives poor results with any given cement it should be tried with another.

Disintegration of Cinder Concrete

The use of cinders as the aggregate for concrete is a common practice. According to George Borrowman (*Journ.*

Ind. and Eng. Chem., June, 1912), there is an element of danger here, for if the cinders contain unoxidized sulphur, the coke contained in the cinders will carry enough air to oxidize it, setting up internal stress, and often producing cracks and general disintegration. Tests on cinders which produced disintegrating concretes showed that after they had been completely oxidized by the weather, there was no further trouble.

Oxygen Additions to Iron Furnace Blast

According to a report by Dr. F. W. Lührmann to the blast-furnace committee of the Verein Deutscher Eisenhüttenleute (*Iron and Coal Trades Review*, May 24, 1912), the managers of furnaces in Mülheim-Ruhr, in Ougrée, and in Kratzwieck are using small oxygen additions in the blast whenever the furnace is working cold. The oxygen is added in the form of "Linde air" (50% O, 50% N), a liquid-air product.

An installation to furnish 17,500 cu. ft. of oxygen per hour occupies a space about 125 ft. square, requires about 800 hp. to operate it, and costs about \$100,000. Doctor Luhrmann finds that for each per cent. of oxygen added, there is a theoretical rise of 100° F. in blast-furnace temperature.

The manufacturers interested state that 1% of oxygen on a 240-ton furnace, costs about 50c. per ton of pig. If this cost be correct, the process is worth investigating for an emergency reserve.

Desulphurizing Zinc Sulphate

A new process for desulphurizing zinc sulphate (Fr. pat. 432,556) is that of Hermann Pape, who heats zinc sulphate in an intimate mixture with zinc oxide, thereby expelling the sulphur as sulphurous acid. The most advantageous method is stated to be that of mixing a saturated solution of zinc sulphate to the finely pulverized zinc oxide to make a paste, drying and heating to such temperatures that the zinc sulphate is decomposed. The mixture of sulphurous acid and oxygen should be used for the manufacture of sulphuric acid.

Clark Placer Mining Apparatus

In the Clark placer-mining apparatus (U. S. pat. No. 1,011,321) the gravel is delivered into a riffle-bottomed trough, through which it is moved by conveyor paddles. The gravel is washed in water which stands in the trough, and is finally propelled up an incline, where it drains. The entire apparatus can be readily moved from place to place, as neighboring gravel becomes exhausted. The idea is to treat gravel in dry regions with a minimum amount of water.

The Sublevel Stopping Method

By F. W. Sperr*

The method of mining known as the sublevel stopping method has been in use for at least 10 years, and is still in use now in a number of mines, but has not yet been given a distinguishing name that seems to be satisfactory. It is locally designated as "subbing," but other methods are known by the same name.

NOMENCLATURE

The first reference to the method for publication was made at the meeting of the Lake Superior Mining Institute, in 1910, by P. S. Williams, in his paper on "Underground Methods of Mining Used on the Gogebic Range." He did not attempt to name the method, but referred to it as a combination of underhand and back stopping. But it also involves drift stopping in the development of the benches at the ends of the subdrifts. In the discussion of the paper, the term substopping was suggested. This term was accepted by Fred C. Roberts in a fuller description of the method presented to the meeting of the Lake Superior Mining Institute in 1911. Objection has been made to this term also, because it is already applied to a different method and is not completely descriptive.

Other terms have been suggested and objections offered as follows: (1) Sublevel back stopping; this is incompletely descriptive, because underhand and drift stopping are also involved. (2) Back stopping by breaking downward from sublevels; same objection as the preceding, besides being too cumbersome. (3) Bench stopping; this would suggest underhand stopping to mining men unfamiliar with the other method. (4) Sublevel bench stopping; same objection as the preceding, beside being more confusing. Perhaps a better term than any of the foregoing would be "sublevel stopping." While it is true that sublevel stopping is sometimes applied to a method which involves caving, the latter is more generally and consistently called sublevel caving. No great violence would be done to custom and practice if the name, sublevel stopping, were applied only to the method of mining by means of sublevels without caving, and sublevel caving to the method of mining by means of sublevels and caving. However, a better term will be welcome if one shall be offered.

SUITABLE FOR SMALL DEPOSITS

In iron-ore mines, many of the smaller deposits, often called pockets, and the narrow ends of large lenses of ore, can be mined advantageously by this method, if the physical characteristics of the ore and of the inclosing walls are right. The ore may be from 12 to 100 ft. wide. It should not be so hard as to make the

This name is suggested as best suited to a method that has been known by various other names for 10 years. Many small deposits can be mined advantageously by this method. Among the important features are a large number of funnel-topped raises and the employment of the caving principle. The method is in use on the Michigan iron ranges.

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cost of driving the sublevels excessive. It should be sufficiently tough so that the back will stand fairly well after being trimmed, and so that the benches will not break down of their own weakness. The inclosing walls should be rather strong, so as to permit the stopes to

the tram cars, may be put in from 20 to 30 ft. apart from center to center. The chute raises are driven up a distance of about 25 ft. above the floor of the level. If the ore is not more than 25 to 40 ft. wide, the chutes may be put in on the sides of the main drift, staggered from side to side.

From the end of the level, the ore in going upward usually trends forward or backward; seldom has it a vertical end. In any case, the end raise is carried up along the end of the ore to the top, or to the level above. If the ore extends forward, as shown in Fig. 2, the triangular block ABC is stoped underhand ("beaten down") into the inclined raise and drawn off through the end chute. This operation must precede the regular method in order to avoid the loss of a large quantity of ore which would hang up beyond the line AD, broken ore standing with a nearly vertical side in a stope, if the other three sides are supported. While the block ABC is being mined out, the ladderway and the sublevels 1, 2 and 3 are put in.

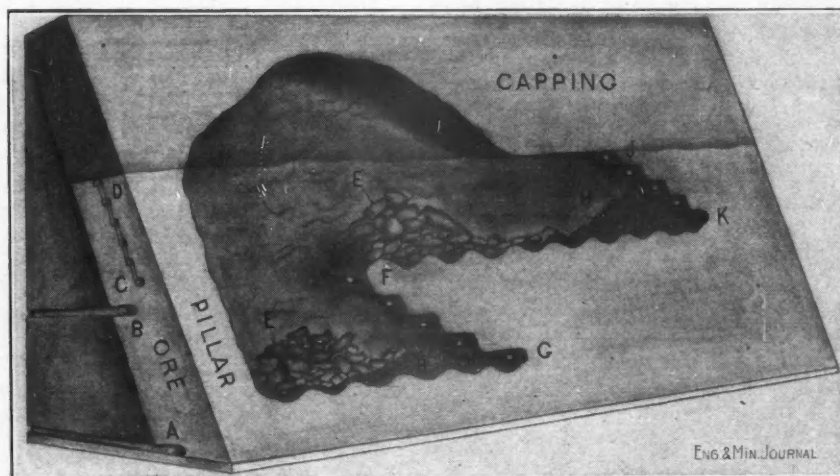


FIG. 1. PERSPECTIVE VIEW, HANGING WALL REMOVED

be of rather large dimensions. The foot wall should dip at a sufficiently high angle to permit the broken ore to run off to the chutes. The method is applicable to a great variety of conditions within the limitations specified above, making it necessary to work out the details in a variety of ways. The general method and a few details are described below.

HAULAGE LEVELS 100 FT. APART

A haulage main level is laid out at every 100 to 150 ft., in vertical depth, on the orebody. On this level a main drift is carried lengthwise through the ore. From this drift, crosscuts are driven to determine the width of the ore. The crosscuts are so spaced that the chutes for drawing the ore from the stopes into

If the ore extends backward, as shown in Fig. 3, the sublevels are started from the end raise as well as from the ladderway.

SUBLEVELS ABOUT 25 FT. APART

The best practicable distance between sublevels is about 25 ft. from floor to floor. The first will be driven to cut off the tops of the chute raises, and the others will be driven above this, as shown in the figures. If the ore is not more than 40 ft. wide, the substopes can be worked with single drifts through the middle of the ore. In such cases the first subdrift is widened out from wall to wall, beginning at the end and working toward the ladderway. Down holes are drilled around the tops of the raises and

upper holes are drilled in the back. The down holes are blasted first, giving a funnel shape to the tops of the raises. Then the upper holes are blasted, breaking down 8 or 10 ft. of the back for the whole width of the ore and for 12 ft. lengthwise at each round. The broken ore falls into the funneled raises and is drawn off through the chutes on the main level.

After the bottom substope has been drawn back 20 to 30 ft., the next one above receives a cut back. About 12 ft. of the end of the drift are widened out from wall to wall, by means of side holes started from the subdrift. This forms a bench over the stope below, and the drill is set up along this bench. From each position of the drill, down holes are put in for the purpose of blasting off the bench, and upper holes are drilled for the purpose of breaking down 8 or 10 ft. of the back; this is shown in Fig. 4. In like manner, one after another of the higher substopes is started, for any number, to the top of the ore, or to the level above. Each main level in turn forms the top sublevel of the series. The substopes are drawn back uniformly, each 20 to 30 ft. in advance of the one above. By the time the ladderway is cut out, the subdrifts to a new ladderway farther back must be ready for use.

VERTICAL AND HORIZONTAL PILLARS

Where a long stretch of ground is to be mined out in this way, it may be necessary to leave pillars at certain intervals, to divide the excavation into vertical panels. The height of the panels may be limited again by horizontal pillars. In one instance, such panels have been laid out 250 ft. long and several hundred feet high. In this instance, it is designed to fill the upper panels from surface, and then to mine out the vertical pillars by topslicing the ore and caving the filling material. Each lower panel will be filled from the one next higher, through winzes in the horizontal pillar. Then the horizontal pillar and the next set of vertical pillars may be mined out by topslicing or subslicing (sublevel caving) methods.

In Fig. 1, the accompanying perspective view, in which the hanging wall is omitted, is shown an excavation made by the sublevel stopping method, leaving a vertical pillar opposite the shaft. The crosscuts from A and B lead to the shaft, which is back in the foot wall. The upper haulage level was driven from B to F and beyond, as far as the ore went. There is a ladderway from C to D, in the pillar from which the subdrifts of the upper level were started. In this case the stopes were started at the pillar and worked away from it. The ladderway in the pillar serves no purpose after the stoping begins, until the extraction of the pillar takes place. The

tops of the funneled raises of the upper main level are shown from F to K. Presumably the end of the ore is along the face from J to K. The broken ore at E and H will fall into the raises of the second level, unless there is another shaft to the right to which tramming may

ore standing on each side; this is illustrated in the perspective view. After this stope has been advanced from 60 to 100 ft., more or less according to circumstances, crosscuts are driven on the sublevels, a certain short distance

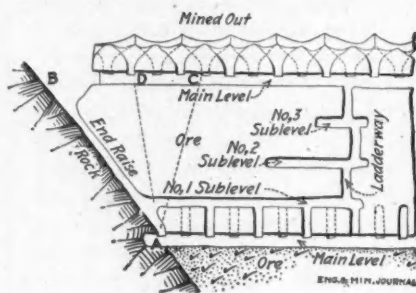


FIG. 2. ORE EXTENDING FORWARD

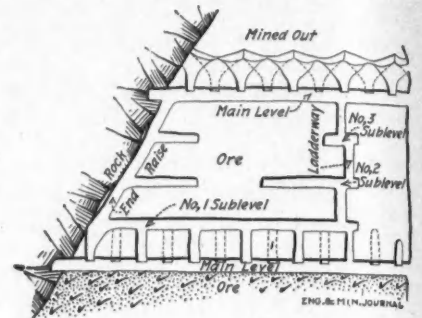


FIG. 3. ORE EXTENDING BACK

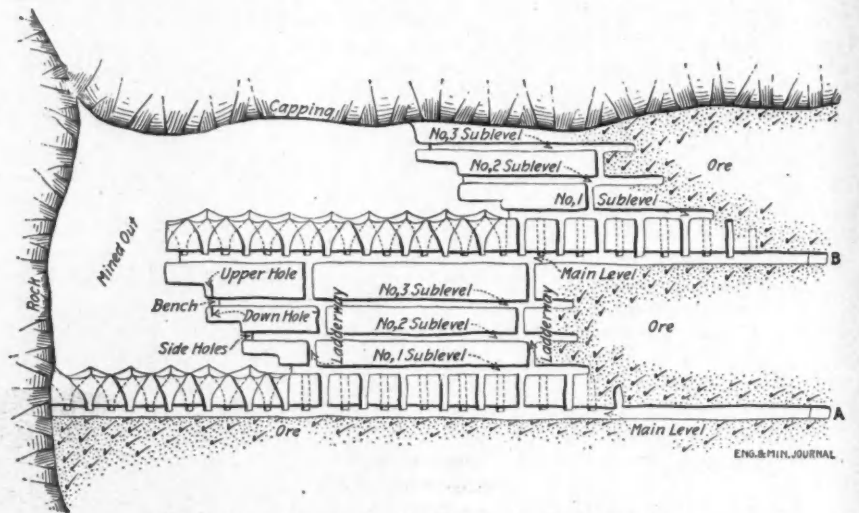


FIG. 4. SIDE VIEW FROM PLANE THROUGH MAIN LEVEL

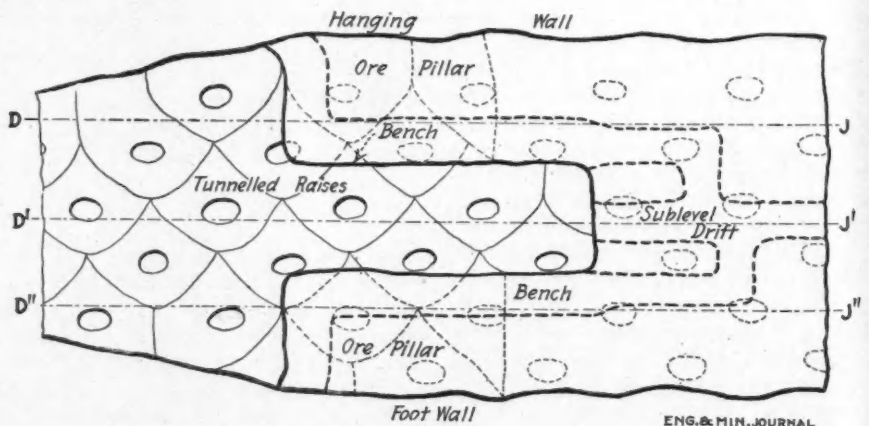


FIG. 5. TOP VIEW ALONG LINE OF DIP

be continued after the end of the first level has been cut off by the stope from below.

WHEN THE ORE IS 50 TO 100 FT. WIDE

Where the ore is from 50 to 100 ft. wide, a narrow stope of about one-third of the width of the ore is drawn back through the middle, leaving a pillar of

from the end of the stope. From these crosscuts, subdrifts are extended to the end of the midstope and from there on continued as benches in the sides of the pillars of ore left standing against the walls. When the benches reach the end of the pillar, they are carried across the pillar to the wall. Then the pillar is mined out by means of down and upper

holes from the cross benches, each lower substoppe being kept in advance a safe distance beyond the one next higher. Side views on vertical planes through the lines *DJ* and *D'J'* would appear somewhat similar to Figs. 4 and 1. A side view on a vertical plane through the line *D'J'* would show the midstoppe worked back to a vertical face.

Ore bodies suitable for mining by this method are as yet more generally mined by back stoping on broken ore or by stoping on square-set timbers. In the ordinary backstopes, the miners are more exposed to danger from falls of rock than they are in the sublevels. In the operation of shrinkage backstopes, there is also danger from the development of caves and rushes, into which the miners may be drawn. Mining on square sets is expensive in the use of timber.

Henry Johns, an Early American Copper Refiner

BY BENJAMIN S. JOHNS*

Henry Johns, my father, came to the United States from Swansea, Wales, his birthplace, in 1846, in his twenty-first year, under contract to work at the Baltimore Copper Works, his brother-in-law, David D. Davis, being superintendent of refining there at that time. While he was employed at Baltimore, some Lake Superior copper ore, a few tons, was treated, but not according to my father's views as to the correct method of treating such ore.

The next year, 1847, he left Baltimore and went to Pittsburgh, going to work at first in the iron mills. There were rumors at that time that a copper works was to be started at Pittsburgh, and shortly after his arrival, my father heard that Dr. C. G. Hussey was interested in the movement and called to see him upon the subject. After several interviews as to the manner in which the Lake ores should be treated, Doctor Hussey concluded to make a trial of it, and an agreement was reached, by which my father and his oldest brother, William Johns, who had also come from Baltimore, were to build a furnace and take out a charge of refined copper before they would receive any compensation therefor, all materials to be furnished by the firm, which was known as the Pittsburgh & Boston Mining Co. Although neither of the brothers was a bricklayer, they managed to build the furnace and a stack 45 ft. high without any help except the building of the foundation of the stack—bricklayers being scarce at that time—doing all the blacksmithing also, and so well was the work done, that the stack remained for 50 years, though many times during that period the waters of the Monongahela surrounded it during freshets.

*Pittsburgh, Penn.

The first charge of refined copper was taken out on a Saturday in July, 1847, only one operation being necessary, the charge of ore being placed in the furnace during the afternoon, melted down during the night, all the dross removed by morning and the charge of metal refined before taking the metal out of the furnace. This was the first successful smelting of Lake Superior copper ore, and the method has never been improved upon since.

HANDLING LARGE MASSES OF COPPER

Great difficulty was experienced in handling the large masses of "mineral," some of which weighed as much as 10 tons. All sorts of plans were devised by other men, one of which was to hang the mass in the cupola by means of a heavy iron chain and use blast to smelt it. Of course, as soon as the chain became heated it broke, and the mass of copper fell and clogged the cupola. Another plan tried was to tear down part of the side of the refining furnace and roll the mass in on the bottom. This plan invariably would destroy the bottom of the furnace. Sometimes the mass would be so long as to extend some distance outside the furnace, and when the part inside melted, the outside piece would fall to the floor, and then it would be necessary to go through with the operation at another time with the piece remaining. This method was almost as bad as the one with the chain, inasmuch as the bottom or hearth of a copper-refining furnace is a most important and costly part of the furnace, and once broken, cannot be repaired satisfactorily. These are only two of the experiments tried. How many others were made it is hard to tell.

To overcome this difficulty, my father devised a plan, which, while simple and efficient, was prophesied to be doomed to failure by many expert furnace builders. The plan, briefly, was to build a large door in the roof of the furnace, having a movable cover, then by means of a large crane to lift up the heavy masses and lower them through the roof door down on to the hearth. In this manner, it was possible to place the heaviest mass in the furnace without injury to the hearth. The size of the roof door had to be so large, at least 5x6 ft., that the critics said it would be impossible for the roof to stand, but by an ingenious arrangement of braces and arches, the feat was accomplished, and thereafter little difficulty was experienced in handling large masses.

From the time of this first successful building and operation of a furnace for refining Lake ores, the method of handling and refining has been the same, only slight changes in the manner of taking out the refined metal having been made.

THE PRESENT FORM OF RECESSED INGOT DEvised BY MR. JOHNS

A great part of the refined product of Lake copper was cast into the form of short ingots with a square section for use in making brass, which was the form of ingots in general use at that time. Before Lake copper came into use, it was an easy matter to break these ingots by simply supporting one end of the ingot about an inch or more above the other end and striking a heavy blow with a sledge hammer. The copper not being tough, was readily broken. But when the Lake copper was cast into the same shaped ingots, it was found to be utterly impossible to break the ingots in this manner, as refined Lake copper will bend double without any sign of breaking. In order to offset this toughness, a form of ingot having grooved recesses in the bottom was devised and used by my father, and soon came into universal use.

It should be remarked here that William Johns, the elder brother, was given the preference as to position by Henry Johns' desire, for although Henry had every claim for first consideration, he waived this in favor of William, who was made head refiner, though it was mutually understood between them that the authority was divided. William Johns was one of the best refiners of his time, and but for an unfortunate fall into the river during the cold weather while recovering from an illness, resulting in his death within a few hours, he would certainly have made his mark in the world, as he was a man of powerful physique and possessed excellent judgment. He, in connection with the younger brother Henry, should receive credit for the first successful refining of Lake ores in one operation, and also in the improvements above noted.

Dr. C. G. Hussey, as promoter and holding largest interest in the company for which the Johns brothers worked, has, in several instances, been given the credit for originating these improvements and ideas in the manufacture or rather refining of Lake copper. He should be given due credit for recognizing their practical value and for encouraging their use, but not for originating them, as he was not an expert on furnace building or on practical work of refining copper, but confided implicitly in the Johns brothers in all such matters.

After the death of William Johns, his brother became the superintendent of refining, and held that position with the parent company and its successors for a period of over 52 years.

Representative Mondell of Wyoming, has offered a bill providing that lands containing phosphate deposits shall be subject to entry only under the placer-mining laws.

Transvaal Mining Notes

JOHANNESBURG CORRESPONDENCE

The declared gold output for March on the Rand was a record one due to the inclusion of 126,875 oz. of gold from reserve stocks. The mines controlled by the Corner House alone declared about 60,000 oz. These declarations were due to several of the groups, in deference to wishes expressed by European shareholders, having decided to abandon the practice of keeping reserves to equalize monthly outputs. Several groups still maintain the practice and as the groups which have abandoned it were in the habit of publishing the amount of reserve gold, there seems little reason for giving up the practice. As a matter of fact, if it is considered necessary to equalize monthly yields, it can be managed easily enough by slightly varying dates of cleanup and increasing or decreasing the severity of the cleanup in battery or cyanide departments.

The Way-Arbuckle plant at the Benoni mine has given such trouble that the mine is now closed down awaiting the provision of further capital and Mr. Bosqui's report. Provisional arrangements have been made for a scheme of amalgamation with the neighboring Apex gold mine which has so far developed ore of a higher grade than the Benoni.

The ore reserves of the mines of the Rand amount to between 80,000,000 and 100,000,000 tons. Recently I wrote that it appeared probable that the Witwatersrand had attained its maximum profit-earning capacity, but a closer study of recent annual reports convinces me that many of the larger mines are in a position (given an adequate supply of labor) to increase largely their outputs and profits and it will probably be three or more years before the field will suffer a serious setback owing to the exhaustion of well known outcrop producers.

In view of rumors that the development in extreme depth, 4500 vertical feet, in the Cinderella Consolidated mine was unsatisfactory, the remarks of the chairman at the annual meeting are encouraging. He stated that development at all levels disclosed ore of the average grade of the mine, 27s. 6d. per ton, and that during the year (despite labor shortage) the ore reserves had been increased to 740,000 tons fully developed ore of 6.73 dwt., with 190,000 partially exposed. During the first quarter of this year 141,000 tons were developed against 49,000 milled. At the end of the year the manager hopes to have 1,500,000 tons in reserve.

The February returns from the alluvial diamond fields in the neighborhood of Bloemhoff in southwestern Transvaal show 7000 carats won, valued at £32,800. The March return was 7760 carats valued at £36,700, the largest diamond won was 129½ carats,

valued at £1050. These sums represent the earnings of several thousand diggers and success comes only to a small proportion of the workers.

Ore Separation by Decrepitation

BY HENRY E. WOOD*

An examination of the various authorities on ore dressing discloses that the application of decrepitation is suggested only as of possible assistance in the crushing of ore, as such action renders it more friable and consequently requires less power. I recall the receipt two years ago of a shipment of several tons of massive corundum ore from Argentina. With great difficulty small portions of it could be broken with a hammer, but after a few blows the hammer was ruined. Samples were given to machinery companies to test their drills, but all had to abandon it as being practically undrillable.

It could not be placed in any of our crushers or mills without ruining them in a few minutes. As a last resort several stoves were fired up and then filled with the ore. After heating the ore it was suddenly plunged into water. This rendered it so friable that the entire lot was easily ground to 30 mesh and successfully concentrated, and without injury to the corundum. This in my opinion should not be classed as a decrepitation result, although it produced the same effect, as it enabled us to pulverize the ore.

Decrepitation is caused by the sudden conversion of hygroscopic water, or water of crystallization, into steam. As this water of crystallization is uniformly distributed, its expansion causes decrepitation. It is the application of this simple theory to a hitherto difficult ore problem that is described herewith.

BLENDE AND BARITE SEPARATED

In various mining sections lead and zinc ores are frequently associated with barite. The usual plan of separation is by means of jigs, which enables one to make a high extraction of the galena with its specific gravity of 7.4 from the barite and blende which have a specific gravity respectively of 4.3 and 4.0. As far as the removal of the galena is concerned, the method is satisfactory, but the blende and barite remain closely associated as a jig middling assaying about 45% barite and 25% to 30% zinc. As it is an unsalable product it must be discarded, although both minerals are of value when separated. An analysis showed that the particular barite under treatment contained 2.3% water. An exceedingly sim-

ple device was arranged for a test, consisting of an iron pipe 6 ft. long and 6 in. in diameter.

The pipe was placed over a blacksmith's forge at an angle of 30°. About two feet of the middle section of the pipe was brought to a dull red heat. At the lower end of the pipe a 30-mesh screen was attached as an extension of the pipe. While the pipe was being slowly revolved, the coarse jig middlings from a 10-mesh to ½-in. size or more, were fed into the upper end. During their passage across the heated portion of the pipe, the barite was instantly shattered finer than 30 mesh, while the blende remained at its original size, and was unaltered. The low temperature prevented oxidation of the blende and it passed over the 30-mesh screen on its way out, while the fine barite passed through the screen to a separate collector. A series of tests was made on jig middlings assaying 23.3% zinc and 44.6% BaSO₄. The concentrate varied from 56% to over 60% zinc, the recovery being over 90%, while the tailing ran 1% zinc and under. By this plan both blende and barite are placed in a marketable condition. A confirmation of this method by means of crude apparatus resulted in a carload of blende assaying 63% zinc.

It should be noted that this system could not have been successfully applied to these particular middlings had they contained fine galena or silicious material. It must be remembered also that all barite does not possess water of crystallization to produce the decrepitation effect. Other ores were benefited by similar treatment at our plant.

The reverse of the above result was noted recently in the treatment of blende-pyrite middlings from a Mexican mine. These assayed 30% zinc, with a high percentage of pyrite which was to be removed magnetically after roasting. On the first application of heat it was noticed that the zinc decrepitated without affecting the pyrite. Simple screen sizing then separated the fine blende from the pyrite, raising the grade to 54.5% with a high recovery.

Patents for this method of separation have been applied for by L. D. Emery. The Denver Engineering Works Co. has drawn plans and is constructing a furnace with attachments for this process. It is perfectly evident from its simplicity that it will be inexpensive to operate and have a large capacity.

[This article is interesting in connection with the article by F. C. Bryant, published in the JOURNAL of May 11. Of course, there is no novelty in separating blende and barytes by decrepitation, but there may be novelty in the method of doing it. Samples of mineral products sent to us by Mr. Wood exhibited a remarkable separation. We fancy that different ores will give materially different results in this respect.—EDITOR.]

*President, Henry E. Wood Ore Testing Co., 1734 Arapahoe St., Denver, Colo.

The Origin of Zinc Smelting

In 1745 the ship "Gotheborg" was wrecked on a submerged rock near Gothenburg, Sweden. She belonged to the East Indian Co. of that town and had a full cargo of porcelain, silk, tea and zinc on board, which she had taken up in Canton, being on her return journey for fully 18 months.

About 40 years ago one Captain Lamper had divers take up the porcelain and incidentally they also saved some of the zinc blocks. These were bought by Alexander Keiller of Gothenburg, who favored me with the above information and who was also kind enough to send me a piece of that zinc.

ANALYSIS OF CHINESE ZINC

This I had analyzed and found to my surprise that it was very pure and extraordinarily well preserved. Its surface was covered with a grayish crust, hard like enamel, which consisted of zinc oxychloride. This crust, being about 1/16 in. thick, successfully re-

By W. Hommel*

Although the art of zinc smelting originated in India, it was more extensively practiced in China, the latter being practically the sole producer of zinc until the middle of the eighteenth century.

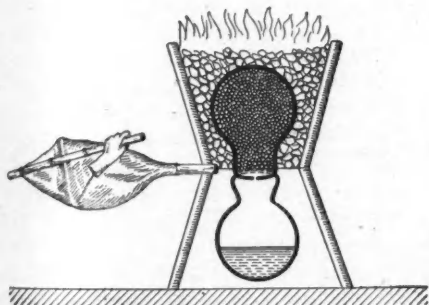
*Metallurgist, Tudor House, Eltham Road, Lee, London, S. E.

A keen competition between the Portuguese and the Dutch was going on at that time in the Indian Seas and a Portuguese ship having been captured by the Dutch, her cargo of *calaem* or "Indian tin" went to Holland where nobody knew what to do with the hitherto unknown metal. The piece which Libavius investigated had also been

1692 where it is said that China delivers *spiauter* to the Dutch, whereas the coast *Cormandel* takes it from them. In India, Chinese zinc was very largely used in the production of brass and I presume that the Portuguese and Dutch took it up in China and exchanged it in India for tin, because in Europe nobody knew what to do with the zinc which the seamen probably took for an impure tin.

ZINC FIRST PRODUCED IN INDIA

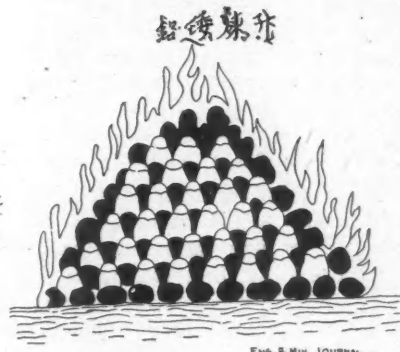
Most of the zinc, if not all, was at that time manufactured in China but the art of its production originates undoubtedly from India. The first Chinese book which mentions zinc, calling it *ya-yuen*, is the Technical Encyclopedia "Tien-kong-gai-ou," which appeared in the beginning of the 17th century. There it is said, that "the metal *ya-yuen* is not mentioned in the old Chinese books and that only the modern authors speak of the same."



KOSCHI APPARATUS FOR SMELTING CALAMINE USED IN INDIA



EARLY CHINESE ZINC SMELTING



ENG. & MIN. JOURNAL

sisted the influence of the sea water for over 100 years and prevented the corrosion of the metal.

The analysis of the metal showed: zinc, 98.990%; iron, 0.765%; antimony, 0.245%. No copper, nickel, silver, arsenic or lead was present. The beautifully bright fracture and the purity of this zinc would certainly be the delight of more than one manager of our days, who has to resort to all kinds of impure ores with which to fill his retorts.

ZINC INTRODUCED INTO EUROPE FROM INDIA

This is the metal which in the 17th and 18th centuries was introduced into Europe by the men of India under such names as *calaem*, *spiauter*, *tuttanago*, the same metal which the famous alchemist Andreas Libavius describes¹ and which he declares consists of silver, cadmia, mercury and arsenic.

¹"Alchymia," 1606; in the first edition of 1597 this passage is not contained.

taken from this lot. For the first time then, in all probability, Oriental zinc had found its way into Europe, as otherwise the excitement which its arrival created among the alchemists of that time could not be explained.

EARLY ZINC TRADE BETWEEN INDIA AND CHINA

However mention is made of *calaem* some time before by J. H. van Linschoten.² He describes it as a metal occurring on the coast of Malacca, where he was in 1579. The metal was not known in Europe at that time but it formed quite an important branch of the trade between India and China, which later on the Portuguese and the Dutch seem to have taken up. This we may conclude from several remarks in Meister's "Orientalisch-indianischer Kunst-und Lust-Gärtner" of the year

²"Travels to India," 1596.

EARLY REDUCTION METHODS

On the other hand there exist quite a number of detailed prescriptions for the production of zinc by direct reduction as well as by distillation in Indian works of the 13th and 14th centuries. In the "Rasarnava," a work which appeared between 1100 and 1300 A.D., it is said that *rasaka* (calamine) mixed with wool, lac, the myrobalans and borax and roasted in a covered crucible, yields an essence of the appearance of tin. Of this, there is no doubt.³

Quite similar are the prescriptions in the "Rasaratnasamuchchaya," which was written in the 14th century. In one of them the advice is given to use a tubulated crucible. "When the flame issuing from the molten calamine changes from blue to white, the crucible is caught hold of by means of a pair of tongs and

³Geerts, "Les produits de la nature japonaise et chinoise," 1878-1883.

⁴Praphulla Chandra Ray, "A History of Hindu Chemistry" 1902, p. 39.

its mouth held downwards and it is thrown on the ground, care being taken, not to break its tubulure. The essence possessing the luster of tin which is dropped is collected for use." Alternatively the following method is mentioned: "A vessel filled with water is to be placed inside a Koschthi apparatus (see Fig. 1) and a perforated cup or saucer placed over it. A crucible charged as above is to be fixed in an inverted position over the saucer and strongly heated by means of the fire of jujube (*Zizyphus injuba*) charcoal. The essence which drops into the water should be applied (in medicine.)"

ZINC NOT SEPARATELY CLASSED AT FIRST

Until that time the "essence of the luster of the tin" was not classified as a separate metal probably on account of the deep reverence the Indians were inspired with before the old authors. Only six metals were then recognized, brass and bronze being distinctly mentioned as alloys. Zinc appears for the first time as a distinguished metal under the name of *jasada* in the medical lexicon of the King Madanapala, which is said to have been written about the year 1374.⁶ It is also mentioned in the medical work "Bhāvaprāśāsa" (about 1550), with the advice to purify and to pulverize it in quite the same way as tin.⁷

FIRST TECHNICAL PRODUCTION IN CHINA

By all these methods, however, which are merely recipes from medical books, hardly more than small quantities of the metal could have been obtained and even those probably only as dust or *poussière*. The first technical production of zinc seems to have taken place in China, and certainly not before the 16th century.

The method of its technical production and its application is for the first time described in the "Tien-kong-kai-ou" (which appeared in 1637 for the second time) and in the great Chino-Japanese encyclopedia, the "Wa-kan-sai-dzu-ye" of the year 1713. In the "Pen-tsao-kang-mu," which was written in the second half of the 16th century, and which represents a compilation from the works of not less than 800 authors, zinc is not mentioned. However the making of brass by means of calamine is described. The "Pen-tsao" only mentions five metals, tin being considered to be a kind of lead. The "Wa-kan-san-sai-dzu-ye," however describes seven.

ZINC HAD VARIOUS NAMES

The encyclopedia enumerates first of all the various names for zinc, as *ya-yuen*, which means "lead of inferior quality" and *totan*. The latter name is

⁶P. C. Ray, loc. cit.

⁷P. C. Ray, loc. cit.

⁸Uday Chand Dutt. "Materia medica of the Hindus," Calcutta, 1900.

said to originate from a foreign language.⁸ Next follows the description of the various forms in which the metal is put on the market, viz., in plates, rosettes, etc., and afterwards a number of prescriptions are given for the making of brass and bronze. The addition of zinc thereto is said to be very essential and the metal is therefore regarded to be a precious one. The best quality is said to come from Canton. Here also the metal is distinctly called a modern one, which was not known in former times.

In the "Tien-kong-kai-ou" zinc making is described in the following way: The ore *lu-kan-shi* (calamine) is placed into crucibles, firmly pressed and the covers are securely sealed with loam. The crucibles intermixed with pieces of coal are built up in the form of a pyramid (see Fig. 2) and after having been brought to a red heat, they are cooled and broken up. The metal is found in the middle of the crucible as a round button.

EARLY CHINESE METHODS IN DOUBT

Nothing is said of reducing coal having to be mixed with the ore. Champion⁹ therefore thought it necessary to propound the impossible hypothesis, that the ore was reduced by carbon monoxide, which entered the porous crucible from outside. Freise in citing this passage from the "Tien-kong-kai-ou"¹⁰ says that a second crucible, filled with powdered coal is to be put in an inverted position over the first one. He does not say, however, where he got his information and I believe that his citation is only a faulty translation of Biot's remark in *Journal Asiatique*, 1835, p. 141. In any case, even this method would not suffice to reduce the calamine.

Berthelot¹¹ doubts, whether the metal produced in this case is zinc at all and not rather an alloy of lead or copper. However taking into consideration the fact that zinc had at that time actually been produced, I am much more inclined to think, that the Chinese author did not describe the process correctly or that he did not perfectly know it. That the art of zinc making was kept rather secret may be concluded from several passages of the Chino-Japanese encyclopedia, where the author does not even know for certain, whether calamine is really the mineral, from which zinc is produced!

A much better description is given¹²

⁹From the Sanskrit "tuttham," to which word also the Tamil "tatanagam" and the Persian "tutia" refer.

¹⁰"Industries de l'Empire Chinoise," 1869, p. 47.

¹¹"Oesterr. Z. f. Berg, Hütten u. Salinenwesen," 1908.

¹²"Archéologie et Histoire des Sciences," 1906.

¹³"An Embassy to China," 1797, II, p. 540.

by Sir George Staunton. He says: "Tute-nag, that is, zinc, is extracted from rich calamine. The ore is powdered and mixed with charcoal dust and placed in earthen jars over a slow fire, by means of which the metal rises in the form of vapor, in a common distilling apparatus, and afterwards is condensed in water. The calamine contains neither lead nor arsenic and only a little iron." Biot¹³ thinks that this represents an improved method over the one described in the "Tien-kong-kai-ou," but I believe that the latter method was in reality quite similar, probably based upon the prescriptions given in the "Rasaratnamuchchaya." The difference in the shape of the crucibles in Fig. 2 should be noted. It is so distinct, that a mere mistake on the part of the artist cannot well be accepted as an explanation for this fact. It is quite possible, that some of the crucibles represent the condensers for the zinc vapors.

OTHER NAMES FOR CALAMINE AND ZINC

Calamine is in Sanskrit designated with *rasaka*, *kharpāra*, *kharpāra-tuttha* and *tuttha*. When translated into Persian and Arabian the latter word became *tutia* and the "essence of the calamine" was consequently called *ruh-i-tutia*, which means "spirit of tutia." From the Sanskrit *jasada* (zinc) was derived the Persian *jas*.

In the "A'in i Akbari" (that is "mode of governing of the King Akbar"), which was edited by Abu al Fadhli ibn Mubarak in 1590, it is said that *jas*, which according to the opinion of some is *ruh-i-tutia* and resembles lead, is nowhere mentioned in philosophical books, but there is a mine of it in Hindustan, in the territory of Jalor, which is a dependency of the subah of Ajmir. Further a number of prescriptions for brass making are given. "Brass, which the Hindus call *pital*, is made in three ways, firstly: $2\frac{1}{2}$ sers copper to 1 ser *ruh-i-tutia*, which is malleable, when cold; secondly: 2 sers of copper to 1 ser of *ruh-i-tutia*, which is malleable, when heated; thirdly: 2 sers of copper to 1 ser of *ruh-i-tutia*, not worked by the hammer, but by casting."¹⁴

CONFUSION IN EARLY NOMENCLATURE

Blochmann translates *ruh-i-tutia* as pewter, also in the new edition of Gladwin's translation it is designated as "a kind of native pewter." Praphulla Chandra Ray therefore accuses Blochmann of inaccuracy (*loc. cit.* p. 92) which, however, in my opinion is not quite justified. At least one may say with cer-

¹⁴"Journal asiatique," 1835, p. 141.

¹⁵Translated by Blochmann, Calcutta, 1873. The translation of Gladwin, London, 1800, of which a new edition appeared in Calcutta in 1897, is quite useless, because it is only an extract.

tainty that nobody knew then what this substance really was and that in Persia and Arabia at that time all kinds of metals and alloys were called *ruh-i-tutia*, just the same as in Germany during the 16th and 17th century *conterfey* designated zinc, pewter, bismuth, antimonial lead, white copper, etc.

Already the above cited remark of Abu al Fadhl shows this clearly and it may further be concluded from the fact, that all sorts of substances were called *tutia*. Thus one finds in the lexicon of Ebn Baithar, who died in 1248, five kinds of *tutia* mentioned. One is said to be found in mines, another one is made in furnaces, "in which the ore is melted." (This is clearly zinc oxide.)

Then there are three fossil kinds, a white one, a greenish one and a yellowish one, the last mixed with red. They are found on the coasts of India and China. The best is the white one, which is covered with a saltlike substance; after this comes the yellow one. The green one is rough, porous and comes from China.¹⁵ In Persia sulphate of zinc was called "white *tutia*," sulphate of copper "blue *tutia*," sulphate of iron "green *tutia*," the word *tutia*—being apparently used in the sense of our "vitriol." Also Avicenna and Geber mention several kinds of it.

A little more consistent was the use of the terms *rasaka* and *lu-kau-shi* in India and in China. In the "Rasarnava" three kinds of *rasaka* are distinguished: one yellow, one of the appearance of treacle (molasses) and one of the color of stone, whereto the remark is added: "No wonder, that *rasaka* if roasted with copper, changes the latter into gold." In the "Pen-tsao-kangmu" calamine is called the "seed of gold and silver." It is clear, that in both these cases the making of brass is referred to. Ono Ranzan, however, the "Japanese Linné," in his work "Hon-zokei-mo-mei-so" (1804) distinguishes four kinds of *lu-kau-shi*, viz. of white, reddish, yellow and blue color."

MANY METALS CALLED ESSENCE OF CALAMINE

It can therefore not reasonably be doubted, that at that time all sorts of metals and alloys carried the name of "essence of calamine" or "spirit of *tutia*." It is indeed quite possible, that in many places even an especially pure *tutia*—or zinc oxide, perhaps one which was prepared in crucibles, may have been signified as *ruh-i-tutia*. Zinc oxide was in fact occasionally made or purified in this way, as may be seen from the following passage in the book "De medicatis

aquis et de Fossilibus" by Fallopius (1564), which shows clearly, that the old metallurgists sometimes worked under conditions fairly appropriate for zinc reduction:

"*Cadmia, quae Venetiis conficitur, fistularis est, quia conficiunt ipsam in fistulis aeneis, nam explent fistulas materia, deinde ponunt fistulas in fornacem: postmodum extrahunt, concutiuntque fistulas et concidit cadmia, quae nihil luti habet coloris.*" How easily could a Belgian zinc furnace have resulted from this, if somebody had been struck by the idea to use clay tubes instead of the copper ones!

It is interesting to note, that China—like Germany—seems to have had a metal called "counterfeit," provided, that Mély¹⁶ translates the passage in question from the "Wa-kan-san-tsai-dzu-ye" correctly.

"WHITE TIN" PROBABLY ANTIMONY

There it is said, that in the year 700 A.D. a man brought "white tin" (*pe-le*)¹⁷ from the province of Tamber, which was found to be just as resistible as tin. "This metal was introduced into China by smelters from the province of Yang. Everybody said, that this was *toen-yn* (a counterfeit). About that time it was used by false-coiners for the imitation of the *sapèques*." The metal in question is in all probability antimonial lead or antimony, which is actually found in that district. Quite a similar story is told by Michael Maier¹⁸ of an alchemist who by means of zinc and methods known only to himself made copper white and induced a magnate to have base money coined from it.

Likewise it is antimony or antimonial lead, but by no means zinc, which as the metal *khar-sini*, Kazwini "the Persian Pliny," describes in his "Cosmographia," about 1200 A.D. To this metal, whose name literally translated means "stone" or "iron from China," the most extraordinary properties are ascribed. Its color is said to be of a reddish black. Spears made from it are tremendously powerful and with harpoons made from it the largest fishes may be caught. It may further be used to make mirrors which serve to cure convulsions of the face and nippers to tear the hair out, which, once removed by them will never grow again.

KHAR-SINI IS ANTIMONY, NOT ZINC

This passage has been cited by some authors¹⁹ as evidence, that zinc was known in the Orient in olden times. This, however, is not so. First of all

¹⁵Les Lapidaires chinois, 1896, pp. 33 and XXXIV.

¹⁶Geerts (loc. cit.) translates: "A metal similar to tin."

¹⁷Examen Fucorum Pseudo-chymicorum, 1617, p. 34.

it must be noted, that Abu al Fadhl who also mentions the metal *khar-sini*, and this in words which show clearly that he takes his information from Kazwini, does not identify the same with *just* or *ruh-i-tutia*. Still it is remarkable that he calls it in a sense "crude gold," adding that "some people regard it to be a kind of copper." This passage has a striking resemblance to the above quoted citations from "Rasarnava" and "Pen-tsao," where calamine is called the "seed of gold and silver," but one must not forget that Abu al Fadhl wrote fully 400 years after Kazwini.

That *khar-sini* was nothing else but antimony or antimonial lead follows clearly from its color (because zinc is silver white and not reddish black) and further from the mentioning of the mirror. Even nowadays cheap mirrors are made in Japan from mixtures of lead and antimony. To seek the origin of the mirror tale in the "well known healing power of zinc preparations for diseases of the eyes," as some authors have done, means nothing else than to go astray into fairy land.

SUMMARY

It may therefore be taken as beyond any question, that the art of zinc smelting originated in India. Thence it came to China, which country remained the sole producer of zinc until the middle of the 18th century, disregarding a minute quantity of that metal, which was occasionally obtained as a byproduct in the lead furnaces of Goslar in the Harz Mountains.

As a curiosity it may be mentioned, that the zinc of which I gave the analysis above, was produced in China about the same time (1743) when in Europe Swab and Marggraf were engaged upon their fundamental researches on the manufacturing of zinc from calamine.

Tom Reed Mines

The report of the Tom Reed Gold Mines Co., Oatman, Ariz., for the year ended Mar. 31, 1912, states that the average value of the ore decreased from \$42.46 per ton in 1910 to \$19.35 in 1911. The treatment of 39,447 tons, a 200% increase over 1910, resulted in a total gross production of \$802,599, which was \$208,486 more than for the previous year. An average extraction of 98.85% was maintained at the mill. The total cost of mining and milling averaged \$6.83 per ton, which is \$2.08 per ton less than last year.

A total of 3365 ft. of mining and development work was done. A winze was sunk from the 350- to the 550-ft. level in the Tom Reed claim, most of the way

¹⁸Translated by Sontheimer, 1840, I, p. 217.

¹⁹J. F. Royle, Essay on the Antiquity of Hindu Medicine, 1838.

²⁰Geerts, loc. cit., II, p. 574.

²¹Sacy, Chrestomathie arabe, 1827, III, p. 430 f.; Schweiggers, Journal für Chemie u. Physik, 31 (1821), p. 357; Neumann, Die Metalle, 1904, p. 293.

in ore. In the Ben Harrison claim, the sinking and timbering of the main shaft to 860 ft. were completed. The Olla Oatman shaft reached a depth of 465 ft. New orebodies of larger dimensions, but of lower grade, were encountered and opened. Twelve dividends, totaling 40%, or \$363,822, were paid during the year.

Iron-Ore Railroads at Lake Superior

SPECIAL CORRESPONDENCE

Actual and pending changes in the railroad situation with reference to the transporting of iron ore to Lake Superior ports and its distribution from them to the points of ultimate consumption may disturb the spheres of influence in the iron trade which have grown out of this vast transportation business and may create new conditions of interest in the iron business of the country. In the Minnesota iron region the two independent iron-ore roads serving the Vermilion and the Mesabi districts, respectively, in their early development, passed into the direct control of the U. S. Steel Corporation with the organization of that company. One other road, acquired by the Great Northern Ry., tapped the Mesabi and divided the important Mesabi traffic with the Steel Corporation roads.

This situation remained undisturbed until the threat of the federal suit against the Steel Corporation caused these roads to anticipate adverse rulings and to cut the rate of 80c. and 90c. to Lake Superior from the Mesabi and Vermilion, to 60c. and 70c. per ton respectively. This cut was met, of course, by the Great Northern, but in this case J. J. Hill had been wise enough to provide, in his lease contracts made on the Great Northern ore lands, that a reduction in the freight rate would act automatically to raise the royalty the same amount as the freight was reduced. This is the situation as to the Mesabi and Vermilion districts today.

CUYUNA RANGE TRAFFIC

The Cuyuna district development introduced a new factor in the transportation situation. The early promoters of the Cuyuna being unable to secure what they thought were satisfactory terms from the Northern Pacific R.R., which runs through the district to the head of Lake Superior, began negotiations with the Minneapolis, St. Paul & Sault Ste. Marie R.R., the "Soo," an American subsidiary of the Canadian Pacific system. The "Soo" was building new lines in the northwest and besides had an alleged grievance against the Hill roads because of "invasions" of the Canadian territory in the west. The business in itself was attractive, for a large tonnage was proved and, as an inducement, contracts for hauling half this tonnage at

65c. per ton, were given to the "Soo" to induce it to build into the district and to provide the necessary costly dock facilities on Lake Superior. The "Soo" road is now completed into the district and is hauling ore from the several mines now in operation.

But with the advent of the "Soo," the Northern Pacific became more amenable and entered into a traffic arrangement with a new road called the Cuyuna Northern, which is being built by Cuyler Adams, the pioneer in the Cuyuna district. This gives the district competitive transportation and gives to the Hill interests, represented in the Northern Pacific, control of a large tonnage of ore. The "Soo" road so far is confined to the Cuyuna district because the greater part of the ore in the other Minnesota districts is controlled or under contract to the interests already in the transportation saddle there. However, should an important extension of the Mesabi be opened, especially at the western end, or if there are discoveries in the prospective territory between the Cuyuna and the Mesabi, the "Soo" would undoubtedly extend into the Mesabi territory.

THE CANADIAN ROADS

The Vermilion district has been served solely by one road and that in the control of the Steel Corporation. A few years ago the Canadian Northern system, now centering at Port Arthur on the north shore of Lake Superior, built a line toward the Vermilion district as far as the international boundary. This line is projected to the Vermilion and to Duluth. It could and undoubtedly would seek to take the independent ore from the Vermilion district to the Canadian port. The late President Hays, of the Grand Trunk, had under consideration a project for an extension of the Grand Trunk system from Canada through the Mesabi and Cuyuna districts to the head of Lake Superior. This project is more remote than the other two noted, but it is entirely feasible and rather likely. An independent road is also projected from Grand Marais, a port north of Duluth, to the Vermilion and to the prospective magnetite deposits of Cook and Lake Counties.

The result of this rearrangement of the vast Minnesota iron transportation business would, of course, be directly felt by the Lake shipping which is more or less closely allied to the railroads and to the former interests that control them. The entrance of competition into the iron-transportation field and the fact that this competition represents strong Canadian railroad interests able to take care of themselves fully and seeking to expand to justify their government subsidized trunk lines, presents a situation of interest and affords a protective situation for the "independents" in the iron trade and in iron mining. This situation does

not so far concern directly the Wisconsin and Michigan districts. The "Soo" line has always participated in this traffic and geographic conditions do not encourage any such readjustment as is possible in Minnesota.

ORE DOCKS

The actual status of the several railroad interests in this vast iron-ore carrying trade is approximately measured by the statistics of the ore-loading docks on the Lakes, recently compiled by W. A. Clark, chief engineer of the Duluth & Iron Range R.R. The total number of docks is 37. These are controlled as follows: Duluth & Iron Range at Two Harbors, 1070 pockets, storage capacity 196,100 tons; Duluth, Missabe & Northern, at Duluth, 1152 pockets, storage capacity 172,800 tons; total for the Steel Corporation roads, 2222 pockets, 368,900 tons storage capacity.

Great Northern Ry., at Superior, 1352 pockets, 420,700 tons storage capacity.

Canadian Pacific roads (subsidiaries), Duluth, South Shore & Atlantic, at Marquette, 400 pockets, 65,000 tons storage capacity; "Soo" road, at Ashland and Superior, 514 pockets, 91,400 tons storage capacity; total for Canadian Pacific roads, 914 pockets, 156,400 tons storage capacity.

Chicago & Northwestern Ry., at Escanaba and Ashland, 1634 pockets, 325,600 tons storage capacity.

Lake Superior & Ishpeming Ry., at Marquette, 400 pockets, 75,000 tons storage capacity.

Chicago, Milwaukee & St. Paul Ry., at Escanaba, 480 pockets, 90,000 tons storage capacity.

These docks are all at the American ports. In addition to these there are at Canadian ports docks as follows: Algoma Central Ry., at Michipicoten, 12 pockets, Canadian Northern at Key Harbor, 20 pockets.

Explorations in Quebec

SPECIAL CORRESPONDENCE

During the coming summer, the Canadian Geological Survey will devote a good deal of attention to the province of Quebec. Two exploring parties will be sent to northwestern Quebec, one of which will examine the country east of the Bell River, between Grand Lake Victoria and Lake Mattagami, while the other will work along the Nottaway River, from Lake Mattagami northward, that being regarded as a likely route for the projected railway from Montreal to James Bay. J. Keele, who has made a specialty of the investigation of clay deposits, has been assigned to make a special inventory of the clay and shale resources of the province. A party will continue the work of mapping, in detail, the geology of Brome and Mississquoi Counties.

Electric Furnace at Lluvia de Oro

By H. R. Conklin*

In 1910 and previously, the Lluvia de Oro Gold Mining Co., at Lluvia de Oro in the state of Chihuahua, Mexico, was melting precipitate from its cyanide plant in crucibles, using charcoal as fuel, and forced draft to obtain sufficient heat. Oil furnaces were objectionable on account of high cost of fuel. Charcoal costs at the mine, \$20 per ton, and oil about 50c. per gal., mainly on account of the distance from railroad. The company owns a hydro-electric power plant the operating cost of which is constant, whether the output is a maximum or a minimum, so that power to operate an electric furnace would actually cost nothing.

With the purpose in view of economy and a hope, in addition, of better work, I investigated in the fall of 1910 all the electric furnaces that I could hear

The electric furnace at Lluvia de Oro cyanide mill is probably the first one to be used for melting precipitate or smelting gold-silver concentrate. Bullion is the only product shipped. The slag produced is used as flux or is treated in the mill as ore. The melting capacity is 400 kg. of precipitate in 24 hours.

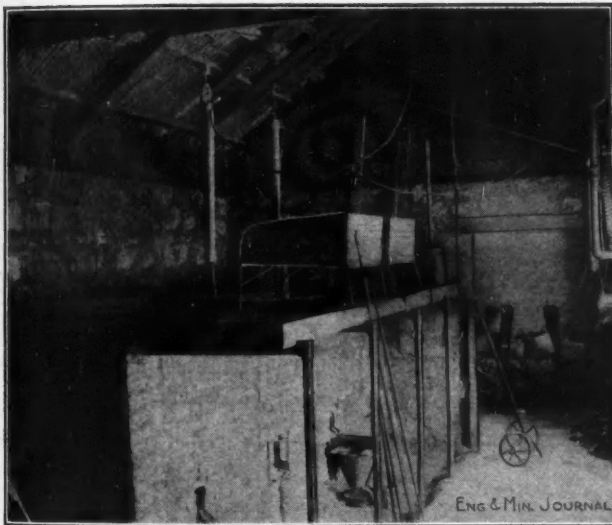
*Manager, Lluvia de Oro Gold Mining Co., Lluvia de Oro, Chihuahua, Mex.

deep. Additional depth is of no value, as if a charge is more than 4 ft. deep the pressure of metal when tapping is too high for good control and the metal spatters out of the mold. The cross section increases as the furnace is used,

extended 4-ft. in front. This extension is supported on old tank sheets and posts of 2-in. pipe, as shown in the accompanying halftones. This gives a floor about 20x12-ft., unbroken except for the four furnace holes, each 16-in. square. In addition there is no woodwork of any kind, and no fire risk. Charges are mixed on top in sheet-iron boxes and all dust and sweepings are put into the furnace. Small boards are laid on this floor to stand on when handling the electrodes.

FIREBRICK LINING USED

The first furnace was lined with chrome dust, rammed in place with sodium silicate as a binder. It lasted about 30 hours, melting precipitate and all dissolved in the slag, which was dark



BATTERY OF ELECTRIC FURNACES FOR MELTING PRECIPITATES AND SMELTING CONCENTRATES AT LLUVIA DE ORO MILL

of as being in anyway suitable. R. S. Wile was then operating two furnaces at Connellsville, Penn., smelting tin dross, and these furnaces seemed to be doing work more nearly like smelting precipitate than any other of which I could hear. The inside dimensions were 20-in. diameter at the top, tapering to 8 or 10-in. at the bottom, and 6½-ft. deep, having a lining of chrome dust. They were plain resistance furnaces, no arc being used, except possibly when starting, and the charge was heated by its resistance to the passage of current. An outfit was ordered from Mr. Wile, and on its arrival at Lluvia de Oro early in 1911 the experiments began.

FURNACE RECTANGULAR IN SECTION

Our present furnace is rectangular in section, 16-in. square inside, and 4-ft.

and at the time of rebuilding is nearly circular and 24 to 26-in. in diameter. By making the cross section square instead of circular the brick lining is much more easily laid and the joints are tighter, making the construction as good as a circular cross section with special brick, and requiring no skilled labor.

In order to avoid all buckstays and to use the minimum amount of brick, we have built a battery of four furnaces, the side and back walls being solid adobe. All bricks, except one course in front, are liners. The bricks in the front course are used many times. In repairing, all bricks are removed and the entire brickwork relaid inside the cavity in the adobe. This design is shown in the accompanying engraving.

The adobe structure makes an excellent floor on top of the furnaces and is

green, exceedingly hard and pasty. After this experience we used good firebrick, laid with ends exposed to the charge. If laid otherwise they are liable to float out of sides or bottom when partly destroyed, but by laying endwise to the charge they will remain in place until more than half gone. All the firebrick next the charge have joints floated full of fireclay. Those not so exposed are laid in red clay. Any spaces between brick and adobe are filled solid with red clay and brick bats. The life of firebrick linings averages about 200 hours.

In the effort to improve on this, we tried one lining of carborundum fire sand, rammed 3-in. thick, with 5% of sodium silicate of 52° Bé. for binder. This lining did not work as well electrically as the firebrick, appearing to conduct the current much better and reducing the

melting capacity of the furnace. It was also rapidly attacked by zinc in the charge. We did not try this lining for melting precipitate; for that work alone, it might do better. The carborundum lining was laid with circular cross section. It was patched once, and a thick syrup of *panoche* (brown sugar) used as binder, which apparently did fully as well as the sodium silicate. The life of this lining was about the same as that of firebrick, and its cost nearly twice as high.

The first tap hole was made by drilling a hole through a firebrick. This was unsatisfactory and was improved by building a piece of 1/4-in. iron plate into the front, having a 7/8-in. hole drilled through it for tapping. Afterward an iron arrangement was made from 3- and 4-in. angle iron, forming a sort of box with a tap hole and a spout for the metal. Iron castings have been ordered of this shape, but have not yet been tried, and there is a possibility that cast iron will not stand the work as well as wrought iron or steel.

At present the brick lining in front is being built with a tapered channel leading from the furnace proper, for three or four inches forward to an iron plate with a 7/8-in. hole. This plate protects the brick from injury by tools when tapping and the brick protects the plate from burning out. A spout of angle iron is laid in the brick work to guide the metal and slag from the tap hole to the mold. For bullion a hole of 3/4-in. diameter is sufficient, but one of 1 1/8-in. diameter is not too large for concentrate smelting.

CURRENT SUPPLY AND REGULATION

Alternating current of 60 cycles is used at 110 volts. Direct current would do exactly the same work. A switchboard, with resistance for regulation when starting, is necessary for each furnace in operation.

Diagrams of electrical connections are shown in the accompanying engravings; a halftone shows the two switchboards at Lluvia de Oro. One side of each furnace circuit is of course grounded through the bottom electrode, and to avoid danger to workmen an independent transformer is used for each furnace.

In order to balance the load of the three-phase generator as nearly as possible each furnace is on one phase. One side of each secondary, at 110 volts, is connected at the switchboard to a common cable leading to all the bottom electrodes, so that there is never more than 110 volts between any upper electrode and the ground. By using bare copper wire for the cable to the lower electrodes a good ground is obtained and no shock is felt when tapping the fur-

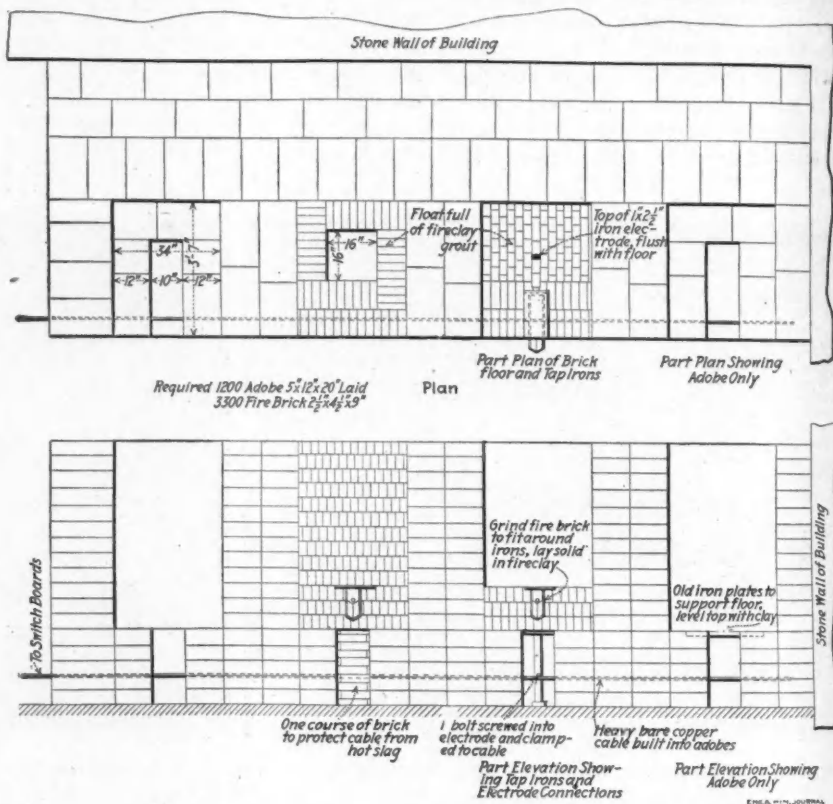
nace with iron tools, although current is being used. When using insulated wire, carried directly to the lower electrode, a strong shock could be received when tapping the furnace, and workmen had to stand on boards, causing much annoyance. Three furnaces could be connected in the same way and balance the entire load on three phases.

GRAPHITE ELECTRODES USED

Graphite electrodes, 4-in. diameter by 40-in. long, made by the Acheson Graphite Co., of Niagara Falls, are used. The first furnaces were built with a graphite electrode in the bottom. Soon after beginning operations, we could obtain no more graphite on account of re-

satisfactory with the exception that the ends burned off considerably forming iron shot, 1/4 to 3/8-in. in diameter, which collected in the bottom of the furnace and gave trouble when tapping. Most of them would run out with the bullion and had to be chipped from the tops of the bars. These pipes were unsatisfactory for electrodes when smelting concentrate, as the addition of metallic iron to that kind of a charge, where there was already an excess, made a pasty mass in the bottom of the furnace which could not be handled. It is better to use graphite for the lower electrode also when smelting concentrate on account of rapid destruction of iron.

The graphite electrodes are threaded



BATTERY OF FOUR ELECTRIC FURNACES AT LLUVIA DE ORO. TWO ARE OPERATED WHILE THE OTHER TWO ARE BEING REPAIRED

revolutionary troubles in 1911 and as an expedient used iron. Iron is just as satisfactory as graphite for the bottom electrode, when used for melting precipitate, and by making it of 1x2 1/2-in. size it lays exactly right in the brick bottom, without any cutting. A long 1-in. bolt screwed into its side near the lower end makes a convenient attachment to the copper cable from the switchboard. This cable is built into the adobe where it is entirely out of the way and protected from any damage, and yet can be readily attached to the bottom electrode when rebuilding.

Temporarily we used for upper electrodes some 2 1/2-in. XX pipe which we happened to have. They were fairly

with male and female threads on the ends. By having a cast-iron block into which they can be screwed, they are completely consumed, a new one being added as required at the top. The cable from the switchboard is brought to this cast-iron block on glass insulators, and fastened to it by bolt and washers.

On each switchboard is mounted a small windlass carrying a flexible cable on which is hung the upper electrode by means of a strain insulator. This enables easy, quick and exact adjustment of the upper electrode in the charge. Current is easily regulated by varying the depth of immersion of the upper electrode, and is roughly regulated by the rate of charging and the temperature

of the furnace. Any arc between the upper electrode and the charge consumes the electrode rapidly. For this reason the electrode should be kept sufficiently immersed to maintain good contact.

MELTING PRECIPITATE

Our precipitate is sometimes quite dirty from slimes, contains more or less zinc, and may be quite wet occasionally. We make no effort to prepare it specially, as it is melted just as well, even if very dirty. One batch was melted which only assayed about \$2000 per ton. This is a great advantage, for nearly everyone sometimes gets a mess of stuff that is hard to handle in crucibles. Since there is no air blast, the loss by dusting is small. Reasonable amounts of zinc volatilize in white fumes and give no trouble.

We vary the fluxes depending upon the quality of the precipitate, but generally the charge is about as follows: Precipitate 100, lime 5, sand 15, borax 10, soda 10. Locally burned lime is used,

accumulates. The switchboard resistance is reduced by closing one switch after another as rapidly as possible, without unduly increasing the current, and is generally all out in 30 to 50-min., with melted slag about a foot deep in the furnace.

Precipitate mixed with flux is then added until the furnace is full, or enough bullion is melted to pour one or two bars. If too much bullion accumulates before tapping, it is liable to chill and not pour well. This is caused by the bullion perfectly conducting the current and therefore receiving heat only from the melted slag above it. No precipitate is charged for half an hour or so before pouring, to allow all shot to settle through the slag, and if the bullion in the bottom is chilled, an iron bar is used for stirring it. In case of necessary shutting down, a 1/2-in iron rod is left in the charge, resting on top of the bottom electrode, in order to establish current when starting cold, but the furnace is always emptied if possible, when shutting down.

between 250 to 350-amp., and about 400 kg. are melted per 24 hours.

MELTING SHORT ZINC

Short zinc is roasted in a small reverberatory furnace, the hearth of which is 5x7-ft., being the same furnace that is used for roasting concentrate. After a thorough roast it is melted without any difficulty, the zinc going into the slag. The charge is as follows: Short zinc 100, sand 30, borax 10, soda 10. Bars are not cast from this melt, but the entire content of the furnace is drawn into slag pots, all the metal collecting in the bottom of the slag pot and the slag overflowing. This button or chunk is remelted with precipitate. The slag assays about \$40 per ton, and is run through the mill. Power consumption and capacity are about the same as when melting precipitate.

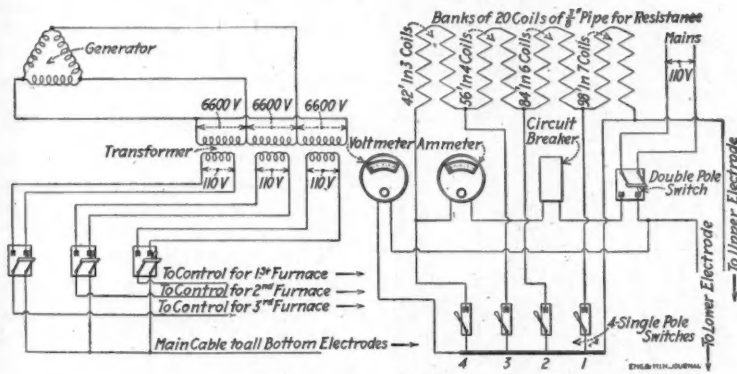
Whenever slag, brick bats, or other furnace waste is run through the mill, a separate stamp is used, (the mill is equipped with Nissen stamps) using a 30-mesh screen, and all shot and small buttons are caught in the mortar, panned clean and melted again with precipitate. All the fine product from the stamp takes the regular mill process and the extraction is satisfactory.

SMELTING CONCENTRATE

The concentrate from this mine constituted about 0.75% of the ore milled, and was dried, sampled and shipped in sacks, the value per ton being about \$1500. Handling, sacking and sampling were troublesome. Dust loss, freight costs and taxes were excessive. The concentrate was readily amenable to a special cyanide treatment, but that required an additional plant, and the output of 15 to 20 tons per month hardly justified the investment. The cost of marketing concentrate was about 5% higher than the cost of marketing the same value of bullion.

The present process is: (1) reconcentrate all the product on one table, bringing its value up to about \$3000 per ton; (2), roast off nearly all the sulphur in the small reverberatory furnace, and partly oxidize the iron content; (3), smelt in the electric furnace with flux as follows: Concentrate 100, lime 15, sand 30, slag from precipitate melting 15. This concentrate consists of pyrite, but carries a high percentage of metallic iron, derived from wear of stamp shoes and tube-mill liners. The percentage of metallic iron is extra high on account of the extreme hardness of the ore causing much wear of iron, and because of the small percentage of concentrate contained in the ore.

By careful work a product is obtained from the furnace consisting of bullion, matte and a heavy iron slag. A larger tap hole is used, about 1 1/8-in. diameter.



ELECTRICAL CONNECTIONS FOR FURNACES AT LLUVIA DE ORO MILL

the same as is used for producing alkalinity in the cyanide plant, and quartz sand from the mine, obtained from the coarse product of a Dorr classifier which feeds the tube mills. A rather large amount of slag is not objectionable, as it assays only about \$60 per ton, and is all used as a flux in smelting concentrate. It is easily treated in the regular milling process, and any excess is put in the ore bin above the stamps.

In starting the furnace, all resistance is cut into circuit by opening all the regulating switches; the upper electrode is lowered to the bottom of the furnace in one corner, five or six inches from the bottom electrode. A handful of powdered graphite is dropped on the bottom, making a line between the electrodes. Current is immediately started through the graphite. A pint or so of borax is added, which melts immediately. Then powdered slag is added until the bottom of the furnace is covered with melted slag which makes a good conductor. As the slag melts, more is dropped in and the upper electrode is raised as it ac-

Bars not suitable for shipment, pieces of bullion, shot and chunks of metal produced from melting short zinc or smelting concentrate, floor sweepings and any rich slag, are all charged and melted with precipitate, so that a general clean-up of all odds and ends is accomplished. Bullion is re-melted if it runs less than 900 fine, but no effort is made to produce bullion of fineness exceeding 900, as the cost of marketing increases for lower fineness, but does not decrease for higher. The bullion from the Lluvia de Oro mine assays generally about 100 fine in gold, 800 fine in silver, and 100 base.

When tearing down a furnace, considerable metal is always found in the bottom and in cracks between the bricks, sometimes even impregnating the pieces of brick. All these pieces of metal are melted over, and all the refuse bricks go through the mill.

If the bullion product were less in bulk and higher in proportion of gold, it might be difficult to prevent loss. When melting precipitate, current is kept

Current consumption of 400 to 600-amp. smelts about 800-kg. of concentrate per 24-hr. Bullion product is remelted with precipitate. Matte product can be melted along with short zinc to a limited extent and produce all bullion. Some can also be added when melting precipitate, but great care must be exercised not to get silver sulphide in the bars of bullion.

A recent experiment is the addition of a small jet of compressed air to bubble up through the molten bullion and slag and burn off the excess of sulphur, producing also a higher grade of bullion, but the scheme has not yet been perfected and was only tried once. The first trial seemed very successful, however, and it should work out satisfactorily after devising the best means of introducing the air pipe. In case of success, all matte will be melted with precipitate.

Slag from concentrate smelting assays from \$50 to \$100 per ton, and the regular cyanide work in the mill extracts easily to \$3 per ton. The simple expedient of running it along with ore from the mine, which was at first intended, does not suffice, however, for the reason that the slag is so heavy with iron that it all comes out with the concentrates on the tables, and would immediately lower their grade and also have to go through the furnaces again. The present intention is to stack it until a sufficient quantity has accumulated to run the mill a day or so on nothing else, at which time the tables would be receiving no concentrate from mine ore, and their entire product, consisting of slag only, would be returned to the tube mills until too fine to be caught, when it would go directly to the cyanide plant.

All slags should be rather high in silica, to prevent too rapid destruction of the firebrick lining. High-silica slags also have more resistance to the passage of current and the furnace can be kept at a higher temperature. This can easily be carried too far, however, and one charge required so high a temperature before becoming sufficiently liquid, that it melted all the tap-iron and part of a heavy cast-iron slag pot when running out.

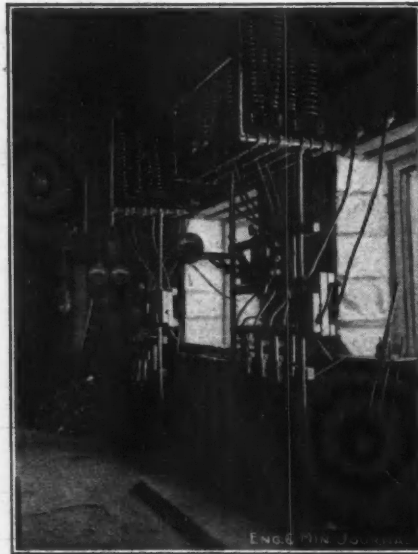
ONLY BULLION SHIPPED

To sum up, the disposal of all the furnace products is as follows: Bullion is shipped to market. Slag from precipitate is used as flux for concentrate, or sent to mill. Slag from short zinc is sent to mill. Slag from concentrate is stacked for future cyanide treatment, the regular mill treatment being satisfactory, but the quantity produced being so small that several months accumulation can be treated in a day. Furnace refuse, consisting of brick bats, clay and sweepings, is sent to mill.

This method leaves everything cleaned, no accumulation of anything valuable, and all products from the mine ore, either shipped as bullion or discharged as tailing from the mill, with no contents that can be recovered economically.

For larger operations, smelting concentrate, I would experiment with a furnace about 3-ft. wide, 4-ft. long and 4-ft. deep, having an electrode in the middle of the bottom, two electrodes hung above, and adjustable horizontally as well as vertically, using a three-phase current at 110 volts, with a switchboard and rheostat in each phase.

So far as I know, this is the first and only electric furnace to melt precipitate or smelt gold-silver concentrate. There is no patent applied for, or intended, on any of the processes or improvements which have been worked out here, and unless some basic patent covers the use of electric current to heat a sub-



SWITCHBOARDS FOR ELECTRIC FURNACES

stance by means of its resistance, which hardly seems reasonable, the furnace and its operation are free for use by anyone who may so desire. If any of the readers of this article know of a lining which would do better than firebrick, a letter to me with full particulars would be greatly appreciated.

Mica in 1911

According to figures published by the U. S. Geological Survey, there were 944 tons of rough-trimmed and cut, and 3512 tons of scrap mica produced in the United States in 1911. This came from North Carolina, South Dakota, New Hampshire, Alabama, New Mexico, Colorado and Virginia.

Two large crystals of mica were found during the year at Celo, N. C. One was 32½ in. thick, by 29 in. wide, by 33 in. long, the other 17½x29½x33½ in. These

are said to have sold for about \$125 and \$100 respectively. The old Silley mica mine, near Burnesville, N. C., was reopened, and much development work done. Some mica was also obtained as a byproduct by the Carolina Mineral Co., which was mining for feldspar near Penland, North Carolina.

It is usually stated that mica containing inclusions of iron oxide is worthless for insulating purposes. In domestic mica this does not seem to be true, as the black specks are thin magnetite dendrites which occur between the laminae, but do not penetrate them. In certain foreign micas the magnetic minerals penetrate the layers. These micas are, of course, spoiled for insulating purposes.

Alaska United Report

The net profit of the operations of the Alaska United Gold Mining Co., at Douglas Island, Alaska, for the year ended Dec. 31, 1911, was \$321,415, according to the official report. Of this amount, \$81,090 was disbursed as dividends and \$195,000 charged off for depreciation.

At the Ready Bullion mine, the development work accomplished in the period was 3968 ft.; the ore reserves are estimated at 1,448,108 tons, averaging \$2.94 per ton. At the 700-ft. Claim mine, the development work was 4786 ft.; the ore reserves, 1,387,076 tons, averaging \$3.08 per ton.

The Ready Bullion mill treated 223,668 tons of ore, the average yield being \$2.32 per ton with the tailing running 25c. The stamp duty is 5.13 tons per 24 hours. The costs were: Mining, \$1.155; milling, \$0.303 per ton. The 225,403 tons produced by the 700-ft. Claim mine were mined at a cost of \$1.063 and milled for \$0.26 per ton. The average yield was \$2.34 per ton, 19c. being left in the tailing.

The cyanide mill for treating concentrates is owned jointly by the Alaska-Treadwell, Alaska United and Alaska-Mexican companies, on the basis of 60%, 20% and 20%, respectively. An extraction of 96.5% was obtained in treating 17,751 tons, the cost averaging \$2.812 per ton.

Geology of Upper Wisconsin

The staff of the Wisconsin Geological Survey is working on new maps, covering the geology of the Northern Wisconsin country. These maps will be published soon, and are likely to be of importance in connection with the mineral development of that section. They corroborate in the main the earlier geological work done in that region, but will bring out certain accessory structural features and details, which are of present significance in the interpretation of the geological conditions of that section with relation to possible new iron and copper deposits.

NEW PUBLICATIONS

DREDGES AND DREDGING. By Charles Prelini. 6¼x9¼, pp. 305, illus.; \$3. D. Van Nostrand Co., New York.

NOUVEAUTE EN METALLURGIE. 6½x9½, pp. 69, illus., paper; 3 francs. Mois Scientifique et Industriel, Paris, France.

EINFUHRUNG IN DIE PROBIERKUNDE. By C. Schiffner. 5¼x8½, pp. 171, illus.; 6 marks. Wilhelm Knapp, Halle a. S., Germany.

HISTORICAL PAPERS ON MODERN EXPLOSIVES. By George W. MacDonald. 6¼x10¼, pp. 192; \$2.50. The MacMillan Co., New York.

COAL NEAR THE BLACK HILLS, WYOMING-SOUTH DAKOTA. By R. W. Stone. Pp. 73, illus. Bull. 499, U. S. Geological Survey, Washington, D. C.

BUILDING STONES AND CLAYS. Their Origin, Characters and Examination. By Edwin C. Eckel. 6x9¼, pp. 264, illus.; \$3. John Wiley & Sons, New York.

I GIACIMENTI PETROLEIFERI DELL'EMILIA. By E. Camerana and B. Galdi. 7¼x10½, pp. 334, illus.; paper. Studio Pubblicato per Cura del R. Ufficio Geologico, Rome, Italy.

CENTRIFUGAL PUMPING MACHINERY. The Theory and Practice of Centrifugal and Turbine Pumps. By Carl George de Laval. 6x9, pp. 184, illus.; \$3. McGraw-Hill Book Co., New York.

ZUSAMMENSETZUNG DER GEBRAUECHLICHEN METALLEGIERUNGEN. By Ed. Wilhelm Kaiser. 7¼x11½, pp. 26, paper; 2.80 marks. Wilhelm Knapp, Halle a. S., Germany.

THEORIE UND PRAXIS DER STAUBVERDICHTUNG UND DER REINIGUNG UND ENSTAUBUNG VON GASEN. By C. Guillemain. 5¼x8½, pp. 54, paper; 2.84 marks. Wilhelm Knapp, Halle a. S., Germany.

INVESTIGATION OF THE COALS OF CANADA WITH REFERENCE TO THEIR ECONOMIC QUALITIES AS CONDUCTED AT MCGILL UNIVERSITY, MONTREAL, UNDER THE AUTHORITY OF THE DOMINION GOVERNMENT. By J. B. Porter and R. J. Durley, assisted by T. C. Denis, Edgar Stansfield and assistants. Volume I. Pp. 236, illus., with numerous plates and maps. \$1. Canada Department of Mines, Mines Branch, Ottawa, Ont.

A TEXT-BOOK OF RAND METALLURGICAL PRACTICE, Vol. I. By Ralph Stokes, Jas. E. Thomas, G. O. Smart, W. R. Dowling, H. A. White, E. H. Johnson, W. A. Caldecott, A. McA. Johnston and C. O. Schmitt. 6½x9, pp. 468, illus., half leather. Charles Griffin & Co., Ltd., London; J. B. Lippincott Co., Philadelphia.

As stated on the title page, this book is designed as a "working tool" and practical guide for metallurgists upon the Witwatersrand and similar fields. Much of the subject matter was first published in the *Journal of the Chemical, Metallurgical and Mining Society of South Africa*. The presentation of these valuable contributions to the knowledge of gold-ore milling in convenient and readily accessible shape alone would have been a boon to the profession, but the authors have gone farther; they have prepared the subject matter of these articles in logical sequence and have added thereto the minor data, often overlooked in similar publications. The book is a guide and catalog to Rand metallurgical practice; it should prove to be a veritable handbook to every gold metallurgist wherever he may be engaged, but, of course, does not embrace the phases

of chlorination and concentration in the metallurgy of gold.

TYPES OF ORE DEPOSITS. Edited by H. Foster Bain. 6¼x9, pp. 378, illus.; \$2. Mining and Scientific Press, San Francisco, Calif.

This is an important collection of papers by a distinguished list of geologists. The book cannot fail to be of interest and value to everyone who is in any way engaged with its subjects. The latter comprise contributions on "The Clinton Type of Iron Ore Deposits," by C. H. Smyth, Jr.; "The Lake Superior Type of Iron Ore Deposits," by C. K. Leith; "Flats and Pitches of the Wisconsin Lead and Zinc Districts," by H. Foster Bain; "Lead and Zinc Deposits of the Ozark Region," by E. R. Buckley; "Native Copper Deposits," by Alfred C. Lane; "The Cobalt District, Ontario," by S. F. Emmons; "Geology at Treadwell Mines," by Oscar H. Hershey; "The Saddle-Reef," by T. A. Rickard; "Contact Deposits," by James F. Kemp; "The Conglomerates of the Witwatersrand," by F. H. Hatch; "Replacement Orebodies and the Criteria by Means of which They May Be Recognized," by J. D. Irving; "Outcrop of Orebodies," by William H. Emmons; "Some Causes of Oreshoots," by R. A. F. Penrose, Jr.

THE METALLURGY OF STEEL. Vol. I, Metallurgy, by F. W. Harbord; Vol. II, Mechanical Treatment, by J. W. Hall. Fourth edition, enlarged and revised. Pp. 933. 51 folding plates, over 500 illustrations in the text and nearly 80 photomicrographs. \$12. Charles Griffin & Co., Ltd., London; J. B. Lippincott Co., Philadelphia.

The first edition of this work appeared in 1904, and was the first treatise in English aiming to cover the subject exhaustively since the classical work of Howe in 1890. The new book therefore assumed at once the position of the standard modern authority and reference book for English practice, as well as the best recent publication in the language on American practice. As far as the mechanical treatment is concerned, the first edition was, and the second edition still is, as far as I know, the most thorough and exhaustive single book of reference extant. Both authors labor under the handicap of practising their profession most of the time in a country in which progress in the metallurgy and mechanical treatment of iron and steel has been relatively slow during the last 10 years at least, and which has dropped in 20 years from first to third place in industrial importance. Nevertheless, both have taken special care to acquaint themselves with practice in other countries, and the new edition may be described as sufficiently up-to-date for all ordinary reference purposes, even as regards American practice, and especially as regards mechanical treatment. It has the further advantage over a book written in this country, of bringing an entirely new and conservative viewpoint to bear upon the innovations which we adopt so readily and

at such great expense and loss of invested capital. Since the first edition is already so well known to all men to whom it is addressed, this review need only concern itself with the changes in the second edition:

The division of the work into two volumes is a distinct advantage, for the previous book of 800 pages in one cover was both inconvenient and perishable. The new scheme also necessitates a stricter differentiation between the metallurgical and mechanical sections of the book, which is more logical. Beyond this, the general scheme has not been altered, "but only such additions and modifications have been made as have been rendered necessary by the advancement in the theory and the practice of the art." Drawings of the latest types of open-hearth furnaces, charging machines and gas producers have been introduced, recent developments of the basic-open-hearth process described, and the discussion of electric smelting and purifying, upon which Mr. Harbord is now one of the world's greatest authorities, brought as far as possible up to date. Plans of representative modern installations in Europe and America have been added.

In the first section of the book, "The Manufacture of Steel," there have been slight changes or additions under: Small converters, gas producers and armor plate (the latter being the new cast armor), and more extensive changes under the basic Siemens process. In section 2, slight changes have been made in the chapter on heat treatment of steel, recent tests have been added under mechanical testing, many new data are given under special steels or steel alloys, under microscopical examination, and new plates in the chapter called "Typical Steel Plants."

In the mechanical volume, extensive changes have been made throughout: "The provision of power for use in steel works is treated much more fully. To the chapter on steam engines has been added a section on the use of steam in exhaust-steam turbines. Entirely new chapters have been added dealing with the generation of steam by solid fuel and waste gases, on the production of power by gas engines working with blast-furnace gases, and on electric driving of the mills."

In Volume II, the changes are so extensive as to make detailed discussion impracticable here, as will be evident from the observation that this subject, which occupied about 288 pages in the previous edition, now covers more than 400 pages. A useful practice in this volume is the addition of a bibliography at the end of each chapter. Those who aim to maintain a modern reference library on steel cannot afford to be without this second edition, even if they already possess a copy of the previous one.

BRADLEY STOUGHTON.

PERSONALS

Mining and metallurgical engineers are invited to keep *The Engineering and Mining Journal* informed of their movements and appointments.

J. R. Finlay has been in British Columbia on professional business.

T. Lane Carter, of Chicago, is examining properties in northern Michigan.

G. C. Bateman has been examining properties in the Swastika district, Ontario.

K. V. Gardiner has resigned his position as manager of the Success mine, Porcupine, Ontario.

Kirby Thomas, of New York, is spending some time in Ontario and Quebec, making mine examinations.

Robert S. Botsford has returned to London from a professional trip to the neighborhood of Vladivostok, in Siberia.

Dwight E. Woodbridge, of Duluth, Minn., has gone to Central America on professional business, to be absent a few weeks.

Edward J. Collins has returned to Duluth, Minn., from British Columbia, where he has been examining copper properties.

W. Parsons Todd has been elected vice-president of the Quincy Copper Co., in place of W. P. Bliss, resigned. Mr. Bliss remains a director.

C. Powell Karr has been appointed metallurgist of the Standard Chemical Co., Pittsburgh, manufacturer of vanadium and other alloys.

E. J. Carlyle left New York on June 6 for London, on his way to Argentina, to take charge of the smeltery of the Famatina Corporation, at Chilecito.

Ambrose Monell, president of the International Nickel Co., has been chosen president of the Canadian Mining & Exploration Co., Ltd., a new organization.

Herbert Johnson, recently with the Oliver Iron Mining Co., at Ishpeming, Mich., has been appointed assistant engineer with Pickands, Mather & Co., at Iron River.

George Wingfield, well known in connection with the Goldfield Consolidated Mines Co., has been appointed U. S. Senator from Nevada, in place of the late George S. Nixon.

S. L. G. Knox, for several months general manager of the Yuba Construction Co., has been elected vice-president and general manager of the Natomas Consolidated of California.

Norman T. Tracy has been appointed manager of the mines of the Compañía Minera Jesus Maria y Anexas, at San José de Gracia, Sinaloa, Mexico, in place of Mauricio A. Newman, resigned.

Frederick A. Pelter, recently assistant superintendent of construction for the Tennessee Coal, Iron & R.R. Co., has been made assistant engineer for the H.

Koppers Co., in charge of new construction.

Richard Henry Thomas has returned to New York from Kyshtim, Russia, where he was engaged for two months in looking over the electrolytic copper refinery, with a view to securing greater efficiency in its work.

Austin H. Brown has closed his San Francisco office and has removed to Walnut Grove Ranch, Willets, Mendocino County, Calif., where he is still open for professional engagements as mining and metallurgical engineer.

N. H. Emmons, having severed his connection with the Tennessee Copper Co., announces that he has opened an office in the Union Oil Building, Los Angeles, Calif., where he will do consulting mining engineering.

John H. Kennedy, formerly general superintendent of the Punxsutawney Iron Co., Punxsutawney, Penn., is in charge of the blast-furnace department of the Rogers-Brown Iron Co., operating the Susquehanna furnaces at Buffalo.

W. R. Bassick, who was general sales manager of the Yuba Construction Co. during the incumbency of Mr. Knox as general manager, has succeeded to that position, and becomes vice-president of the company, with offices in San Francisco.

Waldemar Lindgren, of the U. S. Geological Survey, has been appointed head of the Geological Department of the Massachusetts Institute of Technology, in place of Prof. T. A. Jaggar, who is now director of the Hawaiian Volcanic Observatory.

Frank M. Chambers, for six years past superintendent of the Great Western Ore Purchasing Co., at Goldfield, Nev., has sold his interest in that company and will hereafter represent the International Smelting & Refining Co., in Nevada, with headquarters at Goldfield.

Newton Cleveland, who for a long time had been general manager of the Yuba Construction Co., and the several dredging companies of the Hammon interests in California, has been relieved of these various duties gradually and is now retained as consulting engineer.

J. W. Keffer, manager of the Shelby Iron Co., Shelby, Ala., has resigned to take charge of coal properties recently purchased by him, at Sebree, Ky. He is succeeded by L. W. Searles, of Birmingham, Ala., who has been consulting engineer for the Shelby Iron Co. for the past year and a half.

F. P. Schwindler has resigned his position as manager of the McIntyre Mining Co., at Porcupine, Ont. W. Cooper, who was superintendent of the mine, has also resigned. It is stated that the mine will be under the direct management of C. B. Flynn, who represents the majority of the stockholders of the company.

OBITUARY

Theodore Albert died at his home in Cincinnati, Ohio, May 27. He was president of the William Powell Co., of Cincinnati.

James Moffet died at Los Angeles, Calif., June 4. He was born in Ireland and came to America when a boy. He was 75 years old, and had been engaged in mining and mine development with his brothers for many years in California, Oregon and Montana. He is said to have made a fortune from the Orphan Girl mine near Butte. Two of his brothers survive him.

Senator George S. Nixon, of Nevada, died at Washington, June 5. He was 52 years old, was born in California, and went to Nevada when a young man. Making his home at Reno, he was extensively engaged for many years in mining operations in different parts of the state. He became especially prominent in connection with the development of Goldfield and Tonopah, where he is said to have made a fortune. He served several terms in the state legislature, and was chosen United States senator in 1905, succeeding William M. Stewart. He was reelected in 1911. His death resulted from an operation for throat trouble.

Societies and Technical Schools

State College of Washington—The senior class of the mining department, with Prof. Francis A. Thomson, head of the department in charge, left the college at Pullman for Republic on May 19, and, after having spent three days in that camp, proceeded to Greenwood, Phoenix, Grand Forks, Trail and Rossland, all in British Columbia. Mines, copper and lead-smelting works, and the electrolytic lead refinery at Trail, were examined. The trip was the best the class has made to date.

American Institute of Mining Engineers—At the annual business meeting of the institute, Feb. 29, it was voted to postpone the consideration of the proposed amendments to the constitution until June 3, 1912, and the meeting adjourned to reconvene on that date, or on such subsequent date as should be fixed by the special committee of five, appointed on Feb. 20, and the board of directors of the institute, acting jointly. Owing to various causes, including absence of two members of the committee in Europe for two months, it has not been possible for the special committee of five to complete its report in time for preliminary distribution to members of the institute and consideration by them prior to June 3, and it has been mutually agreed by the special committee and the board of directors to postpone the date at which the adjourned meeting shall be reconvened from June 3 to Oct. 7 next.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

June 5—State Mineralogist Storms has appointed Charles C. Selby curator of the State Mining Bureau, and has directed that a complete rearrangement of the museum and a partial reclassification of the 20,000 specimens be made. These specimens are the accumulation of a great many years of collections and donations and they have been handled numerous times through necessary removals and unnecessary loans to expositions. The desire to have California properly and appropriately represented at fairs and expositions has prompted the loans, but the desire was never strong enough to induce the legislature to appropriate sufficient money to secure fresh specimens direct from the mines for this purpose. So the mining-bureau specimens have gone out and come back and have often been misplaced. The earthquake of 1906 shook up the museum, and, in addition, the frequent returns from exposition loans resulted in much improper arrangement and inaccurate classification.

The present classification, where incorrect, will be corrected, as far as possible. The new arrangement of the minerals contemplates a plan that will make the specimens from the various mines of greater value to the student, and not merely an exhibit that is attractive to the mass of visitors as a picture which they do not comprehend. While the present administration of the bureau has no desire nor intent to destroy the value of the bureau as a show place, the chief purpose is to make it of educational benefit to the student of mineralogy and mining geology.

The errors in classification, Mr. Storms states, include many of the rock specimens, which will also be corrected, and the rearrangement of this portion of the exhibit contemplates the placing of these specimens in such order as to illustrate the transition of rocks. The museum contains fine specimens of the wall rocks of the Mother Lode region, a section of the state that is always of interest in California. These and the wall rocks from other mining districts, and various mineral specimens, have been collected by the field assistants of the bureau and many by Mr. Storms, while employed in that capacity and as a mining superintendent. These specimens include the clay slates, micaceous slates, schists, greenstones and a variety of types of amphibolite schists. Besides the rearrange-

ment of the museum to meet the requirement of students and mining men seeking knowledge of the rocks and minerals of the state, the state mineralogist and the curator will extend to all visitors every courtesy and lend assistance to all who desire information in the pursuit of their studies of any mine or district that is represented in the bureau museum, or in the investigation of the mineral resources of the state. The present curator is relieved of the duties of book-keeper and treasurer imposed on his predecessors, and will be able to devote his entire time to the mineralogical and geological department of the bureau.

Denver

June 6—It is announced that the Argo Reduction & Ore Purchasing Co. has been organized by Boston men, headed by Frank A. Schirmer, of that city, who is also president of the company controlling the Newhouse tunnel, of which his son, R. F. Schirmer, is manager. It is also stated that plans for a mill are being prepared and that construction of the first 100-ton unit will be under way in July, the cost being estimated at \$85,000. The mill is to be erected just below the portal of the Newhouse tunnel and will be under the superintendence of Arthur H. Roller.

The production of gold for the Cripple Creek district for May, as given by the mills and smelters, is 76,704 tons, worth \$1,203,325, as against 77,281 tons in April of a gross value of \$1,216,693. The New Portland mill, at the mine at Victor, treated 14,000 tons last month; Stratton's Independence mill, 10,851 tons.

An incipient Cherry Creek gold excitement is with us again. It has cropped up about every 10 years since 1860, this time engineered by a placer company, capitalized for \$5,000,000, which has been advertising its \$1 shares for 2c. per share. However, the district should not be condemned. The region in question is Newlins Gulch, about six miles from Parker, on the Colorado & Southern Ry. and 25 miles south of Denver; that the sands and sandstone conglomerates of that region contain gold is well known, but until the area has been thoroughly drilled, and working tests of the ore made, it will not be known what the average grade is or whether it can be mined and treated at a profit. The conglomerates would have to be blasted and, of course, crushed for treatment, and

water for a mill would have to be pumped.

The Smuggler mine, at Aspen, has been closed down, owing to a walkout of the timbermen, following a cut in the pay of the helpers, and over 300 men are out of employment in consequence. The matter is one of ordinary mine discipline, as Supt. John Champion decided that instead of two timbermen working together, the pairs should be composed of one timberman and one helper.

Butte

June 4—During May, gold worth \$181,585 was deposited at the U. S. Assay Office, at Helena, from Montana counties. Madison County led with \$83,410. The various counties ranged as follows: Broadwater, \$439; Chouteau, \$20,071; Deer Lodge, \$472; Fergus, \$39,483; Granite, \$66; Jefferson, \$88; Lewis & Clark, \$35,242; Madison, \$83,410; Missoula, \$2000, and \$309 for Powell County.

With both shafts of the Pennsylvania mine of the Anaconda hoisting ore, the output should be increased fully one-third. The third compartment of the air shaft will be used for the compressed-air pipe line and the electric cables. The south crosscut on the 1800-ft. level is advancing at the rate of nearly 100 ft. per month, and has now reached a point 1600 ft. south of the shaft. The fan-driven air system, recently installed, by which fresh air is constantly supplied through a 14-in. galvanized-iron pipe to the miners working in the breast of this crosscut, is accomplishing excellent results, the men working in the decreased humid heat with increased efficiency. While stopping on the 1000-ft. level, a connection was recently made to some old workings of the St. Lawrence mine, causing an inflow of gas from the latter. The opening was immediately closed.

Salt Lake City

June 6—The United States Smelting, Refining & Mining Co. interests secured control of the Consolidated Fuel Co.'s coal lands on June 1, after negotiations extending over about four months. Notice of the transaction was given out by the Deseret National Bank, of this city, which held the stock in escrow, acting as an intermediary. The holdings comprise about 5000 acres of bituminous coal land in Emery County, the town of Hiawatha and a half interest in the South-

ern R.R., which connects the mines with the Denver & Rio Grande, at Price; the Hiawatha mine, one of the largest and best coal mines in the state, the Blackhawk mine, the holdings of the Castle Valley Coal Co. and other properties. The output of the Consolidated Fuel Co.'s mines is at present 2700 tons per day, and when the lands are opened this will be largely increased. Surveys are now being made for what will be known as the Utah Coal R.R., which will extend from Mohrland through Huntington Cañon to Hilltop, and from there parallel to the Marysvale branch and main line of the Denver & Rio Grande to Provo or to Spanish Fork. This road, when completed, in connection with the Southern Utah line, will furnish a direct outlet for the coal fields. When the lands are opened, they will be the largest producers in the state.

The listing of local industrial securities on the Salt Lake Stock & Mining Exchange is being considered, and a meeting of the governing board will be called to take action on the matter. This proposed addition has met with approval on the part of brokers, who are members of the Exchange, and will give a market value to various industrial securities on which there are at present no regular quotations.

Globe, Ariz.

June 5—After a conference of the managers and superintendents of the principal mines of the Globe-Miami district, an increase of wages or reduction of hours has been granted to all employees, to take effect June 10. Nearly 3000 men will be affected. The 9-hour day has been abolished for surface men, and hereafter all employees on surface and underground will not work more than 8 hours per day. All surface men who have been working 8 hours per day will receive a 7% increase in wages. Surface men now working 9 hours will receive the same pay for 8 hours' work. All men working underground will receive the same pay as heretofore, but will spend a total of only eight hours underground, as provided in the eight-hour law recently passed by the legislature. The men will be hoisted and lowered and will eat their lunch in this eight-hour period, which will consume about an hour, so that they will hereafter receive the same pay for 7 hours' work that they have been getting for eight. The increase is in line with the policy of the large mining companies, adopted several years ago, of granting an increase in wages when copper shall have advanced in price beyond a certain point, with the understanding that they shall be lowered to the old rate when the price of copper falls below that point. This "critical point" was fixed at 18c. in Butte and seems to have been established at 16c. in Arizona. The

companies state in the notices posted at the mines that they regret that the wages of underground men cannot be increased, but the 8-hour law, reducing the actual working time to about 7 hours, prevents this, as it is not possible to reduce working hours and increase wages at the same time.

A petition is being signed by prospectors, claim owners and business men of the district, addressed to the Arizona legislature, now in special session, asking that the miners' lien law, recently enacted, shall be amended. The law as enacted provides that persons furnishing labor, or material to be used in mines or on mining claims under contract with the owners or their agents, or with lessees, or with persons or corporations working the mine or mining claims under option to purchase, shall have a lien upon such mine or mining claims for such sums as are unpaid. In other words, prospectors and claimowners will have to stand for any debts contracted by individuals or corporations working their claims under option. It is generally believed that the enforcement of such a law would mean stagnation if not paralysis to the development of mines and prospects in Arizona. While it is admitted that the law affords admirable protection to miner and laborer, for which purpose it was intended, yet it is believed to be grossly unfair to the small claimowner and prospector.

Negaunee, Mich.

June 8—Indications are for a record year in the shipment of iron ore from the Lake Superior region. In spite of cuts in the selling prices of the ores and political unrest, most of the mining companies are shipping large quantities and cleaning up stockpiles of several years standing.

On the Marquette Range, the Lake Superior & Ishpeming Ry. has contracts for the transportation of 2,000,000 tons, as compared to last year's figure of 800,000 tons; this railroad is owned by the Cleveland-Cliffs Iron Co. and the Jones & Laughlin interests. At Negaunee, the Breitung-Kaufman companies have already sold 475,000 tons of ore; this does not yet equal last season's shipment of 575,000 tons, but last season was an exceptionally busy one for these companies.

At Iron River, a boom is on both in mining and general business; this district, where 15 independent companies are operating, expects to ship 2,000,000 tons in place of the 1,000,000 shipped last year; Pickands, Mather & Co. will be the heaviest shippers, with a total of 600,000 tons from its Caspian, Baltic and Fogarty mines.

The Cleveland-Cliffs Iron Co. recently gave an exhibition of first aid to the injured before Pres. W. G. Mather and

other officials, at Ishpeming. Teams from the company's mines, on the Marquette and Swanzy Ranges, participated. The program was as follows: First, Treat condition of a man who is found insensible, with arm across an electric wire, clothing burning; Lake mine team. Second, Treat compound fracture of lower leg and lacerated wound of thigh; teams from North Lake, Morris and Lloyd shafts. Third, Treat man insensible from gas; Stephenson mine team. Fourth, Treat simple fracture of lower leg and wound on side of head; Cliffs shaft team. Fifth, Treat compound fracture of upper arm and bruised forearm and fingers; Salisbury mine team. Sixth, Treat man insensible from drowning, using pulmotor; Negaunee mine team. Seventh, Treat lacerated chest and side, and broken collar bone; Austin mine team. Two- and three-man teams and individual men were then picked at random from the different teams for exhibitions in treating broken bones in all parts of the body, burns, bandaging and carrying injured men.

Toronto

June 8—J. B. Tyrrell, who will report on the territory from the new Provincial boundary through to Port Nelson, which Ontario is to secure from the Dominion, has left Toronto for Winnipeg, from which point he will commence the second stage of his journey. He is accompanied by Ellis Thompson, geologist, and Professor Stewart, who will act as surveyor. Much of the time spent in the north will be devoted to securing data upon the harbor facilities at the mouth of the Nelson River, where Ontario is entitled to a frontage on the river and on Hudson Bay, of 10 miles. The party will then explore along the coast to the southeast, to gain an idea of the best 5-mile strip, to the border of the district of Patricia.

Hon. W. T. White, Canadian Finance Minister, was recently notified that owing to the scarcity of cement, paving and construction companies in western Canada are unable to obtain this material in sufficient quantities to fill their contracts, and that serious business loss and public inconvenience will result unless conditions are remedied. It is stated that Western contractors have been forced to place heavy orders in the United States and to pay the high duty involved. A suspension or reduction of the tariff is suggested as a remedy. F. P. Jones, general manager of the Canada Cement Co. was summoned from Montreal to confer with the government and took the ground that the difficulty was the shortage of transportation facilities. He stated that the company had 1,000,000 bbl. ready for shipment but was unable to get cars. The government is making a full investigation and the Finance Minister promises to announce the result in a few days.

The Mining News

The Current History of Mining

Alaska

Volcanic activity started June 6 in the Aleutian and Alaskan Ranges. Mt. Katmai was reported in eruption, covering villages on Kodiak and Woody Islands with a foot of ashes. Mt. Hayes, southeast of Fairbanks, is also believed to have been a center of disturbance.

Alaska-United—During April the mills crushed 37,464 tons of ore, yielding \$85,287 gross and net \$26,430. Operating expenses were \$47,900; construction, \$10,957; development, 617 ft. The ore averaged \$2.57 per ton at the Ready Bullion mill and \$2.04 at the 700 claim.

Alaska-Mexican—During April the mill crushed 19,152 tons of ore, yielding \$57,058 gross and net \$17,525. Operating expenses were \$31,347; construction, \$8,85; development, 176 ft. The ore averaged \$3.01 per ton.

CORDOVA DISTRICT

There is a larger number of "hard-rock" prospectors operating along the Copper River & Northwestern Ry. this season that ever before. Some good prospects in silver, gold and iron are being worked. Early this spring large shipments of hydraulic machinery were made, consigned to G. H. Birch, manager of the Dan Creek Mining Co., and George Max Esterly, who is operating on Chittitu Creek, 20 miles from the end of the railroad.

YUKON TERRITORY

New Atlas Mining Co.—This company, which last March bonded a group including the principal mineral claims in the Whitehorse copper camp, southern Yukon, has been shipping ore by the White Pass & Yukon R.R. to Skagway, Alaska. W. D. Greenough is manager, and John Mocine superintendent. By May 15 more than 2000 tons of ore had been delivered into the dock bunkers at Skagway and 1000 tons shipped to the Tacoma smeltery. Machinery is being put in on the Valerie claim, but as yet production is from the Pueblo only. R. G. McConnell, of the Geological Survey of Canada has reported that the Pueblo orebody consists of an impure mass of hematite, 300 ft., long, with a maximum width of 170 ft. The surface section measures approximately 33,000 sq. ft. The orebody has been proved to a depth of 100 ft. The company claims 412,500 tons above the 100-ft. level, with a probable average copper content of 3%; the gold and silver value is small, probably about \$1 per ton.

Arizona

GILA COUNTY

Activity is being displayed in the old silver camps in the Apache Mountains, about 12 miles northeast of Globe. The McNorris mine in Richmond basin, a producer of silver in the 70's and as late as 1882, is being reopened by W. D. Fisk of Globe, and associates. A new gasoline hoist has been installed and the 800-ft. shaft has been retimbered for 160 ft. George Wilson is superintendent. John Mitchell and Edward Casson are working Fred Hefty's group of 12 claims under bond and lease. These claims adjoin those of the McMillen-Stonewall company. The Rice brothers are developing the Buckeye group and Lee Ikenberry is taking high-grade silver ore from his claims in Richmond Basin. Edward Simonton is mining rich silver ore on the claims leased from P. W. Gallentine. Earnest efforts are being made to develop this district, with possibilities of success.

Miami—May production was about 2,700,000 lb. of copper, a slight increase over April. Development work for May totaled 5627 ft. Diamond-drill hole No. 1 disclosed commercial ore for over 200 ft. below the 570-ft. level, which is 150 ft. more than has ever been estimated. Work will start soon on a new machine shop near No. 4 shaft, and the foundation is in for a second 500,000-gal. mill-water supply tank. The mill is now using nearly 2,000,000 gal. per day. About 900 men are employed, 500 underground.

Inspiration Consolidated—The concrete work on the dam across Pinal Creek has been finished and grading will be started for the pumping station. Engineers are making the location survey for the spur from the Arizona Eastern R.R. to the mine and millsite, and contractors are figuring on the grading and construction. Grading on the site of the working shafts continues and three development shafts are being sunk to greater depth. About 2500 ft. of drifts and raises were driven in ore last month, the ore being hoisted through the Joe Bush shaft. About 400 men are employed.

Southwestern Miami—Considerable difficulty has been experienced in the churn-drilling for the last two weeks, but the work is now proceeding satisfactorily. Holes 4, 5, 6 and 7 are 585, 675, 520 and 230 ft. deep, respectively. No. 4 has been temporarily discontinued and the drill has been moved nearer to the Live

Oak line, where Hole No. 8 has been started. None of the holes are in ore.

South Live Oak—There has been considerable trouble recently on account of caving ground and losing the tools in the hole; the latter is at about the same depth as last week, 640 feet.

Old Dominion—The May production of the smeltery amounted to 2,160,000 lb. of copper. Production of ore was at about the same rate as for the previous month, there being no attempt to meet the prevailing price of copper with increased production until after the capacity of the concentrator has been increased and other improvements made. An average of 2½ furnaces were in operation during the month. The foundations are in for the new flue and dust chamber at the converter plant and the steel has been shipped. Plans are now being worked out for equipping the shaft for hoisting the ore in skips instead of cages, the change to be made without interfering with hoisting or curtailing production. H. Kenyon Burch is working on the plans for doubling the capacity of the concentrator. An order is being placed with the Power & Mining Machinery Co. for a large converter stand and two shells that will take the place of the three small stands now in use. The shells will be of the Great Falls type, electrically operated; basic lining will be used. The concreting of the fourth section of the Kingdon shaft of the United Globe mine is finished, making a total of 710 ft. of completed concrete lining. The temporary timbering for the fifth and last section, of 290 ft., has been started. Paul Michaelson and C. H. Weideman are the contracting engineers.

PIMA COUNTY

Pioneer—The blast furnace is being changed to use coke instead of oil, smelting with the latter fuel having proved too slow.

SANTA CRUZ COUNTY

Copper Queen—Engineers representing this company are reported recently to have examined and acquired copper claims near Patagonia.

YUMA COUNTY

Arizona-Nevada—This company operating in the Castle Dome district has recently received machinery for a 100-ton concentrator. Development of an old silver-lead mine has been going on steadily. Ore has been developed on the 200 level and work is being done on the 300.

California

AMADOR COUNTY

Kennedy—It is reported that the company has purchased the Barton ranch adjoining the Jackson cemetery and east of the Bright estate, which the company purchased in 1910. The Barton field is situated on the East belt and is believed to contain a continuation of the Zeila vein. Webb Smith, of Jackson, is superintendent.

Zeila—That part of the mine which extends under the surface of Fleming ranch is reported to have been abandoned as regards extraction and development and the machinery taken out. There are other orebodies developed. W. F. Detert, of Jackson, is manager.

Plymouth Consolidated—The unwatering of the Pacific shaft has extended to the 1600-ft. point. This shaft is 1650 ft. deep, and the unwatering has practically drained the drifts of the Empire and Pacific shafts. It is expected that exploration will soon be in progress. J. F. Parks, of Plymouth, is superintendent.

Bunker Hill—A new steel gallow-frame is contemplated. The present wooden frame has been in use for many years. E. Hampton, Amador City, is superintendent.

South Amador—The new compressor has arrived.

CALAVERAS COUNTY

The construction of an electric railway between San Andreas and Valley Springs is contemplated. The installation of automobiles for passenger and freight service is also being considered. Either the electric or the auto service will be equal to the demands. The present auto-stage service runs from Angels by way of San Andreas to Valley Springs. Auto-truck service connecting San Andreas and the surrounding mining sections with the railroad would aid largely in developing and reopening old mining claims that cannot be economically worked without reasonable hauling rates.

Calaveras Mining Co.—This company, operating copper mines at Copperopolis, is installing four Speedwell 6-ton auto trucks to haul ore to the railroad at Milton, and to haul fuel oil to the mine. The oil tank and ore compartment fitted on the body of the truck was designed by R. Harry Croninger, a San Francisco representative of the Speedwell Motor Car Co. A triangular-shaped steel tank rests on the floor of the truck, and the body forming the ore-carrying compartment is built around it. The body of the truck is 15 ft. long and 6 ft. wide.

INYO COUNTY

Bishop Creek Milling Co.—The company is erecting the first unit of 10 stamps. These will weigh 1250 lb. each.

The El Oro mortars will weigh 9000 lb., and will be set on concrete foundations with interchangeable foundation bolts. The other equipment will depend upon experiments.

Southern Belle—This company near Laws is selling its 10 stamps and accessories.

Salt Valley Co.—A long aerial tramway is being installed to transport salt to the railroad.

KERN COUNTY

Rattlesnake—Ten tons of good ore have been mined on a lease on this property in the Stringer district, and are ready for milling. R. Roschl and James Burns are the leasers.

Gold & Platinum Extraction—This company, operating in the Stringer district near Randsburg, is reported to have finished a test run with satisfactory results. No definite information is given out. Improvements are being made in the machinery.

NEVADA COUNTY

Pennsylvania—Installation of a cyanide plant to treat the tailings is being considered. George W. Starr is manager.

Union Hill—Electric motors have been ordered for running the compressor and pump. Clifford Graham is superintendent and Arthur Doe manager.

Empire—Arrangements have been made to operate the hoist by electric instead of by water power. Frank R. Hull is superintendent.

Idaho-Maryland—Arrangements have been made to put in electric power to run the mill, compressor and pump, in place of water power. Robert Nye is superintendent.

Golden Gate—The addition of 10 stamps is contemplated. C. C. Haub is manager.

Montana—Arrangements have been made to change from water to electric power. Arthur W. Hoge is manager.

PLUMAS COUNTY

Alaska and Seattle men are said to have secured options on 800 acres of land in Indian Valley, near Greenville, which will be drilled as prospective dredging ground. The Altoona Mining Syndicate has bonded or taken options on similar lands known as the Hudson, the Lawrence and other ranches. The men concerned are Col. J. W. Bailey, Lincoln Davis, F. D. Wilson, P. H. Bailey, A. A. Taubeneck and J. M. Wiswold. Other prospective dredging lands are to be prospected with Keystone drills near Clio, on the middle fork of Feather River.

SHASTA COUNTY

Afterthought—A trust deed for \$800,000 to the Security Trust Co., of Indian-

apolis, has been filed at Redding by this company. The money is to be used in the extension of the Anderson & Bella Vista R.R. from Bella Vista to Ingot, 13 miles, provided the negotiations for the road from Anderson to Bella Vista are consummated. The purpose of reopening the mine is to recover the zinc contents as the chief product.

Mt. Shasta Power Co.—The tunnel at the big bend of Pit River is being advanced from both ends. About one-half mile of this tunnel is reported completed. The full length will be approximately six miles. W. A. Cooper, of Montgomery Creek, is manager.

SIERRA COUNTY

Goodyear Bar—A vein of commercial asbestos has been opened on this serpentine belt by William Casserly.

Bear Creek—At this Forest mine, the recent cleanup yielded \$150 per ton of ore crushed. The vein at the 150-ft. level is over 3 ft. wide. John Andrews and associates are the owners and operators.

Oxford—This Downieville mine, on the same serpentine belt as the Tightner, York and Sierra Standard, has been bonded to Charles W. Morse, who is connected with the Tightner mine, at Alleghany, and the North Star mine, at Grass Valley.

TUOLUMNE COUNTY

Eagle-Shawmut—Fifty stamps are operating on ore from below the 2000-ft. level. An additional roasting furnace for the chlorination plant has been received and will be installed.

Dutch—The mill contains 40 stamps, eight Johnston concentrators and 10 Fruevanners, and is operated by electric power. A 7-drill Leyner compressor has been installed and an electric hoist is contemplated. A new Ward drill sharpener and forge have also been installed. Charles H. Segerstrom is superintendent.

Colorado

BOULDER COUNTY

The Prussian 75-ton mill at Roena has been remodeled and is in commission again. Monell concentrating tables and slimers were added.

Lee S.—This mine at Sunset has developed some smelting ore. The erection of a small mill is contemplated to treat low-grade ore.

Reppie—This mine at Sugarloaf, is preparing to resume operations. Equipment includes a steam plant, compressor and air drills. The mine is developed by a 220-ft. inclined shaft which will be sunk 200 ft. deeper.

Colorado Metals & Chemical Co.—The company has remodeled the Bailey mill at Eldora from a chlorination to a cyanide plant of 50 tons capacity.

CLEAR CREEK COUNTY

Golden Empire—This company operating at Empire is driving the Denver City Tunnel on Cordove Mountain. E. D. Payne is manager.

Old Town—This company performed 120 ft. of development in May. G. K. Kimball is manager.

Bride—J. J. Hoban and E. D. Payne are reported to have leased this mine with the intention of operating it through the Idaho tunnel. Hoisting equipment will be required.

Stanley—The fifth level south was advanced 114 ft. in May. It may be opened an additional 1500 ft. to prospect the Stanley vein. The Road adit is being placed in working order. The Salisbury 50-ton mill is treating ore from development. The mines are unwatered to the sixth level. All pumping is done with compressed air, obtained with hydraulic power. This equipment may be used eventually for drilling purposes and electric pumping facilities provided.

LAKE COUNTY-LEADVILLE

The Lake County placer diggings are all busy again, and gold in pay quantities is being recovered. In California Gulch the old Tom Star placer worked since 1860, seems to get a new store of gold every winter and is again paying good wages. At the head of Cranes Park, the placers on Tennessee Creek are said to be paying, and at Tennessee Pass Maupin Brothers are taking out coarse gold from their placer diggings; all this work is being done with the old-fashioned flume and riffles.

Dinero Tunnel—Thirty men are employed and the ore being sent to the smeltery is said to yield about 84 oz. silver per ton.

New Dome—One hundred tons of good grade carbonate-of-zinc ore have been shipped.

Yak Tunnel—Seventy-five tons per day of iron-sulphide ore are being shipped from the lower levels of the Louisville shaft, sunk below the Yak Tunnel level by the owners, Hanifen & Reynolds.

OURAY COUNTY

Tomboy—During May the mill crushed 8400 tons of ore, yielding a total of \$81,500. Expenses were \$41,000; profit, 40,500 and \$14,361 were spent on permanent improvement.

SAN JUAN DISTRICT

Mineral Farm—This mine on the outskirts of Ouray, owned by Mr. Lucas of St. Louis, has been closed down for a long time, but it is now to be reopened and this, as in many other cases in the state, is due to improved methods of ore treatment. Though noted for its rich silver ore, the trouble was that it was chiefly an argentiferous gray copper in a baryta

gangue, the medium and lower grades of which could not be concentrated. It is reported that the gray copper has been successfully separated from the gangue by the H. E. Wood & Co. flotation process, at their testing works, and that better results have been attained than by any wet process hitherto tried. Mr. Lucas has men at work at the mine.

Doyle Consolidated—This company, near Mancos, is at work again under W. M. Mauat, superintendent, and the mill, under the superintendence of J. H. Bills, will soon be treating 25 tons of ore per day. Two burro trains are packing supplies, coal and wood over three miles of snow to the mines and this spirit seems to pervade the mining camps of the entire San Juan region.

Mickey Breen—This mine up Poughkeepsie Creek, near Ouray, has commenced shipping concentrates to the smeltery. It is stated that the mill is turning out a product yielding 75% lead and 40% zinc with good gold and silver contents. This mine is being operated by the Haagsma-Hall Mining Company.

TELLER COUNTY—CRIPPLE CREEK

Press reports state that the El Paso, Mary McKinney and Henry Adney mines are to be combined under one management. It is further said that ground for a reduction plant to treat the low-grade ores has been purchased and that plans for the mill are under consideration.

Gold Dollar—In the annual report of H. L. Shepherd, president, it is stated that 30 sets of lessees are at work on this Beacon Hill mine and that the net amount of cash paid into the treasury since the last report is \$39,847 with \$29,064 cash on hand. In driving the 10th and 11th levels most of the work has been in ore and about half of it is of smelting grade. Since the completion of the deep drainage tunnel, it will be possible to sink the main shaft another 100 ft. without reaching water.

El Paso—It is announced by Charles M. Heberton, vice-president, that 400,000 shares of stock have been sold to German and Swiss men, this block representing the holdings of the Bernard-Beaty faction, who fought so hard for the control at the last election and lost to Allan Burris, now president. The deal was made by Joseph Walker & Sons, of New York.

Mary McKinney—The output for May was 45 cars or about 1400 tons of ore averaging about 2 oz. gold per ton. The main shaft, now 820 ft. deep, will be sunk 130 ft. deeper on the Republic claim. Lessees on the Howard shaft on the Grace Greenwood and other blocks are making a good production.

Mountain Beauty—Hatcher brothers, of Goldfield, have installed a 15-hp. electric hoist at this mine, to hoist ore from a depth of 250 feet.

Idaho

BLAINE COUNTY

Croesus—A 200-ft. winze has been sunk from the 800 level and good lead-silver ore opened. W. D. Mouck is in charge. The property is equipped with stamps, tables and vanners.

Elkhorn—These mines, near Ketchum, are being prospected by a syndicate, headed by Colonel Hardess, formerly superintendent of the Ketchum smeltery. Work has been in progress for two years with 25 men. Equipment includes a 50-hp. Diesel oil engine and a compressor.

Idaho Consolidated—This company, owning the Minnie Moore mine, once owned by Charles M. Schwab, is in the hands of J. J. Donovan, receiver. Equipment includes an 800-hp. steel and concrete hydro-electric plant.

Michigan

COPPER

Old Colony—Reports state that hole No. 14 is 1453 ft. deep and that the drill has passed through several alternate beds, showing some copper. No. 15 is in trap at 1140 feet.

Hancock—At 3650-ft. depth, the vertical shaft has disclosed some copper on the foot-wall side.

Adventure—The crosscut from No. 2 to No. 3 lode disclosed copper at 850 ft. from the shaft, close to No. 3 lode; but it is reported that it is still insufficient to identify it as No. 3 lode.

Algonquin—This company has been organized by R. C. Pryor, of Houghton, and Hayden, Stone & Co. and Payne Webber & Co. of Boston. Capitalization is \$3,750,000, par \$25. A tract of about 11,000 acres of land has been acquired in Matchwood township, Ontonagon County.

IRON

Chatham—At this Oglebay-Norton mine at Iron River, a balanced-hoisting system, using two skips, has been installed in the shaft where a single skip was used before. The same drum will serve, but a new cable is required. It is planned to equip the boilers with a Tilden automatic damper for regulating the draught; also a new 30x60-ft. machine shop is planned. Frank Smith, formerly at the Buckeye mine, Commonwealth, is superintendent.

Colby—Corrigan-McKinney & Co. have added 130 men to the force at this mine at Bessemer.

Newport Mining Co.—This Gogebic range company is establishing logging camps at Newport Siding, for cutting mining timber.

Imperial—Shipping from stockpile has been started from this Cleveland-Cliffs mine at Michigamme, although underground operations are at a standstill.

Rolling Mill—At this mine of Jones & Laughlin, in the Negaunee basin, a new wooden headframe is being constructed over the No. 2 shaft. The material used is Washington fir.

Jones & Laughlin—The machinery from the Gogebic range properties of this company has been transferred to Iron River, as the operations on the Gogebic range have ceased. The Iron River mine has a 10x12-ft. shaft down 200 ft. and a drift on the first level at 175 ft. depth has reached the ore. About 50 men are employed.

Volunteer Ore Co.—Shipping is being done from the Maitland shaft and 200 tons per day of soft bessemer ore are being forwarded. No stockpile shipments have been made yet.

Zimmerman—This mine expects to hoist ore from the new No. 2 shaft soon. This shaft is 240 ft. deep and drifting to the orebody has been in progress for several months.

Minnesota

Great Northern—The company has awarded the contract for stripping Section 27 to Winston & Dear. It is reported one of the largest contracts awarded on the Mesabi Range for several years, amounting to about 7,000,000 cu.yd. of overburden. The property is also known as the Adams mine and adjoins the Monroe-Tenner, near Chisholm.

Montana

BUTTE DISTRICT

Anaconda—At the Pennsylvania mine, 750 ft. of advance work on the levels were done during May. Of this raising constituted 80 ft., crosscutting 175 ft. and drifting 495 ft. The enlarging of the air shaft from the 1600-ft. level to surface, by cutting out a third compartment on the east side, has advanced from the 1600- to the 800-ft. level. When this is completed, a large compressed-air hoist will be installed, and two compartments will be used in hoisting ore in addition to the main shaft. No skips will be used at present in the air shaft, but the ore will be hoisted in mine cars on double-deck cages.

Butte-Bataklava—The company recently held its annual meeting in Duluth, and elected George C. Swallow, of Milwaukee, president, in place of P. H. Nelson, who resigned. Mr. Nelson has been at the head of the company for a number of years, and has given much time to its affairs. At the meeting the directors were authorized to raise \$100,000 by debenture notes, for further development, and to defend the Anaconda suit. Development is now being done on one of the veins not involved in the suit.

Butte Copper—A special meeting of stockholders will be held, June 8, to elect a new board of five directors. The com-

pany owns 35 acres, comprising the Trifle, Anselmo Nos. 1 and 2, and a part interest in the Robert Emmet claims, Nos. 1 and 2, situated directly west of the Anaconda's Gagnon mine. On the Trifle claim, a shaft was sunk to a depth of 700 ft. and there is a shaft 300 ft. deep on the Robert Emmet. Since July, 1907, nothing has been done.

Pilot-Butte—For further developing the property, subscriptions for \$100,000 additional stock have just been made by Edward Hickey, president of the Tuolumne company, N. J. Bienlenberg and others, of Butte. The funds will be used in sinking the shaft to the 2000-ft. level, from which point crosscutting will be started.

JEFFERSON COUNTY

Butte-Corbin—It is reported that officers of the company have been conferring with officials of the Great Northern R.R., relative to the laying of sidetracks on the property, at Corbin. Good ore was found in the mine some time ago, and H. Burnson, of Salt Lake City, consulting engineer for the company, has just finished an inspection of the property.

MADISON COUNTY

Bell—A lease has been taken on the Grant 15-stamp mill, by S. J. Bukvich, who recently purchased the Bell mine, near Virginia City. Mr. Bukvich will keep the mill running steadily on his ore, and men are now preparing it for operation, and repairing the road from the mine to the mill. By the end of June the owner expects to have about 40 men at work in the mine and mill. Nine men are now getting out ore for the stockpile.

Nevada

COMSTOCK LODGE

Consolidated Virginia—A cleanup has been made of the ore accumulated from development work on the 2400-ft. level, and the bullion and concentrate were shipped last week from the Kinkead mill. The bullion was valued at \$2300 and the 22 tons of concentrates at about \$12,000. On the 2300-ft. level, the south drift, a short distance east of the foot wall of the main Comstock vein, is now in about 3 ft. of quartz, with occasional bunches of ore. This drift is 100 ft. west of the main south drift leading to Best & Belcher ground, and will develop virgin territory under the bonanza stopes.

Mexican—The cash return from the smeltery, on 12 bars of bullion shipped May 24, netted the company slightly over \$39,000. The new clarifiers for the 100-ton mill are being set up and connections made. This addition is expected to bring the capacity up to 100 tons per day and give a higher percentage of ex-

traction, which has averaged 90%, according to the weekly mill reports.

Union Consolidated—North and south drifts have been started in the east vein at a point where it was cut by the main crosscut from the 2500 station of the joint Union and Sierra Nevada winze. Going in a northerly direction the vein is 8 ft. wide, and face samples at a point 10 ft. in, give average assays of from \$5 to \$10 per ton.

Belcher—A north drift has been started in east crosscut No. 4, on the 1400-ft. level, on the 15-in. stringer of milling ore, and the vein continues to give the same width, dip and strike as found in the crosscut. This stringer is 90 ft. east of some of the early-day stopes that yielded a large quantity of high-grade ore.

Ophir—Complete returns have been received on the last run of ore at the Kinkead mill, and the net cash yield from the smeltery, from bullion and concentrates, was \$48,697. The south drift on the 2100-ft. level is advancing in the West vein formation and is opening ground south of the famous Hardy-vein stopes.

ELKO COUNTY

Bluster—The orebody on the south drift of No. 1 tunnel has been crosscut for 23 ft., the average grade being about \$15 per ton. The new ore on No. 2 level has been found to be 6 ft. wide, yielding about \$40 per ton.

Success—Nothing has been done in this mine since George Wingfield released it. He opened it with over 1200 ft. of underground workings, exposing three oreshoots, carrying \$12 ore. Tonopah men have a bond on the mine and are now investigating it.

Alpha—The Chicago company, now in charge of this property, is doing development with satisfactory results. A gasoline hoist is being placed at the shaft. The latter is 85 ft. deep.

Log Cabin—The development and drainage tunnel being run through the mountain from this claim, is in 80 ft., and has cut the first indications of vein matter.

Jarbridge-Nevada—The tunnel is in about 500 ft.; a gasoline engine has been ordered to run a blower for ventilation.

ESMERALDA COUNTY

Goldfield Merger—With the new hoisting equipment, shaft sinking is nearing the 1100-ft. point. It was originally planned to cut a station to accommodate stationary pumps, etc., at the 1000-ft. point, but as the volume of water encountered thus far is not a serious hindrance, it has been decided to defer this work.

Atlanta—The reorganization of the company having recently been effected,

the new officials are considering the future operation of the property. It is probable that the mine will be explored at depth by a long crosscut from the bottom of the Grizzly Bear shaft of the Consolidated.

Lone Star—The shaft is nearing the 200-ft. point. It is the intention to sink to a depth of 250 ft., from which point drifting and crosscutting will be done.

Florence—The rich strike made in virgin ground on the 250 level, has improved with exploration. The vein has a total width of 11½ ft. Samples from across 3½ ft. next to the hanging wall, gave an assay of more than \$1000 per ton, while the remaining 8 ft. against the foot wall averaged more than \$20 per ton. A raise on the orebody from the 250 level and a crosscut to get under it on the 350 level will be started soon.

Pittsburgh-Silver Peak—The miners at Blair, struck June 1, when a reduction in pay to practically that of Goldfield became effective. The company officials were prepared and operations have not been seriously hampered.

EUREKA COUNTY

Mount Hope Mines Co.—This company has been organized to develop the Good Hope mines in the Mount Hope district. The ore contains lead and zinc sulphides. Walter Whitmore is superintendent.

Nevada Central Copper Co.—This company, operating in the Antelope district, has developed a quantity of oxides and carbonates. Electric drills and alternator have been received and are in operation. Extensive exploration and development are planned. H. A. Linke, Cedar, via Palisade, is superintendent.

Credo-Eureka—The company has taken an option on 30 claims at Adams Hill and is retimbering the old 400-ft. shaft. Drifting and crosscutting will be done to explore for lead-silver ore.

NYE COUNTY

Shipments in tons from Tonopah mines to date and for the week ended May 30, are as follows:

Mines	Week	Year to Date
Tonopah Mining.....	3,600	72,569
Tonopah Belmont.....	1,850	44,826
Montana-Tonopah.....	1,094	22,440
Tonopah Extension.....	1,030	21,132
West End.....	667	15,601
Midway.....		180
MacNamara.....	455	7,725
North Star.....		80
Totals.....	8,696	184,553
Estimated value.....	\$217,400	

WHITE PINE COUNTY

Nevada Consolidated—During May, 314,137 tons of ore were milled at the Steptoe plant, the record tonnage for one month. The 250-ft. smokestack serving the McDougall roasters is cracked and will be replaced. The old one may be dynamited after the new one has been constructed.

New Jersey

American Smelting & Refining Co.—A strike is in progress at the company's refinery, at Perth Amboy. E. M. Faircloth, assistant cashier, and two foremen are said to have been injured in attempting to leave the plant.

New Mexico

SANTA FE COUNTY

Santa Fe—A traction engine outfit was purchased recently and is expected to reduce transportation costs materially. It is expected to smelt 3600 tons of ore per month, for six months starting July 15.

SOCORRO COUNTY

Case Resmelting Co.—This company, formed in El Paso recently, has purchased the old Federal smeltery, near Highland Park, on the El Paso & Southwestern R.R., and has shipped the entire lot of machinery to Socorro, where it will be erected. The old slag dumps, purchased by the company, will be resmelted. The smeltery was purchased from the National Dry Kiln Co., which received it from the holdings of the late Col. W. C. Greene.

Amador—A shipment of high-grade ore is being taken out for treatment in the custom mill.

Deep Down—Leasers on this property sent 85 tons of ore to the Deadwood mill during the last week.

Oregon

Rainbow—Construction has started on a new mill that will contain 15 stamps and one tube mill. Simple amalgamation and cyanidation will be the process. Kelly filter presses and Merrill zinc-dust precipitation will be used. The mill will be electrically operated with power from the Idaho-Oregon Light & Power Co.'s substation, at Gypsum. The machinery should be on the ground within two months. H. S. Lee, Rye Valley, is superintendent, and A. P. Anderson is mining engineer.

Utah

BEAVER COUNTY

The South Utah, Horn Silver, Moscow, Majestic and Red Warrior mines are making regular shipments. New copper discoveries are reported about 30 miles northeast of Newhouse.

Majestic—Returns on ore from the Old Hickory mine recently showed 3.8% copper, 2 oz. silver and 42.5% iron. During May seven cars were shipped. A compressor will be moved from the Harrington-Hickory and installed, and an electric power line brought in soon.

Horn Silver—From seven to ten cars per week are being shipped, mostly from the stope filling formerly considered waste. The 10-drill compressor is being overhauled.

GRAND COUNTY

Eastern oil men, who have been operating at Bakersfield, Calif., have arranged to drive three wells on claims seven miles east of Green River. Drilling rigs will be brought from Bakersfield, with a capacity for deep drilling. Several drilling rigs are reported to be on the way to the San Rafael Swell oil field near Green River.

Moab Oil—A well sunk by this company in the Klondike field is down 400 ft. The ground is caving, and work has been suspended awaiting the arrival of casing. Some gas has been encountered.

JUAB COUNTY

Tintic shipments for the week ended May 24 were 161 cars. This is a gain of about 350 tons over the preceding week. For the week ended May 31, 165 cars were shipped.

Iron Blossom—Connections have been completed on the 200-ft. level of the No. 1 shaft, around the portion damaged by the cave-in. Most of the machinery for the new hoist at the No. 1 workings has been delivered. One piece weighs 13 tons and may require a special outfit to haul it. On June 1, the company had \$175,000 cash on hand.

May Day—The ore recently encountered on the 1000-ft. level is considered of much importance by the company. A new smelting contract has been made by which ore carrying zinc can be marketed. This is to be shipped to Bartelsville, Oklahoma.

Dragon Consolidated—Gold-copper ore has been opened in the northern part of the property, next to the Iron Blossom ground. Diamond drilling is to be done.

Eagle & Blue Bell—The new orebody, first found on the 700, is being developed and appears to be independent of the deposit, which has been mined to the 1200-ft. level and lower.

Uncle Sam—At the annual meeting held May 20, the former board of directors was reelected. Ore sales during the year brought in \$53,103. Cash on hand, June 3, 1912, was \$16,664. There were shipped 3114 dry tons of ore, bringing average net smeltery returns of \$17.05 per ton. Some zinc ore was developed.

Utah Consolidated—Forces have been increased, and two shifts are to be worked. Mineralized ground has been entered by the drift from the main level.

Black Jack—About 100 tons of ore were shipped as the result of a cleanup of the orebins.

SALT LAKE COUNTY

Columbus Consolidated—Ore was cut, May 23, by raising from the west side of the 400-ft. level, and has been opened for 16 ft. It is understood that the mill

will be overhauled and brought up to a daily capacity of 100 tons. Some new equipment will probably be added. A large body of concentrating ore is available back of the old upper stopes. Development is under way to reach the Holland oreshoot on the 400 level.

Flagstaff—Work will be resumed soon at this Alta property.

Alta Consolidated—Carbonate shipping ore has been opened by a raise from the 125-ft. point above the tunnel. The tunnel is being driven for the contact, on which the ore was found. When the roads are opened, it is hoped to be able to maintain shipments.

Utah Mines Coalition—Notice has been sent to stockholders that this company's property has been sold and transferred to the Michigan-Utah Mining Co. The Coalition company's stock is transferable into Michigan-Utah stock on the basis of two shares of Coalition for one of Michigan-Utah.

Maxfield—Leasers have about eight tons of carefully sorted ore, which it is expected will bring \$65 per ton. This came from raises above the main tunnel level.

Virginia

A new pyrite mine is being opened, about 2½ miles northeast of the Arminius mine. It is partly owned and operated by Capt. B. F. Hand, Washington, D. C. The mine is about five miles northeast of Mineral, on the Chesapeake & Ohio Railroad.

Washington

Crescent Mining Co.—This company, at Twisp, Okanogan County, has 42 claims. Of these, 38 contain copper showings and four gold. On the copper property, a tunnel has been driving for two years and an electric plant is now being installed to run heavy drills. Development meanwhile is concentrated on the gold claims. Frank R. Creighton, Twisp, is manager, and D. C. McFee, president, is at the company's offices, in Winnipeg, Manitoba.

Wisconsin

Frontier Mining Co.—The company is developing the Hird and Sedgewick properties and has proved a run of zinc ore on the Samuel Birbeck land, at Days Sid-ing.

Wisconsin Zinc Co.—The company has leased the Grey land, embracing the "Big Tom" workings and is drilling the tract. It has also struck good zinc-lead ore in the new Wicklow shaft, at 108 feet.

Scrabble Creek—The Vinegar Hill Zinc Co. has finished drilling this land and has commenced underground work in the old shaft.

Canada

BRITISH COLUMBIA

Tyee Copper Co.—The Red Cliff Mining Co., of Vancouver, has secured an option on a controlling interest in the shares of this company. The Red Cliff mine is in the Portland Canal division and its ore gold-copper of good grade. The Tyee smeltery has two modern water-jacketed blast furnaces, together about 600 tons capacity.

Slocan Star—The deep-level crosscut being driven was in 1200 ft. on June 1; about 800 ft. more must be driven to reach the orebody.

Kootenay Gold—At the annual meeting of this company, owning the Granite-Poorman gold mines, near Nelson, West Kootenay, it was reported that in the last fiscal year 1900 ft. of development work had been done and more than 10,000 tons of ore crushed. The year's operations showed a loss, but in each month of this year a profit has been made.

ONTARIO

J. D. Grant, who claims to have found diamonds on the east shore of Hudson Bay, has gone north with a party to Cochrane, where they will outfit for an expedition to prospect the Hudson Bay region.

ONTARIO—COBALT

Shipments of ore and concentrates, in tons, from Cobalt for the week ended June 7, and for the year to date, are:

La Rose.....	32.29	1,491.55
Coniagas.....	76.32	889.82
O'Brien.....		263.24
Right of Way.....		148.60
Chambers-Ferland.....	32.00	225.60
McKinley-Darragh.....	68.64	1,209.00
Nipissing.....	76.10	901.28
Hudson Bay.....		312.62
Ruffalo.....	32.80	472.87
Crown Reserve.....		210.26
Cobalt Townsite.....		536.78
City of Cobalt.....		145.84
Trethewey.....	33.65	241.04
Colonial.....		41.60
Kerr Lake.....		319.66
Cobalt Lake.....		207.41
Drummond.....		318.77
Temiskaming.....	32.90	416.87
Beaver.....		187.89
Wettlaufer.....		111.21
Provincial.....		22.22
Casey Cobalt.....		24.50
Totals.....	389.71	8,575.23

Bullion shipments in ounces

Nipissing.....	73,378.00	1,661,141.75
Temiskaming.....	2,331.00	2,331.00

Fire is reported on June 5 to have destroyed a portion of the town of Cobalt.

Coniagas—This company has decided to prospect that portion of the property which lies underneath the town of Cobalt. A crosscut is being driven from the 225-ft. level toward the southern boundary, from which a drift will be run toward an old shaft put down to 60 ft., which will be reached by a raise.

La Rose—It is stated that this company is considering the purchase of the Chambers-Ferland property. Work on the Fischer-Eplett is progressing satisfactorily with good results. Sinking is to be carried to the 600-ft. level.

ONTARIO—PORCUPINE

Pearl Lake—The syndicate of American men who have secured control has resumed operations on this property. The shaft is to be put down to the 800-ft. level and the crosscut started at the 400-ft. level is to be continued until the ore zone is reached.

Porcupine Lake—Satisfactory results having been obtained by diamond drilling, a power plant will be installed and preparations made to sink a shaft.

Hughes—The compressor plant is being installed and the underground working force has been considerably reduced until power is available.

Swastika—A crosscut is being driven from the 400-ft. level, which should intercept the vein in about 30 feet.

Lucky Cross—A few men are working on this property, at Swastika. The grade of the ore is erratic and it is stated that funds are low.

Tough—Good discoveries have been made recently on this Swastika property, which is under option to Haileybury men.

Benson—Good ore has been discovered on this property, in Turnbull Township.

Dane—Considerable work is to be done on this copper property, a few miles from Swastika. Two shafts are being sunk to the 100-ft. level, from which point drifts and crosscuts will be run

Mexico

HIDALGO

Cortez—Olaf Wenstrom, manager and consulting engineer, has returned to Boston from a five months' stay at the properties and reports that work has not been interrupted by the revolution. During 1911, an average of 700 ft. of development per month was done and 259 men, exclusive of staff, were employed. Some additional properties at Zimapan, Bonanza and Pechuga have been acquired and the company now has claims in four districts, aggregating 4200 acres. Actual mining is being confined to the Jacala property; the new acquisitions are being surveyed and examined by a staff, the headquarters being in Zimapan.

MEXICO

El Oro—During May the mill treated 20,860 tons of ore and 15,350 tons of tailings, yielding bullion worth \$168,820. Working expenses were \$94,150; development, \$21,180 and \$62,910, total profit.

SONORA

Greene-Cananea—During 1911, net earnings were \$1,307,131, compared with \$1,184,750 for 1910. Net profit was \$1,026,951. Total production was 44,897,466 lb. of fine copper, compared with 45,680,145 lb. for 1910. The company purchased a four-fifths interest in the Superior-Bonanza mine, near Imuris.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

COAL TRADE REVIEW

New York, June 12—The coal trade in the West continues rather slow. Demand for steam coal is good but buyers are reluctant to pay the advances asked by the mines. The making of contracts by large consumers is slow and many of them intimate that they will take the chances of the open market rather than make contracts at the higher prices which, consumers claim, are necessary owing to the advance in mine wages.

The Seaboard bituminous trade is slow and the markets are still weighted down by the large supply of coal at tidewater. Prices are consequently heavy and business is anything but active. Coastwise trade is slow. New England buyers are not yet scraping the bottom of their bins, but it is hoped that they will begin to sit up and take notice before the present month ends.

The anthracite trade is in rather a peculiar position. The collieries as a rule are running to 75 or 80% of their capacity, but complain that many laborers left during the suspension and have not yet returned. The demand for domestic coal is light. Dealers and large consumers do not seem inclined to lay in stocks. There is quite a rush for steam sizes, however, and the companies seem hardly able to deal with this. The advance in prices has called out a good deal of comment but there is little doubt that it will be held, in spite of threatened investigations in Philadelphia and elsewhere.

Anthracite shipments in May were 1,429,357 long tons, against 6,317,352 in May, 1911. For the five months ended May 31 the total shipments were 29,094,226 tons in 1911, and 19,905,333 in 1912; a decrease of 9,188,893 tons, or 31.6% this year.

IRON TRADE REVIEW

New York, June 12—No material change can be reported in the iron and steel markets, and the slackening up, usual as midsummer approaches, is not yet in evidence. In fact, an active business is rather expected between now and July 1, owing to the expiration on that date of many contracts.

Specifications are still reported heavy and the mills generally continue busy. The Steel Corporation and the leading independents are working up to something like 95% of capacity, which means practically full. The heaviest business at present is in structural steel, but plates

are also in demand and the business in sheets continue heavy. Jobbers report an excellent business in bars and in smaller material. Prices are well held to the recent levels, but there is no apparent effort to advance them. It is thought that new contracts will be closed at about present rates.

Pig iron is rather quiet. Basic is in fair demand, both in the East and in the West. In Seaboard territory there is still a call for low-grade pig for the pipe foundries. Foundry iron has sold a little better, especially in New England and New Jersey, and the stove makers seem to be laying in stocks. Prices show little or no change, although furnaces are inclined to insist upon 25 or 50c. advance for fourth-quarter deliveries.

The coke market has settled down a little, and prices are steadier. The coke people are complaining of a shortage of labor.

The U. S. Steel Corporation reports unfilled orders on its books, May 31, of 5,750,983 tons, which is an increase of 86,098 tons over Apr. 30. This is the highest report since December, 1909. The small increase over April shows that May shipments were pretty heavy.

The taking of testimony in the Steel Corporation suits was resumed before the master on June 10. The evidence now being given relates to the panic of 1907 and the circumstances which led up to the transfer of the Tennessee Coal, Iron & R.R. Co. to the Steel Corporation. Some of this promises to be of considerable interest in bringing out the inside workings of that operation.

Steel Corporation Extensions—It is stated that the Steel Corporation has appropriated from the proceeds of bonds lately sold about \$19,000,000 for new construction. Of this \$3,000,000 is for additions to the Gary mills; \$6,000,000 for completion of the Minnesota Steel Co. plant at Duluth; \$10,000,000 for remodeling the Edgar Thomson works, including new machinery and the substitution of openhearth furnaces for bessemer converters.

Pig Iron Production—The statements of the blast furnaces, as collected and published by the *Iron Age* show that on June 1 there were 247 coke and anthracite stacks in blast, having an aggregate daily capacity of 81,500 tons, an increase of 1800 tons over May 1. Making allowance for the charcoal furnaces, the estimated production of pig iron in the

United States in May was 2,537,100 long tons; for the five months ended May 31 it was 11,562,800 tons.

Baltimore

June 10—Exports for the week included 3,137,760 lb. steel billets and 254,582 lb. nails to Liverpool. Imports included 500 tons ferromanganese from Rotterdam; 12,870 tons iron ore from Cuba.

Birmingham

June 10—The pig-iron market in Southern territory continues strong, though selling is not as active as it might be. Some of the furnace companies report they are disposing of their iron about as quickly as they are manufacturing it, while others claim they are not yet ready to sell in any quantity for the reason that orders booked for delivery during the third quarter of the year are so large as to make it profitable to hold off for a while. The quotations for pig iron are nearer a \$11.50 per ton basis. No. 2 foundry, than any other figure. The manufacturers of pig iron are confident this price will be the minimum for the fourth quarter and are not willing to enter the market with their probable make for the last three months of the year even at \$11.50 per ton. The production in the Southern territory is about holding steady. For instance, in Alabama the make in May was less than 100 tons under what it was in April, when something over 151,000 tons of iron were produced. There has been an appreciable reduction of accumulated stocks of pig iron in the South, something near 20,000 tons having been moved off the yards during May.

The steel trade is looking up a little; the principal business that is being received is in small lots and mostly from points in the South.

There is slight improvement noted in scrap iron. Charcoal iron holds its own.

Chicago

June 10—General conditions in the iron and steel market continue unchanged. Pig iron is in light and finished products in heavy demand.

The pig-iron market is firm, despite the slack demand. Furnace agents have sold the output well up into the last half and on last-half business continue to demand more than the average melter is willing to pay. No. 2 Southern foundry brings \$11 Birmingham, or \$15.35 Chi-

ago, and No. 2 Northern \$14.50 at furnace on most sales; in some cases 50c. more is paid. The buyers are cautious; they prefer small lots of pig iron, bought often, to large lots bought the usual four to six months ahead.

In finished products there is general activity. Structural material is in good and increasing demand for bridge and building purposes locally and throughout the West; material up to 15 in. remains 1.43c. Railroad supplies, chiefly track fastenings, continue to sell well and standard rails will keep the local mills busy for several months. Bars are active with the mills crowded to make deliveries on time and new business coming in constantly; soft-steel bars sell for 1.38c. and iron bars for 1.25c., with higher prices on some orders. Sheets and plates show the same general conditions, with little need of new business, but with a large demand from consumers. Billets are still scarce and a larger demand.

Cleveland

June 10—Iron ore movement continues very active. Some small sales of ore are reported.

Pig Iron—There is a fair tonnage going, chiefly in small lots. Quotations, Cleveland delivery, are \$15.15 for bessemer, \$13.50 for No. 2 foundry and \$13 for forge.

Finished Material—The same story is heard everywhere, heavy specifications on contracts, but new orders rather light. More new business is expected, as many contracts expire with June.

Philadelphia

June 12—Indifference characterizes the pig-iron market because of the previous activity of several weeks which covered the requirements of consumers from two to four months. Quite a number of the smaller requirements were left unfilled and these are now coming forward without inquiry and small lots are being daily ordered to cover the immediate wants. Large consumers in New England who two or three weeks ago closed contracts for all the iron they thought they would want are now in the market again making inquiries which the makers think will result in new business. The fact that so many large furnace concerns are well sold ahead is the basis of the belief that higher prices are assured for the mid-summer months. Large dealings in basic pig have been recently closed and foundry irons are now engaging attention. Forge irons are again under inquiry after a week or two of dullness. Quotations are at \$15.50 for best o. 2 foundry, \$14.75 for gray forge and basic \$15.25 with offers at 25c. less.

Steel Billets—Steel billets are quiet after

two or three weeks of unusual activity and local production has found ready markets outside of this territory.

Bars—Heavy orders have been placed within a few days for bars, and others are under negotiation. Quotations on common iron have been marked up a trifle.

Sheets—Sheets are active and orders are filling the mills, with excellent prospects for an unusual summer.

Pipes and Tubes—Merchant pipe has moved up and good sales have been made for early autumn delivery. Tubes are strong and show an advancing tendency.

Plates—The rush of orders for plates continues. Capacity is well sold up. Advances are threatened but prospective buyers of large quantities indulge in the belief that the mills will accept spring quotations for late fall deliveries.

Structural Material—Large orders for bridge work has been booked this week and inquiries for railroads and other large buyers have unexpectedly appeared.

Scrap—The only activity in scrap worth mentioning is in No. 1 railroad which has been sold at practically yard terms. There is also a better movement in car wheels and steel axles. Prices for all kinds of scrap have moved up in sympathy with other products.

Pittsburgh

June 11—The tone of the steel market is further improved this week, all the indications being that the present activity will last longer than was at first expected. The mills are well sold up and no large amount of new buying could be expected at this time, nevertheless the fact is that there is considerable strictly new business coming in, and this without any material diminution in the volume of specifications against old contracts. Prices are as firm as they were, and in some quarters there is a little greater strength. The advance in merchant pipe and oil-country goods has brought out heavier specifications, and while buying at the new price is exceptional, yet there is some buying of this sort, by consumers who did not have contracts. There is possibility of another advance in pipe July 1. In bars, plates and shapes there is a distinct possibility of an advance within 30 days, presumably of \$1 a ton, which would make bars 1.25c., with 1.30c. for plates and shapes.

The bar, plate and structural mills have actual specifications for 60 to 90 days ahead, and with even quiet conditions are thus assured of full operations for perhaps five months. In tinplates the situation is fully as good, and in sheets nearly as good. In pipe there is actual business on books for nearly 60 days and specifications are certain to be ahead of

shipments during the remainder of this month. In wire the market is slow, but has shown no loss in the past week, which is a good showing for this season.

Pig Iron—The market continues quiet, with the operating furnaces well sold up and prices practically stationary, though showing a tendency to firm up. Sales are noted of 500 tons of bessemer, for early shipment, and 1200 tons of malleable for delivery over second half, the latter at \$13.25, Valley, a trifle higher than could be done on prompt shipment. The Standard Sanitary Manufacturing Co. has just closed for a total of 12,500 tons of foundry grades for third-quarter delivery, this comprising the only activity in foundry iron in the week, and the largest transaction for several weeks. It took a total of 10,000 tons of No. 2, 2000 tons of No. 3 and 500 tons of gray forge from several furnaces in western Pennsylvania and the Valleys, the uniform price at furnace being \$13.25 for the No. 2 and \$13 for the other two grades. These transactions dispel the claims lately made by several furnaces that foundry iron had advanced. Furnaces are not seeking to make sales now, on account of the coke situation. The great majority of operators are trying to get \$2.50 on second-half contracts, but their efforts are not meeting with much success, and their position has been greatly weakened by a decline in prompt coke to \$2. In such circumstances furnaces will hold off from contracting for coke, filling their requirements from time to time by prompt purchases. We quote: Bessemer, \$14.25; basic and malleable, \$13@13.25; No. 2 foundry, \$13.25; forge, \$13, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—Ferromanganese continues scarce, imports being light and sellers behind in deliveries on contract. Consumers are occasionally forced to buy prompt material, at a premium, but are taking the smallest quantities possible. We quote contract at \$48.50 and prompt at about \$55, f.o.b. Baltimore.

Steel—Sales of relatively small lots of billets and sheet bars have been made at advances of about 50c. The market is strong, with only a limited tonnage available, and small billets particularly scarce. The leading sheet interest last week bought about 10,000 tons of sheet bars from a Youngstown mill. We now quote: Billets, \$21.50; sheet bars, \$22, f.o.b. maker's mill, Pittsburgh; billets, \$21; sheet bars, \$22, f.o.b. maker's mill, Youngstown. Rods are \$24.50@25, and are showing a slight stiffening tendency.

Sheets—Mills have canceled considerable tonnage which was due to be specified in May and was not, while they are preparing to make similar cancellations of June tonnage. This is of low-priced material, which could not be duplicated. The price situation is curious, in that the

lowest prices are being made on small lots, sometimes single carloads, and by a few mills. On the other hand, some large contracts are being made, for extended delivery, at full prices—1.95c. for black and 3.00c. for galvanized—and in some cases even at slight premiums. It is distinctly the case that consumers are paying the mills for good service. Operations are as heavy as at any time, representing an average of fully 90% of the available capacity. We quote: Black, 1.90@1.95c.; galvanized, 2.90@3.00c.; blue annealed, 1.40c.; painted corrugated, 2.15c. per lb. and \$1.35 per square; galvanized corrugated, 3.05c. per lb. and \$2.55 per square.

St. Louis

June 10—The market for the past week has shown very little change. The demand is not as heavy as it was and is mostly for small lots. It is natural to have a lull during this part of the season and no desperate efforts are being made to sell as the furnaces have their output pretty well taken care of for the next couple of months. No. 2 Southern foundry is still firm at \$11@11.50 Birmingham, or \$14.75@15.25 per ton St. Louis. Northern No. 2 is quoted around \$15 per ton.

Iron Ore Trade

Shipments of iron ore from the Lake Superior region in May were 5,919,074 tons. For the season to June 1 the shipments were, in long tons:

Port	1911	1912	Changes
Escanaba.....	529,540	792,889	I. 263,349
Marquette.....	218,931	356,914	I. 137,983
Ashland.....	267,337	521,772	I. 253,907
Superior.....	1,315,892	1,995,723	I. 679,831
Duluth.....	947,155	1,294,264	I. 347,109
Two Harbors.....	737,081	1,161,554	I. 424,473
Total.....	4,016,464	6,123,116	I. 2,106,652

Of the shipments this year 4,186,997 tons went to Lake Erie ports.

Imports of iron ore in Great Britain, four months ended Apr. 30, were 2,485,363 tons in 1911 and 1,865,447 in 1912; decrease, 619,916 tons. Imports of manganese ore were 138,528 tons in 1911, and 106,632 in 1912; decrease, 31,896 tons.

METAL MARKETS

New York, June 12—The metal markets have been a little quieter, but the upward tendency is still strong.

MONTHLY INDEX NUMBERS

Month	1911	1912	Month	1911	1912
January.....	110	111	July.....	112	.....
February.....	115	109	August.....	117	.....
March.....	112	111	September.....	111	.....
April.....	114	120	October.....	112	.....
May.....	118	123	November.....	111	.....
June.....	115	.....	December.....	110	.....

Year 1909, 115; 1910, 115; 1911, 112. Numbers for each month and year calculated on approximate sales of pig iron, copper, tin, lead, zinc and aluminum.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold			
Apr. 1912..	\$ 1,816,816	\$ 3,892,599	Imp. \$2,075,783
" 1911..	1,505,634	4,524,835	Imp. 3,019,201
Year 1912..	21,774,902	16,306,794	Exp. 5,468,108
" 1911..	3,364,688	23,990,572	Imp. 20,625,914
Silver			
Apr. 1912..	4,941,259	4,189,512	Exp. 751,747
" 1911..	7,610,154	4,251,532	Exp. 3,358,622
Year 1912..	21,897,247	16,039,732	Exp. 5,857,515
" 1911..	23,611,196	14,898,313	Exp. 8,712,883

Exports from the port of New York, week ended June 8: Gold, \$37,750; silver, \$1,249,815, mainly to London and Paris. Imports: Gold, \$228,803; silver, \$187,557, chiefly from Mexico and South America.

Gold—The price of gold on the open market in London continued at the usual bank rate, 77s. 9d. per oz. for bars and 77s. 4d. per oz. for American coin. Nearly all the supplies arriving for the week were taken by the Bank of England. In New York there was no unusual movement.

Sales of gold bars for industrial use from the U. S. Assay Office in New York in May, amounted to \$2,382,798. For the five months ended May 30, the sales were \$11,433,086 in 1911 and \$11,596,023 in 1912; an increase of \$162,937 this year.

Gold in the United States, June 1, is estimated by the Treasury Department as follows: Held against gold certificates outstanding, \$1,034,895,369; in Treasury current balances, \$169,601,010; in banks and circulation, \$608,540,016; total, \$1,813,036,395. Gold held against certificates includes bullion as well as coin.

Platinum—The market is still rather quiet, but prices are held without change. Dealers ask \$45.50 per oz. for refined platinum and \$48 per oz. for hard metal. The foreign market seems to be a little uncertain, but without any definite change.

Iridium—There has been no change in this metal and the current price is \$64 per oz., New York.

Silver—The market continues very steady and is quiet to firm, with a good undertone. Tendency depends much on the rain prospects in India, as the beginning of the monsoon period is about due.

SILVER AND STERLING EXCHANGE

June	6	7	8	10	11	12
New York....	60%	60%	60%	61%	61%	61%
London.....	28	28	28	28½	28½	28½
Sterling Ex..	4.8710	4.8700	4.8710	4.8720	4.8715	4.8720

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

Copper, Tin, Lead and Zinc

Copper—A large business has been done, both for domestic delivery and for export, the bulk of it having been for

NEW YORK

June	Copper		Tin	Lead		Zinc	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
6	17½	17.05	46	4.20	4.15	6.75	6.60
7	17½	17.15	47½	4.20	4.17½	6.90	6.75
8	17½	17.20	47½	4.20	4.20	6.90	6.75
10	17½	17.25	47½	4.20	4.17½	6.75	6.60
11	17½	17.30	47½	4.20	4.20	6.90	6.75
12	17½	17.30	47½	4.50	4.40	6.75	6.60

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined/corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

June	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
	Spot	3 Mos	Best Sel'd	Spot	3 Mos		
6	78½	79½	83%	203	195½	17½	26
7	78½	79½	83%	207½	196½	17½	25½
8	.....	.....	.....	.....	.....	.....	.....
10	78½	78½	83%	206½	196½	17½	25½
11	77½	78½	83%	206	195½	17½	25½
12	78½	78½	83%	206½	196	17½	25½

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c.; £25 = 5.44c.; £70 = 15.22c. Variations, ± £1 = ± 21½c.

August and September shipment. Buyers seem to have well covered their requirements for earlier deliveries. The price advanced sharply from June 6 to June 11, but at the top business became dull and a tendency on the part of sellers to make concessions became apparent. The recurrence of labor troubles at the refineries has not created a favorable impression and there begins to be more apprehension that the upward movement has been overdone. Consequently, at the close the market is somewhat easier, with Lake copper at 17½@17½c., and electrolytic in cakes, wirebars and ingots at 17.20@17.30c. Casting copper is quoted nominally at 17@17.10 as the average for the week.

The London market has been sensitive

upward, due to realization on part of speculative holders. On June 6, spot was £78 12s. 6d., and three months, £79 1s. 3d. On June 11, spot was £77 18s. 9d., and three months, £78 11s. 3d., and the market closes at £78 2s. 6d. for spot, and £78 15s. for three months.

Copper sheets this week are unchanged at 22@23c. per lb., base for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 18½c. base, carload lots at mill.

Brass Prices—The American Brass Co. announces prices as follows on June 10: Sheets, high brass, 16¾c. net, per lb.; low brass, 18½c. Rods, high brass 16½c.; low brass, 19¾c. Brass angles and channels, 20½c. Brass tubing, brazed, 21½c.; open seam, 20¼c. Scrap allowances, 12½c. net, per lb. for high brass; 13½c. for low brass.

Tin—The feature of this week's market has been the premium for spot tin, both in London and here, due to the scarcity resulting from the London dock strike. Supplies are dwindling down and unless the strike is soon raised, the premium for early deliveries is likely to be still greater.

The London market, which closed on June 5 at £200 for spot and £194 for three months, advanced on June 6 to £203 for spot and £195 5s. for three months. On June 10, it reached £206 10s. for spot and £196 10s. for three months, and closes at £206 10s. for spot and £196 for three months, a difference of £10 10s. between these positions.

The New York market has also been strong and advancing, and closes at 47½c. for spot.

Lead—A heavy demand has made itself felt, and on June 12 the A. S. & R. Co. raised its price to 4.50c. Consumption is excellent, and it is reported that the market is strong and looks as if it might advance still further. Missouri lead has been selling above the New York parity at about 4.17½@4.20c. It closes nominally at 4.40@4.42½c. and New York at 4.50 cents.

The scarcity of lead for early delivery in London continues, and the market is firmer, Spanish lead being quoted at £17 8s. 9d. and English 2s. 6d. higher.

Spelter—Considerable business has been done for both early and distant deliveries. The market is slightly firmer at 6.60@6.75c., East St. Louis, according to the time of shipment.

The London market is somewhat easier, good ordinaries being quoted at £25 10s. and specials at £25 15s.

Base price of zinc sheets is \$8.65 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Zinc dust is quoted at 7¼c. per lb., New York, in carload lots.

Other Metals

Aluminum—The market has been quiet, with little business forward. We continue to quote 22½@23c. per lb. for No. 1 ingots, New York. Negotiations are reported pending for about 3,000,000 lb. of aluminum wire for an electrical transmission plant.

Antimony—Business is quiet for the present. Cookson's has been advanced a shade, to 8.10c. per lb.; Hallett's is unchanged at 7.75c.; while 7.10@7.25c. per lb. is quoted for Chinese, Hungarian and other outside brands.

Quicksilver—Business remains fair. New York quotations are \$41 per flask of 75 lb., with 60c. per lb. charged for retail lots. San Francisco, \$41 for domestic orders and \$38.50 for export. The London price is £8 5s. per flask, with £8 2s. 6d. quoted from second hands.

Bismuth—The syndicate which controls the European production quotes 7s. 6d.—equal to \$1.80—per lb. in London. In New York a quotation of \$1.72 per lb. is made for metal produced from American ores.

Magnesium—The price of pure metal is \$1.50 per lb. for 100-lb. lots, f.o.b. New York.

Nickel—Large lots, contract business, 40@45c. per lb. Retail spot from 50c. for 500-lb. lots up to 55c. for 200-lb. lots. The price of electrolytic is 5c. higher.

German Metal Trade

Imports and exports of metals other than iron and steel in the German Empire, three months ended Mar. 31, were, in metric tons:

	Imports	Exports	Excess
Copper.....	59,548	21,817	Imp. 37,731
Copper, 1911....	46,400	20,016	Imp. 26,384
Tin.....	3,756	2,481	Imp. 1,275
Tin, 1911.....	3,496	2,679	Imp. 817
Lead.....	16,272	12,322	Imp. 3,950
Lead, 1911.....	17,467	10,024	Imp. 7,443
Zinc.....	10,585	24,643	Exp. 14,058
Zinc, 1911.....	12,669	35,512	Exp. 22,843
Nickel.....	470	682	Exp. 210
Nickel, 1911....	820	580	Imp. 240
Aluminum.....	3,781	1,174	Imp. 2,607
Aluminum, '11.	1,920	795	Imp. 1,125
Minor metals....	460	4,137	Exp. 3,677
Minor, 1911....	449	3,482	Exp. 3,033

The figures include alloys and manufactures of the different metals. The imports and exports of ores for the three months were, in metric tons:

Ores:	Imports	Exports	Excess
Gold ore.....	51	.....	Imp. 51
Gold ore, 1911..	19	.....	Imp. 19
Silver ore.....	296	.....	Imp. 296
Silver ore, '11..	737	.....	Imp. 737
Copper ore.....	9,990	5,219	Imp. 4,771
Copper ore, '11.	4,431	3,748	Imp. 683
Tin ore.....	3,689	.....	Imp. 3,689
Tin ore, 1911..	3,960	.....	Imp. 3,960
Lead ore.....	42,382	691	Imp. 41,691
Lead ore, 1911.	30,884	1,146	Imp. 29,738
Zinc ore.....	54,328	9,482	Imp. 44,846
Zinc ore, 1911.	52,134	9,626	Imp. 42,508
Nickel ore.....	3,678	.....	Imp. 3,678
Nickel ore, '11.	2,843	.....	Imp. 2,843
Miscellaneous...	7,545	2,085	Imp. 5,460
Miscellaneous, '11	1,720	262	Imp. 1,458
Chrome ore....	4,262	220	Imp. 4,042
Chrome ore, '11	1,761	162	Imp. 1,599
Pyrites.....	211,220	11,223	Imp. 199,997
Pyrites, 1911..	144,629	2,483	Imp. 142,146

Miscellaneous includes ores of tungsten, molybdenum and other rare metals.

Zinc and Lead Ore Markets

Platteville, Wis., June 8—The highest price paid this week for zinc ores was \$57; the base price, 60% zinc., was \$56 per ton. The base price paid for 80% lead ore was \$52@53 per ton.

SHIPMENTS, WEEK ENDED JUNE 8

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Benton.....	855,000	52,000	644,200
Shullsburg.....	802,600	.....	.....
Mineral Point.....	748,910	.....	.....
Galena.....	576,200	66,400	.....
Highland.....	389,000	.....	.....
Platteville.....	362,000	.....	50,000
Cuba City.....	299,150	.....	133,220
Hazel Green.....	270,000	.....	.....
Harker.....	220,050	.....	.....
Rewey.....	82,000	.....	.....
Montfort.....	60,000	.....	.....
Linden.....	.....	63,300	.....
Total.....	4,664,910	181,700	827,420
Year to date.....	90,410,140	3,754,110	12,384,870

Joplin, Mo., June 8—The high price of zinc sulphide ore this week was \$61, the base per ton of 60% zinc is \$54@58.50. Zinc silicate sold from \$27 to \$30 per ton of 40% zinc. The average price, all grades, was \$54. The high price of lead ore is \$55 and the average price, all grades, is \$53.54 per ton.

The zinc-ore market remained the same as the previous week.

SHIPMENTS, WEEK ENDED JUNE 8

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville.....	4,637,690	.....	1,485,630	\$169,965
Joplin.....	2,111,800	.....	226,550	65,138
Galena.....	1,006,640	.....	61,470	29,782
Duenweg.....	820,020	60,000	38,910	24,870
Alba-Neck.....	600,300	.....	49,130	18,733
Oronogo.....	455,760	.....	4,440	10,226
Granby.....	205,250	272,280	9,470	9,810
Miami.....	163,450	.....	187,000	8,784
Spurgeon.....	130,570	247,490	.....	7,235
Springfield.....	171,000	.....	86,000	7,100
Carl Junction.....	228,680	.....	.....	6,860
Jackson.....	209,300	.....	8,560	5,861
Carthage.....	173,650	.....	.....	4,688
Cave Springs.....	119,380	.....	.....	3,461
Wentworth.....	129,590	.....	.....	3,240
Aurora.....	65,020	63,000	.....	2,585
Sarcozie.....	62,440	.....	.....	1,685
Totals.....	11,291,540	642,740	2,157,150	\$380,028

23 weeks.....233,313,340 13,867,950 39,693,130 \$7,079,379
Blende val. the week, \$312,162; 23 weeks, \$5,795,905
Calamine the week, 10,106; 23 weeks, 203,618
Lead value, the week, 56,760; 23 weeks, 1,079,856

MONTHLY AVERAGE PRICES

Month	ZINC ORE				LEAD ORE	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January.....	\$41.85	\$44.90	\$40.55	\$43.54	\$55.68	\$58.92
February.....	40.21	45.75	39.16	43.31	54.46	52.39
March.....	39.85	51.56	38.45	49.25	54.57	54.64
April.....	38.88	52.00	37.47	50.36	56.37	54.18
May.....	38.25	55.30	36.79	53.27	55.21	52.45
June.....	40.50	.....	38.18	.....	56.49	.....
July.....	40.75	.....	38.36	.....	58.81	.....
August.....	42.50	.....	41.28	.....	60.74	.....
September.....	42.63	.....	41.29	.....	59.33	.....
October.....	42.38	.....	40.89	.....	54.72	.....
November.....	45.40	.....	43.27	.....	57.19	.....
December.....	44.13	.....	40.76	.....	62.03	.....
Year.....	\$41.45	.....	\$39.90	.....	\$56.76	.....

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

Chemicals

New York, June 12—The general market is still in good condition, but is beginning to feel something of the midsummer dullness, which is becoming a regular feature of the season.

Arsenic—Demand has visibly slackened and supplies have improved a little, but not much. White arsenic is held still at \$3.87½ per 100 lb. for spot. Futures are nominally \$3.50 per 100 lb., but there is very little interest in them.

Copper Sulphate—As was expected, an advance in this article has followed the advance in copper metal. Current quotations are up 25c. and are now \$5.50 per 100 lb. for carload lots, and \$5.75 per 100 lb. for smaller parcels.

Nitrate of Soda—Business is rather quiet, as is to be expected at this season, but the market continues firm. Quotations are \$2.40@2.42½c. per lb. for spot and futures up to Oct. 1; while for all positions after that date, 2.45c. is asked.

Potash Salts—Exports of potash salts from Germany three months ended Mar. 31 were, in metric tons:

	Total	To U.S.
Crude salts, kainit, etc.	361,934	169,839
Potassium chloride	95,603	60,885
Potassium sulphate	25,474	6,870
Potassium-magnesium sulphate	30,999	2,619
Totals	514,010	240,213

Comparisons with 1911 cannot be made as the German authorities have this year changed the classification of the different varieties.

Imports and Exports—Imports and exports of chemicals and raw material in the United States, four months ended Apr. 30:

	Imports	Exports	Excess
Copper sulph. lb.	7,118,825 E.	7,118,825	
Copper sul., '11	6,488,357 E.	6,488,357	
Bleach, lb.	26,670,268	400 I.	26,669,868
Bleach, 1911	33,094,400	17,368 I.	33,077,032
Potash salts, lb.	234,877,645	1,377,817 I.	232,499,828
Potash salts, '11	310,908,547	1,445,736 I.	309,462,811
Soda salts, lb.	3,982,409	169,281 I.	3,813,128
Soda salts, 1911	13,228,260	191,430 I.	13,036,830
Acetate lime, lb.	22,309,463 E.	22,309,463	
Acetate, 1911	27,504,701 E.	27,504,701	
Nit. of soda, tons	142,784	3,315 I.	139,469
Nitrate, 1911	226,309	2,759 I.	223,550
Phosphates, tons	334,500 E.	334,500	
Phosphates, '11	354,738 E.	354,738	
Sulphur, tons	7,308	14,593 E.	7,285
Sulphur, 1911	7,308	647 I.	6,661
Pyrites, tons	291,009	I.	291,009
Pyrites, 1911	310,041	I.	310,041
Magnesite, lb.	69,150,213	552,150 I.	68,598,063
Magnesite, 1911	93,658,540	933,550 I.	92,724,990
Sul. ammonia, lb.	48,506,690	134,715 I.	48,371,975
Sul. am'nia, '11	88,110,626	I.	88,110,626
Arsenic, lb.	1,352,988	I.	1,352,988
Arsenic, 1911	1,613,143	I.	1,613,143

Exports include reexports of foreign material. Estimating sulphur contents of pyrites the total quantity of sulphur imported this year was 123,168 tons.

MINING STOCKS

New York, June 12—On June 6 the Exchange showed some weakness, but recovered before the close. The Curb was fairly active and strong. Copper shares sold up generally; there was good trading in Motherlode and Yukon Gold, and a small advance in Cobalts.

June 7. The Exchange was rather reactionary, with small declines in nearly all the active stocks. The Curb showed small dealings in copper stocks; a recession in nearly all the Cobalts, and heavy sales, at a decline, of El Paso Consolidated and Tri-Bullion.

June 8, the Exchange was more active and the general position at the close was stronger. On the Curb interest was mainly in the industrials and mining stocks were rather dull, El Paso Consolidated was the exception, selling largely at a small advance.

June 10, the Exchange was dull and price changes insignificant. On the Curb copper shares were quiet with fair sales of Braden and Mason Valley. El Paso Consolidated made good sales at a slight advance, as did Yukon Gold also. Cobalts were quiet but steady.

June 11, the Exchange turned weaker again and prices declined on moderate trading. Curb prices were also off, copper stocks losing fractionally. Other mining stocks were fairly steady, on light trading.

June 12, the market recovered a little, but business was not especially heavy.

Sales at auction in New York, June 3, included: Naica Mining Co. note for \$250 and 2500 shares stock, \$1 par, \$10 for the lot; also note for \$500 and 5000 shares stock, \$15 for the lot; Federal Mining & Smelting Co., 80 shares preferred stock, \$100 par, \$40.25 per share.

Boston, June 11—Copper shares fairly boiled at one time during the week; although at present they are simmering, yet the market is in a strong and healthy position. The heaviest advances have been recorded in some specialties and the greater part of the gains have been maintained. Ahmeek and Calumet & Hecla are notable examples. The former rose \$45 per share to \$360, which is its record price, and the latter \$36 per share to \$530, the highest for a long time. The key to the advance in Ahmeek is the raising of the dividend rate to \$5 per share. The company instituted these payments last November with a \$2 disbursement. Thus far in 1912 the company has divided \$12 per share in addition to the \$2 paid last year.

Butte & Superior and Island Creek common stocks have also had notable advances during the week. The former rose \$12.37½ to \$49, and the latter \$11.75 to \$65.75. Butte & Superior developed from a copper to a zinc mine and the new mill is saving over 90% of the ore contents. Island Creek's advance was due to the placing of the stock on a dividend basis. The directors have declared a quarterly dividend of 50c. and \$3 a share payable in common stock. This latter will be financed through an issue of 6000 additional shares of common.

Curb trading received inspiration from

COPPER PRODUCTION REPORTS
Copper contents of blister copper, in pounds

Company	March	April	May
Alaska shipments	4,987,916	1,243,911	1,720,391
Anaconda	25,900,000	25,480,000	25,800,000
Arizona, Ltd.	3,150,000	3,400,000	3,500,000
Copper Queen	7,197,121	6,806,425	7,024,087
Calumet & Ariz.	4,652,000	4,104,000	4,424,000
Chino	1,108,351	.....	.....
Detroit	2,246,238	2,506,718	2,092,478
East Butte	1,480,000	.....	.....
Mammoth	1,939,310	1,718,450	.....
Mason Valley	1,140,000	.....	.....
Nevada Con.	6,380,000	6,115,095	.....
Old Dominion	2,432,000	2,167,000	.....
Ray	2,300,000	2,611,920	.....
Shannon	1,388,000	1,544,000	1,461,000
South Utah	299,000	264,215	236,884
United Verde*	2,250,000	.....	.....
Utah Copper Co.	8,160,000	8,615,775	.....
Lake Superior*	19,750,000	18,260,000	21,260,000
Non-rep. mines*	7,291,619	8,250,000	.....
Total production	104,051,585	.....	.....
Imports, bars, etc.	23,519,215	26,842,014	.....
Total blister	127,570,800	.....	.....
Imp. in ore & matte	8,736,874	9,350,972	.....
Total	136,307,674	.....	.....
Miami	2,755,000	2,554,352	2,565,000
Brit. Col. Cos.	.....	.....	.....
British Col. Copper	.....	.....	.....
Granby	1,882,073	1,941,797	1,914,460
Mexican Cos.	.....	.....	.....
Boleo	2,424,800	2,149,260	2,260,160
Cananea	2,834,000	4,654,000	.....
Mocetzuma	2,446,731	2,797,718	2,892,521
Other Foreign	.....	.....	.....
Cape Cop., S. Africa	725,760	954,240	.....
Kyshtim, Russia	.....	1,545,000	.....
Spassky, Russia	638,400	649,600	.....
Famatina, Argen.	.....	.....	.....
Tilt Cove, Newf'd.	104,992	119,869	.....
Exports from:	.....	.....	.....
Chile	3,584,000	6,496,000	.....
Australia	8,064,000	9,408,000	.....
Arrivals in Europe†	12,559,680	12,064,640	.....

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister. *Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Production	Deliveries Domestic	Deliveries for Export
V. 1911	126,962,544	64,543,963	61,978,557
VI.	124,554,312	61,655,561	71,460,519
VII.	112,167,934	56,982,582	74,880,658
VIII.	125,493,667	59,935,364	69,855,660
IX.	115,588,950	57,311,584	50,824,011
X.	118,255,442	64,068,307	60,084,349
XI.	111,876,601	68,069,776	67,049,279
XII.	122,896,697	65,988,474	79,238,716
Year	1,431,938,338	709,611,605	754,902,239
I. 1912	119,337,753	62,343,901	80,167,904
II.	116,035,809	56,228,368	63,148,096
III.	125,694,601	67,487,466	58,779,566
IV.	125,464,644	69,513,846	53,252,326
V.	126,737,836	72,702,277	69,486,945

VISIBLE STOCKS

	United States	Europe	Total
VI. 1911	165,995,392	202,540,800	368,536,732
VII.	157,434,164	195,932,800	353,366,964
VIII.	137,798,858	191,891,840	329,690,698
IX.	133,441,501	191,228,800	324,670,301
X.	130,894,856	191,945,600	322,840,456
XI.	134,997,642	176,825,600	311,823,242
XII.	111,785,138	164,281,600	276,066,738
I. 1912	89,454,695	158,323,200	247,777,895
II.	66,280,643	154,851,200	221,131,843
III.	62,939,988	141,142,400	204,082,388
IV.	62,367,557	136,819,200	199,186,757
V.	65,066,029	134,176,000	199,242,029
VI.	49,615,643	117,801,600	167,417,243

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

the activity on the board and prices generally hardened. The sequel to the recent decline in Boswyocolo, is the placing of the Laramie, Hahns Peak & Pacific Ry. in receiver's hands. These two companies are closely allied, being under the same management.

Assessments

Table with columns: Company, Delinq, Sale, Amt. Lists various companies like Alpha Con., Andes, Best & Belcher, etc., with their respective assessment dates and amounts.

Monthly Average Prices of Metals

SILVER

Table showing monthly average prices for silver in New York and London from 1910 to 1912. Columns include Month, New York (1910, 1911, 1912), and London (1910, 1911, 1912).

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

COPPER

Table showing monthly average prices for copper in New York and London from 1911 to 1912. Columns include Month, New York (Electrolytic, Lake), and London (Standard).

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

TIN AT NEW YORK

Table showing monthly average prices for tin at New York from 1911 to 1912. Columns include Month, 1911, 1912, and Av. Year.

Prices are in cents per pound.

LEAD

Table showing monthly average prices for lead in New York, St. Louis, and London from 1911 to 1912. Columns include Month, New York (1911, 1912), St. Louis (1911, 1912), and London (1911, 1912).

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

SPELTER

Table showing monthly average prices for spelter in New York, St. Louis, and London from 1911 to 1912. Columns include Month, New York (1911, 1912), St. Louis (1911, 1912), and London (1911, 1912).

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

PIG IRON AT PITTSBURG

Table showing monthly average prices for pig iron at Pittsburgh in Bessemer, Basic, and No. 2 Foundry from 1911 to 1912. Columns include Month, Bessemer (1911, 1912), Basic (1911, 1912), and No. 2 Foundry (1911, 1912).

STOCK QUOTATIONS

Table of stock quotations for COLO. SPRINGS and SALT LAKE. Columns include Name of Comp., Bid, and Name of Comp., Bid.

TORONTO June 11

Table of stock quotations for Toronto. Columns include Name of Comp., Bid, Name of Comp., Bid.

SAN FRANCISCO June 11

Table of stock quotations for San Francisco. Columns include Name of Comp., Clg., Name of Comp., Bid.

N. Y. EXCH. June 11

Table of stock quotations for New York Exchange. Columns include Name of Comp., Clg., Name of Comp., Clg.

N. Y. CURB June 11

Table of stock quotations for New York Curb. Columns include Name of Comp., Clg., Name of Comp., Clg.

BOSTON CURB June 11

Table of stock quotations for Boston Curb. Columns include Name of Comp., Last.

LONDON June 12

Table of stock quotations for London. Columns include Name of Com., Clg., Name of Com., Clg.

‡Last quotation.