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Steel Prices

For some weeks past there have been signs that the break in steel prices, which the Steel Corporation has so stoutly resisted, was nearly ready to come. A reduction has been in the air, so to speak, and buyers have felt it. They have been holding back orders and purchasing as little as possible, the general belief being that the leading interest could not much longer resist the pressure. Three weeks ago it was said in these columns that a break was sure to come, the only question being whether it would come by a general readjustment as in 1909, or by a gradual crumbling away of existing quotations.

The larger independent companies have so far held with the Steel Corporation in resisting any lowering of the price level. This week, however, the Republic Iron and Steel Company announced that it had broken away from the tacit agreement and would pursue a "more aggressive policy to secure business." The immediate result was a break in the price of steel bars from 1.40c., Pittsburg base, to 1.25c., and in some cases 1.20c.; followed by the placing of heavy contracts. The Steel Corporation mills necessarily followed the cut, through under strong protest. The Republic company is an important factor in the bar market, but is not a large maker of structural material.

The result was a "conference" called by Judge Gary and held in New York on Monday, at which it was decided to make general reductions in prices of nearly all steel products except rails; the details are given elsewhere.

Of course, the new prices have not been tested, but it is hardly necessary that they should be in order to form a judgment. It has been the steel manufacturers' idea that business in the second half of this year would be good from a tonnage standpoint, and that about July 1 would be the time to take action, either awaiting a revival in buying on the existing basis or making ra-

dical reductions to stimulate a general buying movement which eventually would carry prices upward again. Republic's action was regarded as altogether premature, in opening the price question at a time when there was no disposition to buy. Presumably, therefore, Monday's action was taken merely to remove glaring irregularities and to furnish testimony that Republic's withdrawal did not disrupt the price agreement.

The cut in sheets was of a different nature from the others, being a recognition of the shading by independent mills. With a reduction of only \$2 in sheet bars the spread between steel and sheets is reduced \$2 a ton, making it certain that independent mills which must buy their steel cannot meet the situation. If this price alinement was adopted to put such mills out of business the action was a radical one, and not in keeping with the general spirit of the coöperative movement as so frequently elucidated from high quarters. In any event it would be inconclusive, for the independent sheet mills which have steel works of their own can, with the Steel Corporation, supply much more than the existing demand. If on the other hand the arrangement was adopted to put the burden upon Republic of meeting the sheet cut by making a further reduction in sheet bars to its sheet-mill customers there is an effort to force it to pursue a course of open competition which it has been criticized for entering upon at all. Thus from either construction the price maintenance movement has involved itself in the complication of being conservative with one hand and radical with the other. A halting policy is always a mistake; but the reduction is a wise one.

Electric Smelting

A correspondent asks us to tell him whether there is any electric smelter that is a practical success, especially to smelt and refine in one operation ores carrying several metals.

The art of electric smelting is still in its infancy. Only in the metallurgy of

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aluminum and steel has it yet become a commercial process. For copper, lead, tin, zinc, etc., the electric furnace is still only in the experimental stage.

As with all new things to which the magic name of "electricity" is attached, there will doubtless be a lot of visionary schemes and devices to entrap the unwary brought out in connection with electric furnaces and electric smelting. It will be well to explain what the electric furnace is and what it can and cannot do. The incandescent electric lamp embodies the principles of the resistance furnace; similarly the arc lamp illustrates the arc furnace. Both types of electric furnace are simply developments of those prototypes.

The electric furnace is merely a means of generating heat. Its advantage lies in the ability to generate heat right at the place where wanted, and very much concentrated at that place, wherefore, there is likely to be thermal economy, and under some conditions, there may also be commercial economy.

The temperature of an electric furnace is not necessarily high, except in the case of the arc furnace. The temperature of a resistance furnace may be established at any desired point within a fairly wide range and may be maintained closely at the desired point.

In the experimental work in the field of copper and zinc smelting, the aim has been generally to maintain temperatures about the same as are maintained in the furnaces wherein the heat is derived from the combustion of carbonaceous fuel. The metallurgical reactions that take place are about the same. The metallurgical problems are about the same, plus some that are inherent to the new apparatus. The electric furnace is not to be expected to perform any deeds of magic, such as taking a charge of rebellious ores containing several metals, smelting it in one operation and delivering the metals, each in a separated refined state, by several spouts.

The Postal Savings System in Mining Towns

It is interesting to note the patronage of the postal-savings system in mining towns in which it has been established. The service was inaugurated on Jan. 3, 1911, one postoffice in each State and Territory being selected; the system is

being extended to other cities as rapidly as practicable, and it is expected that in time practically every money-order post office will be designated as a savings-depository office. Up to March 31, 1911, 48 depository offices had been established; at the head of this list stand three mining towns, Leadville, Anaconda and Globe, holding the record both for the total amount of deposits and for the average balance per depositor. Globe, Ariz., had the highest average balance per depositor, \$87.15, with a total deposit of \$15,339. Leadville, with a population of 7508, according to the last census, had the largest amount on deposit, \$34,679, and an average balance of \$81.22 per depositor.

In contrast with this it may be noted that Rutherford, N. J., a town of 7045 people, had on deposit only \$1485 or an average of \$17.68 per depositor. Cohoes, N. Y., a city of 24,000, had on deposit only \$1054, or an average of \$17 per depositor. The average balance per depositor was uniformly high in the offices established in mining centers. Some of these may be of interest; the average balance at Anaconda, Mont., was \$73.57; Carson City, Nev., \$67.63; Pittsburg, Kan., \$56.09; Johnson City, Tenn., \$57.85; DuBois, Penn., \$38.40; Oroville, Cal., \$55.83; Cœur d'Alene, Idaho, \$58.65; Deadwood, S. D., \$44.19. The average balance per depositor for all offices was \$46.89, from which it will be seen that the mining towns have, as a whole, appreciated the establishment of the postal-savings system more than the industrial centers.

Metallizing Processes

A good deal of attention has been directed recently to the development of processes based on the idea of reducing the metal of certain ores by carbon without the complete fusion ordinarily accomplished in the blast furnace, the reduced metal being subsequently separated by jiggling and otherwise. The most noteworthy of these processes appears to be the so called Jones "step process," the invention of John T. Jones, of Iron Mountain, Mich.

In the Jones' process, which is intended for the extraction of iron from low-grade ore, not at present commercially available for blast-furnace smelting, the reduction is effected in a long revolving cylindrical furnace. The spongy

product, containing the reduced iron and the unmelted gangue, is dropped into water and subsequently concentrated by magnetic or by ordinary gravity separation. Elaborate experiments with this process have been going on, and we understand that it is shortly to be tried on a commercial scale.

A similar process is to be introduced in Katanga for the treatment of the silicious oxidized copper ore of that region. A plant for this purpose, constructed in the United States, has been shipped to the mine, but owing to railway difficulties we understand that the plant has not yet been delivered and its erection and operation during the present year are hardly to be anticipated.

Oliver B. Dawson has been experimenting at El Paso, Tex., with a similar process, using a furnace shaped like the frustrum of two cones with their bases together, the furnace being lined with magnesite brick and arranged to be hermetically sealed after the charge has been heated to the reduction temperature. The Dawson furnace has been constructed upon a large scale, as shown by a photograph of it that we have received. Some samples of "metallized" copper ore sent to us showed the formation of metallic copper in globules. Crushing and panning a small parcel of these samples, mixed indiscriminately, gave a pretty good extraction of metallic copper. Our tests were, however, made on far too small a scale to warrant any conclusion as to the commercial usefulness of this process.

We understand that some experiments with the Jones' process for the extraction of zinc have been made at a mine in Illinois, but we fail utterly to see how zinc can be "metallized" in this way, or how the idea is applicable in the metallurgy of zinc. Our attention has been called to a recent patent of another inventor, covering a process in which zinc-lead ore was to be treated by metallizing the lead, which is then to be jigged out, leaving a residue to be smelted for zinc in the usual way. It does not seem to us that this idea is likely to be of any value.

We refer to these processes merely as a review of current experimentation that is engaging considerable attention. Before any opinion as to their probable usefulness be expressed, it is best to await the results of some practical applications.

Correspondence and Discussion

Preventing Mine Disasters

Noting in the JOURNAL of April 29, the findings of the jury on the inquest of the Pancoast mine disaster and the comments as to the necessity of prompt action in the matter of getting the recommendations before the legislature, I am constrained to make a few suggestions that I think of value.

Mining at best is a dangerous vocation, and there are many dangers seen and unseen that surround even the most skillful miner. This being the case, it would be a wise and economical policy to take every precaution for the protection of the lives of these toilers. Along this line I make a few suggestions in addition to those mentioned in the report of the jury, which recommendations I concur in.

Relative to what the mines law directs, some say it is ambiguous and hard to interpret. If so, why not either do away with it and start over again, or change it, so that it will be easily understood. How about the "unwritten" law in this? During the last year I worked with my men for a number of months in a zinc mine in northern New Jersey. There are no mines laws and no mines inspectors, but the mines are looked after by capable mining men, and they can give us several pointers. The plant is first class in every particular; steel tower at the 950-ft. vertical shaft, erected in the early '90's; a four-track shaft inclined at an angle of 47 deg., vertical depth, 1150 ft.; first-motion hoisting engine with automatic cutoff to prevent overwinding; electric haulage underground; pumps and auxiliary engines at various points driven by compressed air, no steam being used underground. There is no oil used in the mine; acetylene lamps are used by all underground employees and there are stationary lamps for lighting the haulage roads. A large proportion of the men are of the same nationalities as we have here at Scranton. There is telephone service throughout the mines on various levels with outside connections and water under pressure and fire extinguishers are to be found at various places.

The recommendations I make are:

(1) Install automatic devices to prevent overwinding—an accident happened at the Pancoast mine within a few days of the disaster, fortunately resulting in no loss of life. An engineer at the lever of a hoisting engine holds a responsible and trying position, and any little mistake on his part means a mishap. If, in an emergency he loses his nerve when he might be hoisting men from a burning mine, when in his haste to get them

Views, Suggestions and Experiences of Readers



out he makes a mistake, the plant is disabled and a cage load of men possibly sent into eternity and others left to get out as best they can. Automatic devices to prevent overwinding would avoid this. Several are in use in this valley, but the use is exceptional. Why not make it imperative?

(2) Do away with the use of oil in the mines. Every miner has his wooden box in which to keep his tools, powder and oil—nice combination. The box becomes saturated with oil; the oil lamp drops sparks frequently; the acetylene lamp does not.

(3) Avoid using steam as much as possible, except at the pumping stations at the foot of the shafts. It dries the timber and makes it like a tinder box. Use compressed air or electricity.

(4) Make air bridges of concrete—a method that is now being generally adopted. Make mule barns without timber as far as possible, which now is generally done. Make towers over shafts of iron. Have fire extinguishers at all dangerous places.

J. H. RITTENHOUSE.

Scranton, Penn., May 10, 1911.

Electrolytic Lead Refining Patents

The abstract of the German and French patents of Siemens & Halske for the use of lead-perchlorate solution for a refining bath, which was published in the JOURNAL of May 6, 1911, gives the impression that Siemens & Halske discovered the use of perchlorates in refining baths. I should have the credit for having devised the method and for having made the first experiment upon it.

My claims for priority are: (1) U. S. patent 931,944 (1909) for the plating and refining of metals from perchlorate solutions. This patent belongs to me. (2) An article, describing the lead-refining process, which I published in the *Trans. Am. Electrochem. Soc.*, Vol. 17, p. 261. (3) A translation of the lead-refining article was published in the *Chem. Ztg.* (1910), p. 1316. (4) Siemens & Halske, before they had received their patents and presumably before they had applied for patents, wrote me letters ask-

ing if I intended to protect my process in Europe.

I do not see how there can be any doubt about the priority of my discovery and wish to make a statement of these facts as a mere matter of justice to the American inventor of the process.

FRANK C. MATHERS.

Indiana University, Bloomington, Ind., May 16, 1911.

A New Filter Frame

In the JOURNAL of May 20 there appeared, under the above heading, an excerpt from the *Monthly Journal* of the chamber of mines of Western Australia. The article shows how little must be known in West Australia of the work done in this country during the last seven years in connection with slime filtration.

Referring to the illustrations given, Fig. 1 shows a cross-section of one of the Butters' filter-frame headers, although not so stated, which, if properly constructed, works admirably, even with the most sticky slime. In Fig. 2 is shown one of the early Butters' methods long since abandoned. Both methods are covered by Butters' patents. One reason why the Fig. 2 method never became popular is that when the cake is exposed to the air a channel of low resistance to the water wash forms at the right-angle corner between the cake and the header. The effect of this is not marked with fine granular material, such as the so called slime of West Australia, but with slimes, as we know them in the United States and Mexico, we have a noticeable difference. No careful observer could fail to see the weak point in washing a cake formed on a frame made as shown in Fig. 2, especially if true slime is handled.

The article further alludes to the use of cocoa matting between the filter cloths, as if it were something new. Surely everyone who has followed the literature on slime filtration for the last six years knows that this is the subject of a Butters' patent; the JOURNAL has repeatedly referred to it. The only feature described about the frame that could be designated as "new" is the cast-iron shoe, which, by the way, adds nothing in strength, durability or efficiency, but unnecessary weight. Further, it would be undesirable to use exposed iron where the Butters' process for regenerating filter cloths is in use. This process may not be used in West Australia, but in most parts of this country where lime has to be added to the slime under treatment, the use of the Butters process of removing the lime coating becomes essential.

There are a number of other details in the construction of successful filter frames that the author passes over, presumably because they have never presented themselves to him in treating the simple West Australian product. Careful attention to details, especially minor details, makes all the difference between a troublesome and a successful filter, especially when the operator has to handle true slime.

Incongruous as it may appear, it is evident that in this age of rapid intercourse between nations there are still people who will not profit by the experience of others, but prefer to waste energy going over the old ground again and again.

G. W. SHEPHERD,
Secretary, Butters' Patent Vacuum
Filter Company, Inc.

New York, May 23, 1911.

The Coal Dust Problem

The March 25 issue of the JOURNAL, gave an abstract of a paper read by Frank Haas before the West Virginia Mining Association.

As one interested in the coal-dust problem, I wish to record my appreciation of Mr. Haas's efforts to arrive at a method of treating coal dust to render it non-explosive. Some further explanations appear to be necessary in view of some of the statements in the abstract, and I hope Mr. Haas will favor us with more details.

An early statement in the paper is this: "Prevention of ignition by removal of all explosives, and flames, would add dangers no less deadly than the explosion of coal dust itself." I fail to follow this statement. Does Mr. Haas mean to imply that by removing all shotfiring from the mine, the danger of explosions is increased? Or that by taking precautions to prevent fires, further danger is added to the mine?

The results of three years' experiments with the introduction of steam into the intake air currents are given, and comparisons made as to cost with the water-car method. This seems an unhappy comparison, the water-car method of sprinkling being cumbersome, costly, inefficient, and wholly futile, and there are hundreds of mines where exhaust steam is not available so that the comparison is of no use to the operators of these mines.

Mr. Haas goes on to say that he "can advance an unreserved opinion that a wet mine is a safe mine as far as the propagation of a dust explosion is concerned."

A WET MINE

Let us now satisfy ourselves as to what a wet mine really is. The floors will be wet, the ribs, and the roof must be dripping wet, there must not be a dry spot in the mine. To use Mr. Haas's own words "you want water everywhere, and

all the time." The air as it enters the mine must be superheated so that the moisture will be carried to the working faces. What are the conditions going to be like for men to work in? The sweating of men, and mules, the heat, the high humidity. It is easy to imagine that the roadways of the mine will be converted into a veritable labyrinth of sewers. The clothing of every man would be wringing wet, the miner could not take off his undershirt and leave it in a dry place, to put on again at the end of his shift, because there would be no dry place. He would be compelled to work under these conditions for eight or 10 hours every day, and in the winter time he would pass from this sewer-like atmosphere with his wet clothes, into the night air with the temperature often 10 deg. below zero. The wet-mine theory must be a case if ever there was one of the cure being worse than the disease.

Mr. Haas says additional water in mines does not make roof conditions more unsafe, and we will take his word. The interior of the best coal mine is not a delightful abode of toil and if we can treat coal dust to render it safe, and at the same time not make the working conditions any worse, I think we ought to do so.

USE OF ADOBE DUST SUGGESTED

In this part of the world, the remedy may be close at hand, and more plentiful than water. It is "adobe", which covers parts of this western country for hundreds of miles. It is the material that has been used for centuries in Mexico for making sun-dried bricks. During wind storms in the Rocky Mountain region the air is filled with adobe dust.

At the Altofts collieries where the management has had the experience of a violent explosion, and also the experience gained from the experimental galleries at Altofts, the stone-dust method of treating coal dust has been applied for the last two years.

The gallery experiments have shown that a coal-dust zone of 275 ft. which usually produced a flame of from 140 to 180 ft. in length, has been extinguished by a stone-dust zone of a length of only 55 ft. The chemical analysis showed that stone dust, or other inert matter produced a cooling effect on the incandescent portions of an explosive blast. The microscopical examination of the dust collected and examined after the explosions in the galleries showed that the fine stone dust was found to have adhered to the minute pieces of tarry, or pitchy coal. Eight miles of underground haulage roads have been treated at Altofts with stone dust without interfering with the health of the workmen, or without causing any inconvenience, or obstruction to the traffic, and on the authority of the general manager of the collieries, we learn that the cost of ap-

plying the stone dust has been less than one-fifth of one cent per ton of the coal produced.

THE USE OF STONE DUST

A method of treating a road with stone dust is to cover the floor to the depth of about 1 in., and string boards between the roof timbers and props and load these up with stone dust.

The first explosive blast no matter how started will dislodge the stone dust and cause it to become mixed with the coal dust in the air and so choke any flame; stone dust being noninflammable.

In my opinion, one of the first things to do to combat the coal-dust menace is to change the type of cars. The end-gate car is unsatisfactory. It begins to deposit fine coal and dust, from the time it leaves the coal face until it reaches the tippie. The day must come when the solid car, and the rotary dump will be the rule and not the exception.

If Mr. Haas can see his way to prepare a further contribution, I would like him to compare the stone-dust method with the water method, and if he prefers the latter to state his reasons in detail. Our Government inspectors might present their opinions and the working miner who works in a wet mine could tell how he likes it. But I would warn the miner before he begins to write, to be certain that he is working in a wet mine, and not in a partly wet mine, because there is a big difference between the two, and there are not many of the former.

Regarding the inspection of mines, a statement by John Mitchell in his speech last week at Philadelphia is worth repeating. He said: "Inspectors of mines should be thoroughly trained in the work the law requires them to do, and should be removed from the sphere of political influence." Surely every right thinking man must agree with Mr. Mitchell here.

SAMUEL DEAN.

Delagua, Colo., April 11, 1911.

Mining in Nicaragua

In the article on "Mining in Nicaragua" in the JOURNAL of March 25, certain misstatements were made with reference to the Siempre Viva mine.

The ore in the lower workings of this mine is of a good working grade, quite as high, if not higher, than the average of the oxidized zone. The average value of the sulphide ore on the lowest levels is \$17.50 per ton, which can hardly be called low-grade. It is a sulphide ore carrying blende, but there is no difficulty whatsoever in obtaining a high extraction by cyaniding, and at a much lower cost for chemicals than the highly-acid ores of the oxidized zone.

HENRY B. KAEDING,

General manager, Siempre Viva Mining Company.

Bluefields, Nicaragua, April 20, 1911.

NEW PUBLICATIONS

THE PRACTICE OF COPPER SMELTING. By E. D. Peters. 6x9, pp. 693, illustrated. \$5. McGraw-Hill Book Company, New York.

It is the cruel fate of all students and practitioners that they can repose on no final authority—except, perhaps, in mathematics, which dear old Benjamin Peirce described as “the one science which draws necessary conclusions.” In everything else, both data and conclusions are perpetually undergoing revision and correction, so that there is scarcely a department in which books more than 20 years old are good authority, or material for anything but historical inquiry. And the worst case of all, I fancy, is that of the science and practice of metallurgy. Some of us who have relied upon the books of Professor Peters treating of the metallurgy of copper, have had to acquire successive and augmented editions, or fall hopelessly behind the times; and now we are confronted with a new work from his tireless pen, intended to “replace” all its predecessors! Yet there are consolations for us. In the first place, we have cause to be grateful that a veteran observer, critic and expert has been spared to do his own work of revision and substitution, infusing into it the wisdom of experience upon which we are accustomed to rely. And, in the second place, we find, upon investigation of his latest utterance, that it does not supersede his earlier ones. We cannot do without this, but we need not throw them away! In other words, Professor Peters has stated in former books the principles of copper metallurgy, with a clear logic that needs no restatement; and, in this respect, the new book is rather a codicil than a substitute. It does indeed set forth the elements of the art so far as was required to make a complete treatise. But the full and felicitous discussions, illustrations and examples given in former volumes have been necessarily condensed to gain room for new material, describing more modern practice.

What Professor Peters has undertaken to do, unquestionably needed to be done. In the metallurgy of copper, as in many other departments of applied science, the art is forever outstripping the formulated theory, and the instruction of the schools is in danger of becoming inadequate as a preparation for practice. The evidences of this swift progress are either scattered through innumerable technical publications, or hidden in the experience of practitioners. Certainly they ought to be collected, sifted and combined, for the guidance of students and operators. But whoever does that important work must have two qualifications: he must be able to judge the material presented in publications of varying merit and authority;

and he must be able to get the necessary additional material not thus available. It is superfluous to say that Professor Peters possesses these qualifications in high degree. Besides his personal experience as practical metallurgist, author, critic and teacher, he stands in friendly relations with the captains and noncommissioned officers of the industry of which he writes, and can command the certified results of their campaigns—including defeats as well as victories. Of this, an interesting proof is afforded by his preface, in a long list of acknowledgments for assistance received from professional colleagues, at the head of which appears the name of the Anaconda Copper Mining Company, “whose attitude toward the scientific investigator constitutes a personal favor to every student of metallurgy.”

Among the fundamental elements and modern developments of copper-smelting described and discussed in this book, the following may be particularly noticed: Chap. IV describes the behavior at high temperatures of the principal ingredients of ores, in a manner clear and helpful to a thorough understanding of the more complicated furnace reactions. Chap. V contains an interesting discussion of the development of mechanical-roasting furnaces, including valuable data of MacDougal furnace practice and results. Chap. VI and VII contain an excellent general account of the copper blast furnace and its accessories. Perhaps more space might have been given with advantage to the mechanical handling and feeding of blast-furnace charges, which is but scantily represented in the present literature of the subject. But I am not prepared to say that anything else should have been omitted, to make room for this.

The table on pp. 146 and 147, giving the principal dimensions of certain copper blast furnaces, includes a number of plants not remarkable for successful practice. Some of them, indeed, have been out of business for some time past. This is not to be condemned in a simple compilation of the raw materials of history. But the results are sometimes lamentable—as when, for instance, the journalistic summarizer treats all the items of such a table as equally significant, and reports the dimensions of modern furnaces, etc., as “from — to —;” or, worse still, when some young scientist, ambitious to use tools which he does not yet understand, deduces “averages” and “curves” from such miscellaneous data. I remember a technical paper, written many years ago by an expert of no mean ability, and based on a fatally large amount of undigested scraps of fact, in which the “average dimensions” of all the iron blast furnaces of the United States—old or new, idle or active, visionary and experimental or practically successful—were laboriously set forth, with

a delicious, pedantic unconsciousness of the fact that these averages, put together, represented a furnace which not even an idiot (and there were idiots in those days!) would have dreamed of proposing. A reader who has studied Professor Peters' book will not commit this blunder in the use of his table; and I have, in truth, mentioned the matter, not by way of criticizing his work, but in order to introduce the above remarks about other people—which I contemplate with a critic's just pride!

In the chapters on true pyritic smelting and partial pyritic smelting, the different phases of this interesting branch of metallurgy are clearly set forth, and, in accordance with the practical experience gained in the last few years, a more rational classification is presented. These chapters are based upon the now classical investigations of Robert Sticht, of Mt. Lyell, Tasmania, and constitute, in fact, a condensation of the treatise on the subject in Professor Peters' former book, “The Principles of Copper Smelting.” Illustrations of the latest type of pyrite-smelting furnaces at Mt. Lyell increase their value.

On p. 253 the statement is made that at Anaconda, Mont., the blast-furnace flue dust, much of which comes from the fine material in the briquets, is regarded as a welcome addition to the reverberatory-furnace charge, “being preferred even to the roasted concentrates from the MacDougal calciners.” This seems to be contrary to the experience at Cananea, Sonora, mentioned by Dr. L. D. Ricketts in a paper on the “Cananea Reverberatory,” read before the Institution of Mining and Metallurgy, in which he calls attention to the fact that calcines are more cheaply smelted than flue dust, probably, (1) because they enter the furnace at a temperature from 400 deg. to 500 deg. F. higher; and (2) because the particles roasted in the MacDougal furnace are slowly heated to incipient fusion in contact with other fluxing elements, whereas the flue-dust particles are blown from the top of the charge and oxidized with extreme rapidity while traveling through the air. In chap. X, on partial pyrite smelting, there is an interesting discussion of the effect of coarse and fine material in blast-furnace smelting, tersely presented in the questions: What is the smallest size of material that is judicious to feed into the blast furnace? and, what is the largest size that it is worth while to briquet, agglomerate or otherwise compact?

The blast-furnace practice at the Washoe, Mont., plant is given in considerable detail, including a description of Mathewson's gigantic smelting furnaces. There are also considerable data on the blast-furnace practice at Cananea, with copious illustrations of furnace details,

most of which, however, have been previously published elsewhere, though they well deserve republication here. An account of Doctor Carpenter's pioneer work, at the Deadwood & Delaware smeltery in the Black Hills, South Dakota, in making low-iron, high-magnesia slags, is also given.

In the chapter on reverberatory furnaces, we have an important statement of the principles upon which high efficiency and rapid driving have been secured in recent years. Professor Peters emphasizes the fact that "it is the last 50 or 100 deg. of heat that does the smelting," and the consequent necessity of burning the coal rapidly with strong draft, and of conserving the temperature by preventing the ingress of cold air and the egress of heat. He points out also, the effectiveness of the propinquity of ingredients to be smelted. The Washoe reverberatory is described and illustrated, as are also some of the special reverberatory features worked out at Cananea, mostly taken from the important paper of Doctor Ricketts, already referred to, but pertinent in this connection. Among these features are the experimental firing with pulverized coal, which was not distinctly successful, and the present practice of oil firing. Reverberatory smelting with wood is treated in chap. XI, where metallurgists who have to improvise ways and means for treating ores in remote regions will find some valuable hints.

Chap. XII, blast furnace vs. reverberatory, presents a summary of the important points in this time-honored controversy, and suggests the proper line of calculation of the fluxing problem, in considering the merits of fire as compared to water concentration. The treatment of fines is discussed at some length in chap. XIII. Among the processes described are: briquetting; blast roasting in pots, and by the Dwight-Lloyd system; and agglomeration by mixing the molten converter slag, as worked out at the Sasco smeltery in Arizona. The rapidly growing practice of converting copper matte in the basic-lined converter finds mention in chap. XIV; and credit is given to Messrs. Peirce and Smith, of Baltimore, for the first continuous commercial success in the treatment of ordinary copper mattes in the basic-lined converter. The remaining chapters are devoted to copper refining; flue dust and smoke (a question which in these days of "smoke-farming" may outweigh all other technical and commercial considerations, and in connection with which there is given a description of the recently constructed flue-dust system of the Boston & Montana company, at Great Falls, Mont.); copper slags (an abstract of the more detailed discussion to be found in the author's "Principles of Copper Smelting"); and, finally, a chapter of miscellanies, with

mention of various unclassified accessories, tables of costs of producing copper by various companies, and statistics of production. The book, as a whole, takes rank, beyond question, at the head of its class and department. If Professor Peters should do no more, he would be warranted in cheering his well earned rest with the thought that he "kept the best wine to the last."

R. W. RAYMOND.

The Outlook for the Semi-Common Metals

The price of a metal is a function not alone of its rarity and the complexity of its metallurgy, but also of the demand for it and the consequent rate of production. The uses of a metal are often dependent on the availability of a steady supply of a uniform grade of either the metal or an alloy. With a view to stimulating the study of some of the metals which are becoming common, W. R. Whitney contributes a paper to the "Transactions of the American Brass Founders' Association," from which we take excerpts as follows:

Calcium a few years ago was a museum metal selling for several dollars per gram, but in 1908 sold at \$1.50 per lb., and would certainly sell far below this were there a greater demand and a larger output. It decomposes water slowly, giving hydrogen, and should be a fine deoxidizer. Thallium is similar to lead, but softer and heavier. Molybdenum, tungsten and tantalum can now be obtained in wire form and offer a tempting field for research on their alloys. Tellurium has an entirely fictitious market price, as it has long been an apparently useless metal. [However, recent patents mention it as a constituent of resistance alloys, and it may come into extensive use in that connection. It also gives beautiful ruby glasses, but its price and the difficulty of obtaining the metal in pure form have made the use of copper, gold and selenium more desirable.—EDITOR.]

Cobalt is a metal of which the world's supply has been greatly augmented in recent years, but no new or augmented uses have developed. A possibility of a new use is seen in the chromium-cobalt alloys described by Elwood Haynes¹. Silicon in 1900 sold for 40c. per gram, and is now about 5c. per lb., thousands of tons being used as a deoxidizer and for transformer iron. Boron is coming forward as a deoxidizer and purifier for making high-conductivity copper castings. Cadmium is whiter and less crystalline than zinc, and is a beautiful metal, but its price of \$1 per lb. keeps it out of the hands of the practical worker.

Vanadium is now selling at about \$5 per lb. in ferrovanadium, and is finding

extensive use in tool steels, automobile parts, etc. Titanium also is being produced in great quantities; and is a valuable reagent in the production of steel. It is a ductile white metal of high melting point, with a great affinity for both oxygen and nitrogen, and is rather unique that its use in the metallurgy of iron is not dependent on its remaining in the finished product.

There is no question that the study of those metals which have not advanced to a first-order production cost (as have iron, lead, zinc, etc.), is most interesting. Consider the element chromium. Is it a workable metal? Can it be hammered or cast? Is it permanent in the air? Is there a considerable possible ore supply? Has the cost of obtaining the metal been reduced to what seems a reasonable rate? etc., etc. As it is unlikely that such an element will suggest itself for use by men as did copper and iron, it is probable that its properties must first be determined and made known. As a metal, it is only about 15 years old. It is made in the metallic state by reduction of the oxide by metallic aluminum and also by electrolysis of its salt solutions. It cannot yet be produced at a lower cost than that of the aluminum required, and it now sells at about 80c. per lb. In its alloys with iron, which are made by direct reduction with carbon, it is sold for 29c. per lb. This gives a rough idea that ultimately, by perfection of metallurgical processes, etc., we may possibly obtain the metal much below 80c. per lb. It withstands heat exceedingly well. When pure it melts at a high temperature (Ostwald, about 3000 deg. C.) and it does not scale when heated red hot in air, as copper and iron do. It is for this reason that it is used in resistance alloys for electric-heating devices. It has been plated on metals, and then looks and acts like nickel plate. Doubtless its use will rapidly increase in special alloys, as it has already come into use in tool steel.

Russian Osmiridium Production

According to official statistics, the production of osmiridium in 1910 in the Urals (Perm and Orenburg governments) amounted in all to 62 oz. It is mostly used in the manufacture of fountain pens, the tips of which are lightly covered with this rare metal to secure durability. If for the production of platinum we must add to the official figures about 60 per cent. as surreptitiously placed on the market, then for iridium we must add at least 1000 to 2000 per cent., says the *Mining Journal*, for it is difficult to follow closely the production of a metal, the annual production of which can be carried away by a single person in his pocket.

¹Journ. Ind. and Chem. Eng., Oct., 1910.

Details of Practical Mining

This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent of telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of a pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

Notes of Interest to Prospectors and Operators of Small as well as Large Mines Things that have to be done in Everyday Mining

the length over all of pump and motor being 33 ft. 5½ in., with a maximum diameter of 5 ft. 6 in. The whole is suspended from the surface. Advance drills are kept boring in the bottom to minimize the danger of a sudden and overwhelming rush of water. At the present time all sinking is being done with a powerful winch operating a bucket, which travels without guides in the center of the shaft.

Use of Sprags in Coal Mines

BY FRANK LYNDE

Mine cars are seldom provided with brakes in the Pennsylvania coalfields; the system of controlling the cars by spragging is much more effective, as well as quicker. Fig. 1 shows a typical sprag such as is generally used. It is 21 in. long, the diameter at the middle is 2¾ in., while the diameter at the extreme ends is ½ in. The sprag is made of oak and weighs approximately 2½ lb., and costs about \$20 per 1000 at the factory.

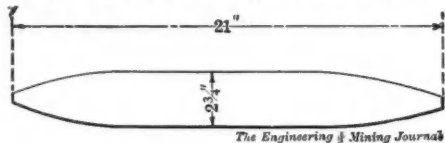


FIG. 1. COMMON FORM OF SPRAG

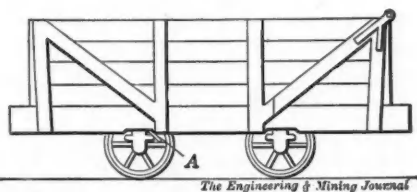


FIG. 2. METHOD OF APPLYING SPRAG TO CAR

This sprag is applied to the moving wheel between the spokes and jams against the base of bed frame, causing the wheel to stop running. Wherever it is necessary to keep the car standing in the mine or outside, the sprag is always used. In Fig. 2, A shows the sprag as applied to a mine car.

Fig. 3 shows the wedge sprag applied to the wheel of a car. This latter form of sprag is especially adopted for use at the foot of a shaft, where the motion of the car is slow and the foot-tender wishes to stop the car within an inch or two. The wedge sprag is made of oak. One end of it is made round for the handle while the other end has two faces; one of these faces is made to fit the tread of the wheel, while the other face fits the rail.

The use of the sprags causes the wheels to slide on the rails. This sliding, in turn, causes the wheels to be-

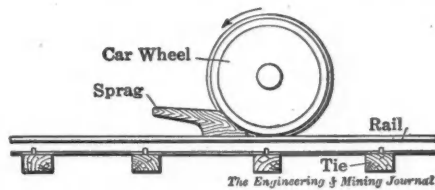


FIG. 3. WEDGE SPRAG IN OPERATION

come "flat" when the car has been in long use. Such wheels are sent to the machine shop to be ground, otherwise they become so flat that the car refuses to run on a 3 or even 4 per cent. grade.

The Gemsbokfontein Shaft

The Western Rand Estates Company commenced sinking the circular shaft of the Gemsbokfontein in September, 1909, but owing to the difficulties connected principally with the soft, decomposed chert and dolomitic breccia in which it is sunk, the depth at the end of June, 1910, was less than 80 feet.

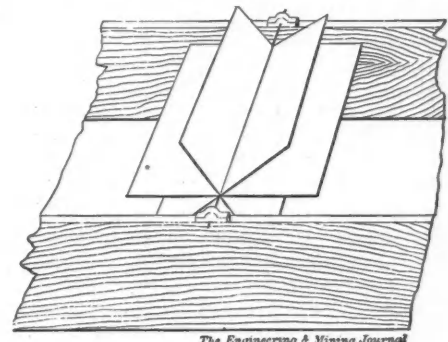
The shaft is 17 ft. 9 in. in the clear, and will be lined throughout with lead-jointed cast-iron tubing, varying in thickness from 1 3/16 in. for the first 100 ft. to about 2¼ in. at the lowest depth of the water-bearing strata. The whole shaft will be completely water tight, the tubing being strengthened by concrete fillings behind. The tubing is made in 10 segments to the circle, the width of each ring varying from 2 ft. 6 in. to 5 ft. Bearer rings, which will be let in at intervals on the solid rock, project 2 ft. outside the circle.

The question of an influx of water has been met, according to the *South African Min. Journ.*, by using two Sulzer pumps entirely novel on these fields, capable of lifting over 200,000,000 gal. per 24 hours. This is a centrifugal pump and is operated by 2300-h.p. motor, cast all in one piece, weighing about 30 tons,

Prevention of Foaming in Launderers

BY VICTOR H. WILHELM*

A simple device to prevent foaming over of slime launderers is used in the Last Chance cyanide plant, at Mogollon, N. M. It was usual for foam to collect in the Dorr classifiers and overflow the slime launderers, especially when there is much wood mixed with the ore. This



WHEEL TO PREVENT FOAMING

overflowing was successfully overcome, by placing a small wooden paddlewheel in the launders, as shown in accompanying illustration. This wheel was revolved by the force of the slime stream, the paddles serving to knock down the foam.

A Double Tool Zinc Lathe

At the Desert mill of the Tonopah Mining Company, a lathe is used for cutting zinc shavings, the unusual feature of which is that shavings are cut simultaneously on each side of the mandrel.

The two cutting tools are fed against the zinc by a screw feed. The screw feeds, one for each of the cutting tools, are operated by pawls, driven by eccentrics that engage ratchet wheels on the screw-feed axles; in this manner the high speed of the driving shaft is stepped down. The screws make 3.5 r.p.m. and are cut with threads so spaced that a forward travel of 0.58 in. per min. is secured.

*Mining engineer, Portland, Ore.

On the mandrel 22 sheets of No. 9 zinc, 36 in. wide and 108 in. long are wound. The tools cut this into shavings in 58 min. so that the lathe has a capacity of 100 lb. of zinc an hour. The mandrel on the lathe is cooled by passing some of the head solution through the mandrel as it is pumped to the precipitation boxes.

A Gas Board for Coal Mines

BY THOMAS T. JONES

In gaseous mines of the anthracite field, the miner must learn from the fireboss the condition of his working place before entering the mine in the morning. In such mines the gas board is kept by the fireboss, either on the surface or at the foot of the shaft, in a shanty where the miner reports to the fireboss for his duty of the day. The miner simply calls out his number to the fireboss, who in turn notes the number on the board.

The gas board is a blackboard about

of the men are written on small pieces of paper and pasted opposite the number, the miner's name above the laborer's.

When the fireboss makes his round in the morning, he takes note of every working place and on his return to the shanty puts on the board the conditions of each place. One cross right of the hole indicates a trace of gas found at face, two crosses show that there is sufficient gas in the face to require a safety lamp, three crosses signifies that the volume of gas is so great that extra precautions must be taken to remove it. The miner is not allowed to enter the face under such condition, unless he is accompanied by the fireboss to reexamine the place. Crosses between two peg holes indicate the condition in the crosscut.

As the miner enters the mine, he stops at the shanty and calls his number to the fireboss, who in turn puts a peg into the hole and cautions the miner as to the condition of his working place, whether there are one, two or three crosses.

A PRACTICAL GAS BOARD

Number Miner Laborer			Number Miner Laborer			Number Miner Laborer					
Joe Hoboskey..	1	O	O X	G. Urbin.....	101	O	O	201	O	O	
Jno. Cabbage..				Q. Hiskey.....				Jos. Akavy....	202	O	O
M. Kasarage..				S. Grebath....	102	O	O X	Jno. Yeoky....	203	O	O
Frank Kuse... 2	O	O		Y. Grebath....	103	O	O X	Mike Brick....	204	O	O X
Jno. Hoffman..	3	O	O X X	H. Cacosky... 104	O	O X	S. Kozels.....	205	O	O	
Jno. Nerick...				Jno. Kutz.....	105	O	O	Jos. Bekos....	206	O	O
Mike Beaty... 4	O	X	O X	S. Keach..... 106	O	X	O X	James Mike... 207	O	O X	
Jno. Bahinky..				Y. Bress..... 107	O	O	Jno. Dawe.... 208	O	O X		
Y. Welsh..... 5	O	O	O X	S. Tovitch... 108	O	O X	J. Luky..... 209	O	O X		
Jno. Lunon... 6	O	O	O X	Chas. Kline... 109	O	O	W. Wazeo.... 210	O	O X		
Mike Bolla... 7	O	X	O X X	F. Coffl..... 110	O	O X	J. Micok.... 211	O	O X		
A. Kinkus.... 8	O	O	O X	S. Kunitz... 111	O	O X	Y. Topac.... 212	O	O		
Job Shank... 9	O	O	O	Job Gerry... 112	O	O X X	F. Topico... 213	O	O X X X		
Angelo Moor.. 10	O	O	O X	Wm. Kuder... 113	O	O X	M. Tokash... 214	O	O X		
E. Parggar... 11	O	O	O X	James Comel.. 114	O	O X	G. Gatz.....				
R. Yorkes... 12	O	O	O X X	Art Inka.....			Chas. Rusick.. 213	O	O X X X		
Jno. Franco.. 13	O	O	O X	Joe Hotchi... 113	O	O X	H. Volosky... 214	O	O X		
H. Fissy..... 14	O	O	O X	Frank Shin... 114	O	O X	AL. Bric.....				
Y. Galleo.... 12	O	O	O X X	Y. Lucae.... 114	O	O X					
S. Gemis..... 13	O	O	O X	Paul Yee.... 114	O	O X					
Pete Ranko... 14	O	O	O X								

36x36 in. and is 1 in. thick, made of ordinary wood. The accompanying table shows the usual form found in a fireboss' shanty. The circles on the sketch represent holes about 1/4 in. diameter and 1/2 to 3/4 in. deep, so that wooden pegs, 1 in. to 1 1/2 in. long, may be inserted in them. The first row of these holes is for the miners, and the second row for the laborers. Each working place is represented by two holes; that is, the miner and his helper; also each working place has its number which corresponds to the number of the miner. The miner and his laborer have the same number, therefore each pair of the holes on the blackboard has a single number.

The holes are numbered in the order from the top to the bottom. The series of numbers from 1 to 100 represent the men who are working in the first seam, 101 to 200 represent the second seam; 201 to 300 for the third seam, etc. Names

Rating Electric Generators

A correspondent inquires why some electric generators are rated in kilowatts and others in kilovolt-amperes. It is customary to rate direct-current machinery in kilowatts. The capacity of an alternating-current generator, however, should be expressed as kilovolt-amperes, because if the power factor does not happen to be 100 per cent. or unity, which is rarely the case, the kilowatt rating is not sufficiently definite. The capacity of a generator is usually expressed in the number of kilowatts or kilovolt-amperes which the machines can generate continuously without exceeding certain temperature rises above the surrounding atmosphere.

With alternating-current generators the product of pressure in kilovolts and the amount of current expressed in amperes rarely gives the true output of the

machine. The capacity of alternating-current machines is, therefore, preferably expressed in kilovolt-amperes unless the power factor is known, when the rating may be stated, for example, as 800 kw. at 80 per cent. power factor. This machine would be rated at 1000 k.v.a., if the power factor were unknown.

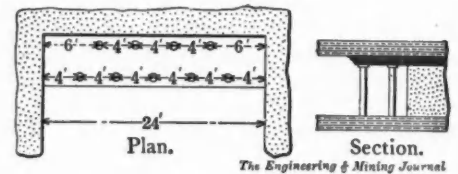
Placing Mine Timbers

BY C. C. MCGREGOR*

Improper and careless methods of placing posts in coal mines, result in a greater number of fatalities than are due to all other causes combined. The accompanying sketch shows a simple method of timbering that has proved highly successful. The following rules are suggested for enforcement:

The draw slate shall be posted with two rows of posts, always placing same under the slate as promptly as circumstances will permit.

The first row of posts is to be placed about 1 ft. from the edge of the slate. The first post from the rib shall not be a greater distance than 4 ft.; the next shall be not over 4 ft. from this post and so on across the room or entry.



PLACING POSTS IN COAL MINES

The second row of posts should not be over 12 to 18 in. from the back end of the cut or face of the coal. The first post set in the back row shall not be over 6 ft. from the side of the rib, and the second post in this row must not be over 4 ft. from the first post having no greater distance than 4 ft. between posts.

Thus, when the whole of the slate over a cut of coal is posted, the position of the posts will represent (after the coal is extracted) a series of equilateral triangles across the face of the room or entry, as shown in the cut which represents a room 24 ft. wide, where the slate is posted after the cut of coal is removed. This system of temporary posting is to be used in all rooms and entries where slate is not taken down promptly.

In pillar workings where the draw slate is not taken down immediately after the coal is extracted, the posts should be set not more than 3 ft. apart (distance between posts and face not to exceed 4 ft. under any condition), keeping same in rows parallel to and perpendicular to the retreating face, maintaining in position a sufficient number of rows to insure the slate being kept in a firm and safe condition until the posts are withdrawn.

*Large, Penn.

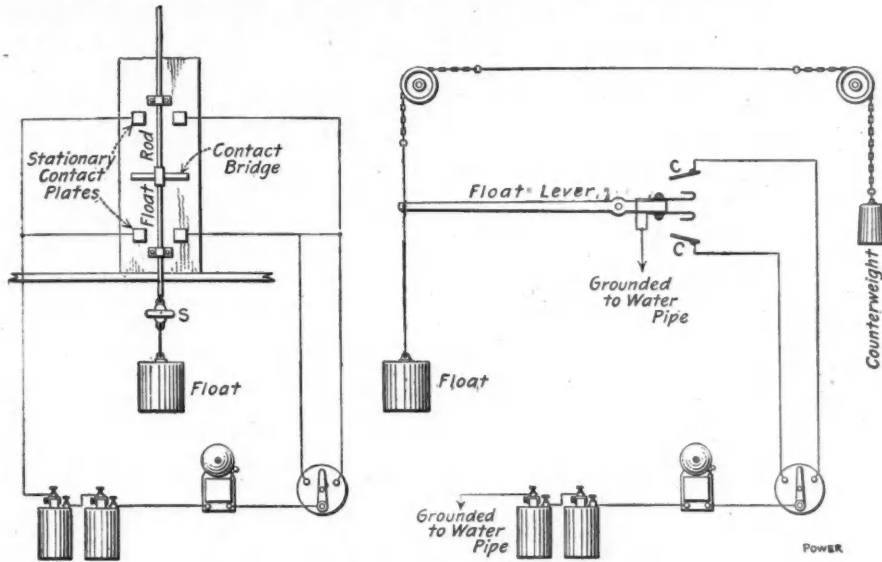
Rusting of Steel in Concrete

In view of the extended use of reinforced concrete in structural work, the report issued by the committee of the Concrete Institute, on the "Rusting of Steel Inside a Concrete Covering," is of more than ordinary interest. As a result of their investigations, the committee has drawn up the following conclusions. Reinforced concrete will last as long as plain concrete in any situation provided that certain precautions are taken during its construction. The precautions are as follows: The materials (cement, sand and stone) must be of good quality. They must be carefully and thoroughly mixed and scientifically proportioned, so as to be practically water-proof and air-proof. The mixture must be fairly wet, and must be well tamped into position so as to minimize voids. The aggregate should be as nonporous as possible, should all pass through 3/4-in. mesh, and

should not be oiled or painted, and thick rust should be scraped and brushed off before placing. The scantling of the various members of the structure should be sufficient to prevent excessive deflection. If electric mains are laid, care must be taken that no current is allowed to pass through the reinforced concrete. Fresh water should be used in mixing, and aggregates charged with salt should be washed. These recommendations have regard only to the prevention of corrosion of steel and not to fire resistance or any other property of reinforced concrete.

Water Tank Signal Systems

Two arrangements of a signal to give warning when the water in a tank becomes too high or too low are shown in the accompanying illustrations (*Power*, May 9, 1911). The diagrams are self explanatory, and will be appreciated by



TWO ARRANGEMENTS FOR WATER-TANK SIGNALS

any aggregate which is known to have a chemical action on steel should be avoided. The concrete covering should in no case be less than 1/2 in., and it is suggested that if round or square bars be used, the covering should not be less than the diameter of the bar.

In structures exposed to the action of water or damp air the thickness of covering should be increased at least 50 per cent., or the size of the aggregate should be reduced so as to insure a dense skin. In the case of structures exposed to severe conditions the concrete might be covered with some impervious coating as an extra precaution. The reinforcement should be so arranged that there shall be sufficient space between one piece and its neighbor to allow the concrete completely to surround every part of the steel. All steel should be firmly supported during the ramming of the concrete, so as to avoid displacement. It

¹Mech. Eng., March 24, 1911.

everyone who either dislikes to see water pumped into an overflowing tank, or who objects to being caught with none.

Sanitary Drinking Fountain

One of the features of American city life is the increasing recognition of the importance of guarding against the spread of contagious diseases. In the West one of the latest indications of the awakening to such matters is the increased number of sanitary drinking fountains in which pollution by germs from the lips of users is prevented by the flow of a constant stream of water over the surface of the upturned nozzles from which the men drink.

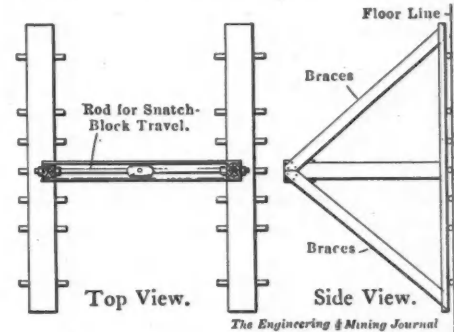
At the International smeltery, at Tooele, Utah, somewhat similar drinking fountains are provided. These work on the same principle as the more elaborate ones in the cities, but cost a mere trifle. An elbow is attached to a nipple from a water pipe, and a funnel-topped

drain pipe is provided below to catch the water that overflows. This elbow is screwed on securely and points upward, consequently, the water as it discharges washes the sides of the elbow and prevents the germs from adhering to it. Sufficient head of water is provided so that the jet rises about 3/4 in. above the elbow before it falls back. It is inexpensive to install and is well worth using.

A Rigging Crane

BY LEWIS L. BEEKEN*

The accompanying illustration shows a cheap yet handy man-power crane for erecting or rigging work. It is merely a gauntree frame centered on two 12-ft. planks, for supporting a snatch block and differential chain hoist, with the planks resting upon rollers. The snatch block runs upon a rod, thus giving the trolley or cross motion, and the whole frame, by means of the rollers can easily be moved to get the travel, while the chain blocks will facilitate the lift. For rollers, pieces of iron pipe are most convenient. For work such as placing motors, small pumps or other machines upon their foundations when it is either difficult or impossible to rig up tackle, this simple crane is most useful.



RIGGING CRANE

It can be made in an hour or so by one man with a hatchet, saw, and nails, from a few pieces of timber and an iron rod, and when its usefulness is completed it is easily knocked apart. If made of stout timbers and properly braced, it can be used for handling rather heavy work and will save time and a great deal of labor above the usual pinch bar, blocking and jack methods of getting a bedplate placed over the foundation bolts or in accurately placing some piece of machinery, such as an armature. As is always the case where rollers are used either a good floor or carefully placed planking is necessary to insure a comparatively level surface for the rollers to roll upon. An improvement upon the rollers, however, is to use a "dollie," or timber jacks, under the centers of each plank, thus doing away with the trouble of having to continually pick up and carry forward the rear rollers.

*5141 Woodlawn avenue, Pittsburg, Penn.

Zinc Oxide in Chemical Glassware

By A. M. SMOOT*

In examining commercially pure metals for traces of nickel I have repeatedly found small quantities of zinc, when, from the nature of the material, zinc would not be expected to occur, for example in copper wire bars and cathodes. After determining that the chemical reagents used in making the analyses were perfectly free from zinc, further examination showed conclusively that it came from the glass apparatus. The so called refractory or insoluble glasses used in the best, or rather in the highest-priced, chemical glassware are made by substituting zinc oxide in part for lime and boric acid for part of the silica. This zinc-boro-silicate glassware has certain superior qualities, for instance it is less liable to break when exposed to heat than ordinary silica-lime-alkali glassware, and under some conditions it is less soluble, that is, it is less affected by chemical reagents in solution. The composition of the principal kinds of glass and the effects of reagents upon them have been shown by Percy H. Walker¹. The zinc-oxide glasses are comparatively resistant to water and acid saline solutions, but not to solutions containing fixed alkalis nor to alkaline saline solutions.

By heating alkaline solutions, or even allowing them to stand at room temperature in zinc-oxide glass vessels, relatively large amounts of zinc may be dissolved. Since the amount depends upon the nature of the solution, the concentration, the temperature, the time and the surface of glass exposed a statement of quantitative figures would be useless. It is sufficient to say that neutral and acid saline solutions do not dissolve an appreciable amount of zinc from the glass. With ammoniacal solutions the amount dissolved is small, even in a long time. With alkaline-carbonate solutions the action is appreciable and with solutions of the fixed alkaline hydroxides it is distressingly large. Three or four milligrams of zinc oxide may easily be dissolved from a 300-c.c. beaker in a comparatively short time by a 2 per cent. solution of sodium or potassium hydroxide. This undesirable property of zinc-oxide glass does not appear to have been emphasized before. It is important in dealing with the fourth-group separations, especially in separations of nickel and zinc or cobalt and nickel and it may have a bearing on other determinations as well when accurate results are required. Of course, other things are dissolved from the glass but this is well known. The disconcerting effects of a small quantity of zinc derived from glassware may in some cases lead to erroneous conclusions.

*Ledoux & Co., 99 John street, New York.
¹Journ. Am. Chem. Soc., Vol. XXVII, p. 865.

Opening Alaska's Oilfields

By W. T. PROSSER*

A noteworthy oil development is taking place in Alaska. The Katalla fields, once regarded as most promising, and then for half a decade almost forgotten, are coming to the front again. New owners have obtained possession, and find that high-grade oil is ready to flow at least 2000 bbl. per day. Steel tankage to contain 30,000 bbl. of oil was shipped from California to Seattle early in March, 1911, and then forwarded to Katalla to be put in place at the harbor, where tank vessels can load direct. Besides this tankage two other steel tanks are being put in place at the wells, about nine miles distant from the harbor. One of these tanks is of 2000 bbl. capacity, and the other 5000 bbl. A 2-in. pipe line is almost completed from the wells to the harbor, but recent developments at the wells convinced the owners that this will be entirely inadequate. A 4-in. pipe line, to cover the nine-mile distance, is on the way to the coast from Pittsburg.

In May the first commercial shipment of Alaska oil will be made—at least the oil producers hope to have their equipment in place by that time. The flow of the wells will be sufficient to fill two vessels a month, even if no other gushers are found. A refining plant, to reduce about 500 bbl. of oil per day is under construction near Katalla. About half the flow of the four wells would supply Alaska's entire needs, as the northern district now imports a little over 17,500,000 gal. annually, worth over \$500,000.

The oil belt extends about 25 miles east of the Copper river's mouth, and back from four to eight miles from the coast. Years ago seepages were noted there, by the Indians, who carried the information to traders. In 1897 much of the land was taken up. A number of American claimants, having some of the most promising locations, formed the Alaska Development Company, which later leased to the Pacific Coal and Oil Company, a Canadian corporation, which in turn leased to the Pacific Mines Company, Ltd. This last named company did the actual operating. Drilling outfits were set at work, and four of the five first bores resulted in oil. Then each of the companies sought to oust the others.

About a year ago the Amalgamated Development Company quietly began the task of acquiring all the old ownerships, or of absorbing those that could not be purchased. Only recently the task was finally completed. That company is going ahead with the development of its properties on an extensive scale. So far \$200,000 has been expended, chiefly Canadian capital, in acquiring possession,

*333 Lumber Exchange building, Seattle, Wash.

and in providing equipment to handle the northern oil. Aside from this company half a dozen other companies will be at work this season, and perhaps as many as 25 wells will be drilled.

The crude oil contains a high percentage of inflammable and illuminating products. Analyses from different wells show that the Katalla oil is from 30 to 40 per cent. gasolene, benzine or naphtha, as the various government reports classify it. An equal or greater proportion is the coal oil or kerosene of commerce. These ingredients make the Katalla product particularly valuable in the market, and strongly in demand, as gasolene-producing petroleum is none too plentiful. Pennsylvania and Ohio wells supply nearly the entire country. The California oil, for the most part, is on an asphaltum base, and a government analysis gives it only 5 per cent. of gasolene—such a small proportion that it is not worth refining. The California oil is chiefly used for fuel in its crude state. In the market the northern flow is worth three or four times as much, barrel for barrel. Some Colorado wells yield 20 per cent. gasolene, as does much of the Pennsylvania flow, while the Oklahoma and Ohio wells are classed at from 10 to 15 per cent., and the Wyoming product at 10 per cent. California oil is higher in illuminating products, the figures running from 21 to 33 per cent. Some tests show Alaska's burning oil to run 50 per cent.—about equal to the Pennsylvania oil. Colorado's oil runs about 40 per cent. The remaining 20 or 25 per cent. of Alaska's oil is divided into two or three grades of fine lubricating oil and some coke and paraffin. The Alaska wells are not deep—the deepest producing bore going down not more than 1500 ft. From the formation of the country, oil experts are of the opinion that it will not be necessary to go much deeper than that, at any time.

Peculiar Occurrence of Mercury

At Myponga, about eight miles south-east of Wallunga, South Australia, is a peculiar occurrence of mercury. The metal is found native in small globules distributed over the faces of certain tunnels. When fresh faces are exposed no metal can be seen, but the miners assert that after a time metal sweats out on these new exposures. The government geologist says¹ that while this may be the case with rocks *in situ*, it did not occur in specimens taken to Adelaide.

If mercury does thus come to the surface it does not follow the lines of cleavage of the rocks, being found mainly on the flat exposed schistose surfaces. When rock which did not show mercury on the

¹Report of the South Australia Minister of Mines, for the half year ended Dec. 31, 1910.

surface was panned it gave a dull streak of mercury in the dish, the particles not coalescing readily. Repeated searching for cinnabar or other combinations of mercury gave negative results, and an analysis of some rock from which all adherent globules had been brushed gave only a faint cloudiness in the second-group precipitate.

An Opinion on Porcupine

Walter Harvey Weed, who recently returned from Porcupine where he has been engaged in examination work, stated that he was satisfied that the camp was going to be a large producer. He believes that the spectacular showings of free gold will cause a rush to the district when the railroad begins operating July 1. He believes that ultimately, however, Porcupine will resolve itself into a large low-grade camp. He states that in all the developed properties, in addition to veins carrying free gold that the wall rock is impregnated with pyrite carrying profitable quantities of gold readily amenable to cyanide treatment.

river, a distance of 12 miles. The route is then by launches to Hills Landing, from which point there is an eight-mile walk to the camp along the railroad grade.

Converter Tilting Device

One of the recent patents of William H. Peirce (U. S. pat. No. 530,312) deals with a new converter-tilting device, which is especially applicable to the Peirce-Smith converters, because of their great weight. The application is that of the old idea of swinging jib cranes and other similar apparatus by means of a rope around a horizontal wheel at the base. In case of the converters, couplings are placed on the shell and two pairs of oppositely wound wire ropes are connected to them. The other ends of the ropes are then attached to two connected cross-heads which are actuated by hydraulic power. Means are provided for adjusting the tension and keeping these ropes taut. In the illustration the channel irons *A* can be seen which connect the cross-heads *B*. Under the channels are the

sure equal to static plus velocity pressure; while the pressure in the trailing set is equal to static minus velocity pressure, thus causing different pressures in longitudinal chambers leading to the outer end of the plug, which are communicated to the meter.

The meter element consists of two vertical cups connected at the bottom by a tube. They are half filled with mercury and the whole arrangement is free to move about a set of knife edges like a balance.

The different pressures in the orifices cause the mercury to rise in the left-hand cup and to fall in the right-hand cup until the unbalanced mercurial column exactly balances the difference in pressure. This action causes the beam carrying the cups to move until the movement of the mercury is balanced. The motion of the beam is multiplied by means of levers and actuates the recording pen, the movement of the latter being proportional to the amount of mercury displaced.

Operations at Esperanza

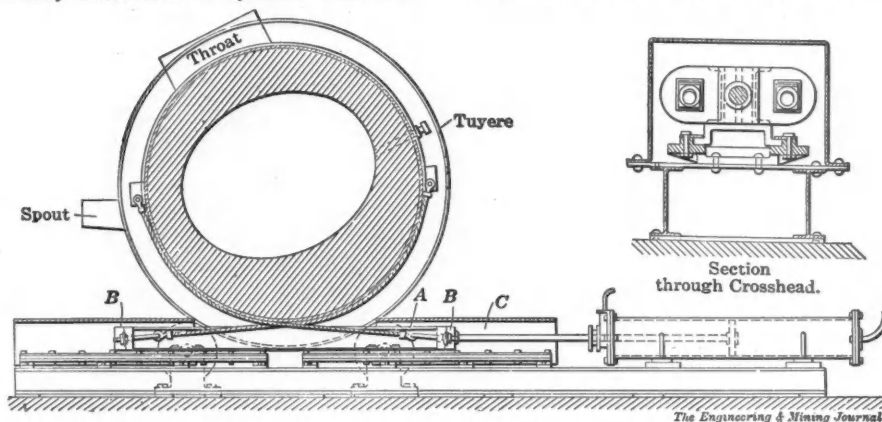
At a recent meeting of the Esperanza Mining Company, which operates mines in the El Oro district of Mexico, the chairman said that during the last year 193,000 metric tons of ore were treated at the Esperanza mine from which a yield of £437,000, equivalent to about \$11 per metric ton, was obtained. The net profit was £176,000, equal to \$4.42 per ton, or £15,000 more than for the previous year, and is equivalent to 38 per cent. on the capital. Four dividends, totaling 30 per cent. of the capitalization, were paid during the year.

It is estimated that there are in sight 367,000 metric tons of ore, which should yield a profit of £289,000. The tailings dumps, it is estimated, will yield a profit of £82,000 in addition to paying back £41,000, the cost of the plant. The treatment of these tailings has been discontinued for the present.

The costs, including development, depreciation and all other charges, amount to 18s. 10d. per ton, and with the plant working at the full capacity of 1000 tons daily, operating costs may be further reduced.

Developments in oxide ore have been satisfactory, the sulphide ores are lower in grade than had been expected and developments at depth are not encouraging. There is considerable ground yet to be developed and old filled stopes in the upper workings can be relied upon to supply some ore that can now be profitably treated.

The plant is now uptodate, and four more tube mills and six Pachuca vats have been added to the mill equipment. Since the inception of the company 7½ years ago, a total of £2,229,000, or 490 per cent., has been paid in dividends.



PEIRCE CONVERTER-TILTING DEVICE

Regarding the fire of Friday May 19, Doctor Weed states that the principal damage was confined to the Hollinger property, where all buildings were destroyed except the hay barn. The mill building was completely burned, the heavy machinery was damaged but little, but the electrical machinery was almost entirely destroyed. At the mine the hoist burned and the shaft was damaged slightly, the management, however, at once started to repair this and by Sunday, work was well under way. A director of the company has placed the total damage at \$175,000 and the delay at four months' time.

Doctor Weed stated that there are probably as many as 5000 men in and about Porcupine, and that notwithstanding the present difficulties of reaching the camp, owing to the swampy condition of the country, that many men are going in daily. He stated that in 15 min. he counted 35 men walking the track in the direction of Porcupine. Trains are now operating from Kelso to Frederickhouse

guide bars. These guide bars have upward projecting ribs *C*, which carry a set of bars or narrow plates, which project over angular extensions of the cross-heads and thus hold them down on the guides.

Improved Flow Meters

In order to use water, steam or gas economically, it is necessary to know not only the amount available, but more particularly the amount delivered. In order to meet a growing demand, the General Electric Company has developed several efficient flow meters, both recording and indicating.

The recording water-flow meter comprises a nozzle plug screwed into the pipe and projecting across it at the point where the flow is to be measured, a meter element, and a recording mechanism. The nozzle plug has two sets of orifices: the leading set facing the direction of flow, and a trailing set opposite.

The water impinging against the orifices of the leading set develops a pres-

Steel Prices

Whatever is to be the result of this week's preliminary outbreak of price reductions in the steel trade, says the *Evening Post*, at all events the episode forces on fresh consideration the new economical theories of which the Steel Corporation has become the exponent. This is the day, if not of new economic theories, at least of new interpretation of the old ones. When principles of government which had been accepted as immutable are uprooted by constitutional experiments in as widely separated fields as England and Arizona, when science and philosophy are daily discovering new axioms, it is not in the spirit of the time to toss aside arguments which reject supply and demand as proper influences on prices. If the Steel Corporation's theories are right, their correctness is not in the least impaired by the fact that guerrillas in the outside trade refuse to recognize them. The real question is, are they right?

Economists who have looked on them with a friendly eye, have presented two sets of arguments in their favor. Reduction of prices at a time of industrial depression is futile, because no one who is not buying now will be induced to buy because of lower prices. Either he has not the purchase money, even at the lower price; or else the opportunity for profitable and immediate use of his purchased steel is too small to make concessions in price an object; or else (this is a very familiar argument) the saving to the purchaser, through a cut of two or three dollars a ton on structural material, for instance, is so slight as to be negligible in a 10- or 20-story building. That is the first line of reasoning. The second is that a cut in prices, at a time of trade reaction, is not fair to consumers who bought before the cut—that it will upset the business plans of such purchasers, will probably induce them to withhold further intended purchases until they are sure that prices have touched bottom, and will thus defeat its own purpose.

Now the very obvious comment on these two arguments is, that they are mutually destructive. If nobody will buy more on such occasions with prices low than with prices high, and, if there is no advantage in buying at the reduction, and if the margin between the higher and lower prices is in any case a matter of indifference—then how is the purchaser wronged who bought at the higher price, and why should he wait for the lower? The stand-pat theorist impales himself on the horns of his own dilemma.

The truth is, all past experience of every trade proves that new buyers will be attracted by a cut in prices; that foresighted business men do find inducement to accumulate supplies on a falling market, and that nothing is more absolutely

characteristic of successful enterprise in the twentieth century than careful observance of economies in cost. Since the beginning of commerce, every trader in possession of his senses has been aware that the way to stimulate a reluctant market is to mark down the prices of goods. That a dominant influence in any trade, which should be used to restrain the excesses of rising prices in a "boom" and the sometimes equally mischievous excesses of the "cut-throat competition," is a most useful and salutary thing, is a principle recognized a thousand years before the Steel Corporation. But the industrial machinery which undertakes to go very far beyond those laudable achievements will be wiser in reconstructing human nature first.

Ducktown Sulphur, Copper and Iron Company

At the recent annual meeting of this company it was stated that a contract for the sale of its output of sulphuric acid for 10 years had been secured at a price which would enable the company to pay a dividend of 10 per cent. on its ordinary stock, even if the selling price for copper should fall so low that there would be no profit from it at all. Development work in the mines has shown that the ore reserves are larger than ever known before. Diamond drilling in the Isabella mine has proved the accuracy of previous estimates of the large quantity of ore existing in the deposit. Some of this ore which contains a high percentage of sulphur, and less than the average of copper, will pay for the manufacture of sulphuric acid only.

Natrambygonite

Natrambygonite is, as the name indicates, a sodium ambygonite (hydrofluorophosphate of alumina and soda with the soda in part replaced by lithia). This new mineral was found by Waldemar T. Schaller, of the U. S. Geological Survey, in a large mass of pegmatite about four miles northwest of Cañon City, Colo., in a low oval hill composed of pegmatite inclosed in contorted biotite and hornblende gneiss, in which the presence of lithium minerals—lepidolite and pink tourmaline—had already been noticed. The minerals associated with it were few in number and did not possess any unusual properties. The specimen measured about 7x5x3 cm. and in general appearance much resembled massive ambygonite. The hardness was 5.5 and the specific gravity about 3.04. The luster is vitreous, inclining to greasy; color, grayish white to white. Heated in a blow-pipe flame the mineral fuses easily without decrepitation, but with a slight intumescence to an opaque white enamel. The flame is colored yellow, with no indication of the lithium red. In this par-

ticular natrambygonite differs markedly from ambygonite and can thereby be distinguished from the common mineral. (It would be well to test ambygonite from different localities by this flame test.) Heated in a closed tube, water is given off and the mineral then quietly fuses without decrepitation. The analyses gave P₂O₅, 44.35 per cent.; Al₂O₃, 33.59; Li₂O, 3.21; Na₂O, 11.23; K₂O, 0.14; H₂O, 4.78; F, 5.63; total, 102.93 per cent.; less oxygen equivalent of the fluorine, 2.37 per cent.; net total, 100.56 per cent.

Chronology of Mining for May, 1911

May 5—Seven men killed by fire in the Hartford mine of Republic Iron and Steel Company at Negaunee, Mich.

May 8—Leaching plant of the Warrior Copper Company in Gila county, Ariz., destroyed by fire.

May 11—Fire in the Boston colliery of the Delaware & Hudson company at Larksville, Penn., suffocates five men.

May 12—The mine tibble and buildings of the Pierson colliery near Jasonville, Ind., destroyed by fire.

May 15—Supreme Court orders dissolution of the Standard Oil Company of New Jersey.

May 19—Bush fires at Porcupine destroy surface plant of Hollinger and other mines in Pearl and Gillies Lake sections.

May 24—Cut in steel prices started by Republic Iron and Steel Company.

May Dividends

The accompanying table shows the amount per share and total amount of the dividends paid during May, 1911,

UNITED STATES MINING COMPANIES	Situation	Per Share	Total
Alaska Mexican, g.	Alas.	\$0.20	\$36,000
Alaska Treadwell, g.	Alas.	0.50	100,000
Copper Range Co., c.	Mich.	1.50	150,000
Hecla, ls.	Ida.	0.02	20,000
Homestake, g.	S. Dak.	0.50	109,200
Parrot S. & C., c.	Mont.	0.15	34,477
Tuolumne, c.	Mont.	0.15	120,000
CANADIAN, MEXICAN AND CENTRAL AMERICAN COMPANIES	Situation	Per Share	Total
Beaver Con. Mines, s.	Ont.	\$0.02½	\$49,912
Buffalo Mines, s.	Ont.	0.03	30,000
Coniagas Mines, s.	Ont.	0.45	360,000
Crown Reserve, s.	Ont.	0.05	88,441
COAL, IRON, INDUSTRIAL AND HOLDING COMPANIES	Situation	Per Share	Total
Amal. Copper Co.	Mont.	\$0.50	\$769,439
Cambria Steel Co.	Penn.	0.62½	562,500
Internat'l Nick. Co., pf.	U. S.	1.50	133,689
Lehigh Coal & Nav. com.	Penn.	1.00	482,956
National Carbon, pf.	U. S.	1.75	78,750
U. S. Steel Co., pf.	U. S.	1.75	6,304,919
Va. Car. Chem., com.	U. S.	1.25	349,905

by a number of mining and industrial companies in the United States, Canada and Mexico.

Ore Occurrence at Little Bell Mine

By Edward R. Zalinski*

The Little Bell mine is situated near Park City, Utah, on the eastern slope of the Wasatch range, at an altitude of 8440 feet. The shaft and mine buildings are near the head of a gulch which descends in a northerly direction past the Daly-West mine and connects with Empire cañon. The sides of the gulch are not precipitous, but have slope enough to cause occasional snowslides, one of which, occurring in 1902, wrecked the Quincy shaft and boarding house, killing several people.

The property consists of some 20 claims, covering the ridge, which forms the dividing line between Summit and Wasatch counties, and also marks the boundary between the Uintah and Snake Creek mining districts. The ridge extends easterly and westerly between Bonanza Flat and the basin at the head of Empire cañon. The greater area of the claims lies north of the ridge, while

Silver-lead orebodies in this Utah mine occur as replacements in limestone where the contacts with quartzite have been cut by mineralizing fissures.

*Mining engineer, 607 Newhouse building, Salt Lake City, Utah.

of 2400 ft. Ore is sent down to the railroad in wagons or sleighs. Water is obtained from the Ontario pipe line, leading from one of the Bonanza Flat lakes. The equipment consists of two Sterling 80-h.p. boilers, with Underwood automatic stokers, a 70-h.p. Fairbanks-

the latites in texture, though no chemical analyses were made. The rock is of interest, as presenting a somewhat complicated form of occurrence, and also as being genetically connected with the Park City ores.

While porphyry covers the ridges south and west of the Little Bell shaft, it has not been encountered by the workings on the 700-ft. level, which extend under this ground. This would indicate a laccolithic character, or else that the porphyry broke irregularly across the bedding, rising from the south and west. The 300-ft. level of the Little Bell, some distance south of the shaft, encountered porphyry with a nearly vertical dip, which is a part of the belt that outcrops on the divide. The porphyry is evidently in the form of a neck, or stock here, as further development failed to cut its continuation along the strike to the southeast. Mineralization, in part at least,

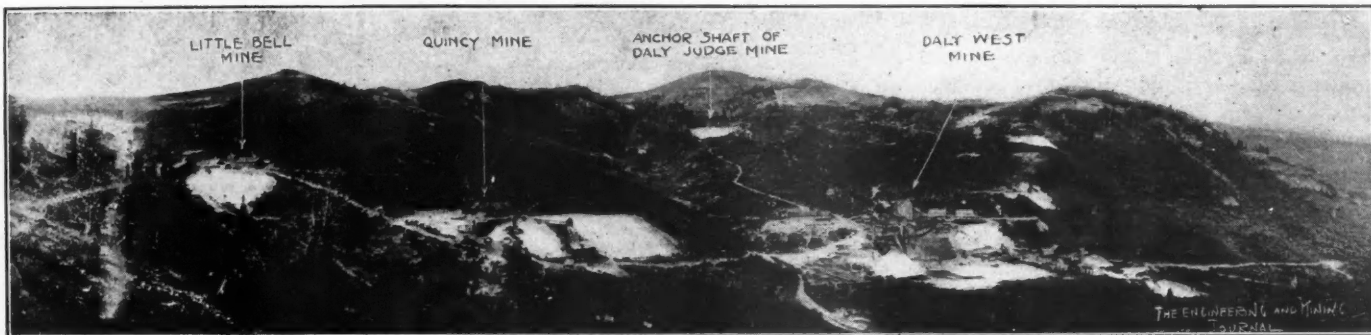


FIG. 1. THE LITTLE BELL AND NEIGHBORING MINES, PARK CITY DISTRICT, UTAH

a part of the property crosses the divide on the southern or Bonanza Flat slope. Two ridges extending northerly from the divide and the gulch between them are also covered by the claims. The Little Bell mine lies on the southern edge of a group of well known mines, among which are the Daly West, Quincy—now owned by the former company—Daly, and Ontario. The Wabash, Lucky Bill and West Quincy border it on the east and south, while the Thompson Mining Company's claims lie on the west and separate it from the Daly-Judge. The West Quincy and Thompson have recently been merged under the name of the Quincy-Thompson Consolidated.

Fig. 1 shows the Little Bell at the extreme left, the dumps and shaft house of the Quincy in the left center, the Daly West mill and buildings on the right, and the Anchor shaft of the Daly-Judge in center background. The mine buildings consist of an office and boarding house, hoist house, compressor building, ore bins, blacksmith's shop, etc.

The mine is reached by wagon road by way of Ontario cañon. Supplies are hauled from Park City, a distance of three miles, with a difference in elevation

Morse hoist, and an Ingersoll-Sergeant 10-drill compressor.

GEOLOGY

The surface of the Little Bell mine is rounded, with few prominent outcrops. Quartzite and limestone with intruded porphyry are the principal country rocks. The limestone belongs to the Park City ore-bearing beds and covers the greater part of the surface. It extends from the west end of the claims to the gulch, which is shown on the left in Fig. 1. From here easterly Ontario quartzite outcrops, the contact being along the bottom of the gulch. The beds strike N. 20 to 30 deg. E. (magnetic), and dip to the northwest at 26 deg., with local variations.

Porphyry outcrops along the divide on the southern part of the claims. A dike cuts across from here northwesterly past the Quincy shaft toward the Daly West. The porphyry is intruded into the sediments in the form of dikes, and possibly laccolithic masses. It forms an irregular belt with an east-west trend, extending across Little Bell ground and some distance beyond to the east. Thin sections indicate that the rock is a rapidly cooled form of monzonite approaching

was subsequent to the intrusion. Thin seams of sulphides are found along fractures in the porphyry, but so far no ore has been developed either in it, or along its contact with the limestone.

NON-IGNEOUS ROCKS

The ore-bearing beds of the camp and adjoining formation are well exposed on the divide south of the Little Bell. Fig. 2 is a section along this ridge. The elevations are by barometer reading, taking the Daly West shaft as 8260 ft. Beginning on the east, are limestone beds of unknown thickness, which, according to Boutwell,¹ are of lower Carboniferous age. So far no large orebodies have been developed in this lower limestone and it has proved of relatively little economic importance. On top of these beds lies the Ontario quartzite about 1500 ft. thick, which contains interbedded limestone of small thickness. The Ontario quartzite forms the foot-wall of many of the large replacement orebodies of the district. The ore-bearing limestone lies on top of the Ontario quartzite and is about 600 ft. in thickness. It forms the

¹"Contributions to Economic Geology," Bull. 213, U. S. Geol. Surv., 1902; pp. 31-40.

country rock for the bonanza orebodies, which have made the camp noted. Above this are a series of thick, red shale, limestone and sandstone beds. A more detailed description of the beds is given by Boutwell.²

IGNEOUS ROCKS

There are two types of igneous rock exposed along the ridge: a fine-grained typical diorite, which forms a saddle southwest of the Anchor shaft of the Daly-Judge, and a coarser porphyritic type, which breaks through the ridge at various points, and which has been referred to as porphyry. The section (Fig. 2) is ideal insofar as the underground relations of the igneous rocks are concerned, though it shows their surface extent with accuracy, and indicates the points where porphyry broke through the sediments. The extent of the porphyry underground is probably somewhat greater than shown in the section. It is a question whether the rock forms only a thick belt or dike along the ridge, or whether it has widened out along the bedding in places forming laccolithic masses, which are now exposed by erosion. In favor of the latter view are the facts that the underground workings of the Little Bell pass under this ground and do not encounter porphyry, except at one point on the 300-ft. level. There are also several small shafts east of the Lucky Bill which enter porphyry and pass into quartzite at no great depth. The porphyry may be partly in the form of sills, and break across from bed to bed. If this is not the case, it would be necessary to regard a part of the rock as extrusive to account for the above occurrence. The greater part, however, if not all, is undoubtedly intrusive.

The rock is a rapidly cooled form of monzonite. In hand specimens, it is greenish to grayish in color, and shows phenocrysts of feldspar from 1/16 inch to 1/2 inch in length, which give the rock a speckled appearance. The groundmass is fine-grained and compact, inclosing occasional needles of hornblende. Rock sections under the microscope show both soda-lime and potash feldspar. The hornblende is partly altered to chlorite. Some biotite and augite are present in small quantity. The accessory minerals are apatite and zircon. There is no glass in the base, but rapid cooling is shown by the fine-grained felsitic groundmass which, with approximately equal quantities of orthoclase and plagioclase would bring the rock under the latites, or rapidly cooled form of a monzonite magma. The rock greatly resembles a portion of the Bingham monzonite adjoining a limestone contact in Sap gulch, near the Highland Boy mine. This has a felsitic groundmass and had evidently

cooled rapidly near the contact. Thin sections of this rock are nearly identical with those of the Park City porphyry.

ORE OCCURRENCE

The orebodies in the Little Bell occur along the contact of a small bed of quartzite in the Park City limestone. This bed is called the intermediate quartzite and is from 18 to 50 ft. thick. It is separated from the Ontario quartzite by 150 ft. Quartzite forms the foot-wall, and the ore replaces the limestone where the contact is cut by mineralizing fissures. Ore makes in some beds above the contact. In the Silver King Coalition and other properties the ore makes on the contact of the Ontario quartzite with the limestone, but until recently no ore has been found here in the Little Bell.

is the only reversed fault noted and has a throw of about 25 ft. It brings limestone on the west into contact with the foot-wall quartzite. There are numerous barren fissures, with or without gouge, striking in various directions. The dips in all cases are steep, ranging from 50 to 90 degrees.

The ore was deposited in lenticular bodies, having a maximum thickness near the mineralizing fissure and gradually feathering out along the bedding. The greatest length of these lenses is along the fissure and ore may extend a hundred feet or more on the dip of the beds. Usually the ore is 2 to 4 ft. in thickness. In some places there are two layers of ore, one 2 to 3 ft. thick lying along the quartzite foot-wall and separated from a second layer or bed of ore by 4 to 5 ft. of white limestone. The upper ore lying

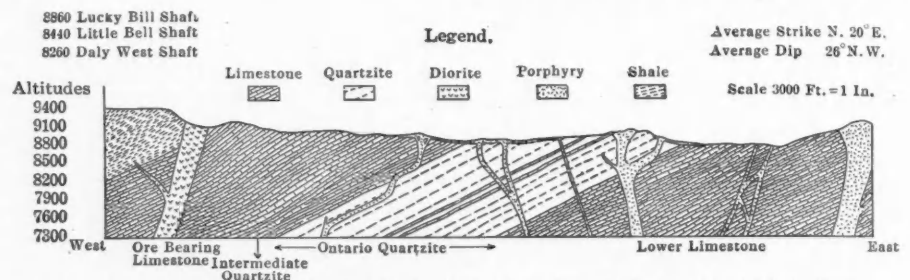


FIG. 2. Section through Ore Bearing Series Park City along Ridge South of Little Bell.

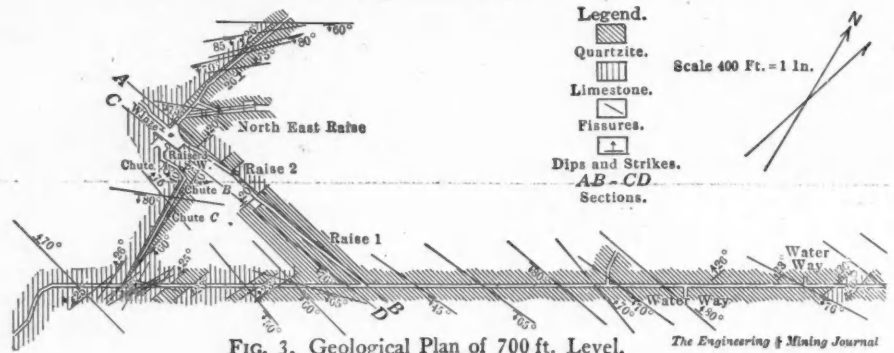


FIG. 3. Geological Plan of 700 ft. Level.

There has been strong fissuring and faulting. Both prominent northeast and northwest fissures occur with zones of marked crushing and shearing. The principal fissuring is northeast, and the prevailing dip is steep to the northwest, except in the mineral-bearing fissures, most of which dip steeply to the south toward the porphyry. Faulting in nearly all cases is normal and with relatively small displacement. Some strike faulting on the bedding has occurred. The fissures along which marked displacement is shown include some of the mineral-bearing fissures. These strike mostly northeast and dip southeast. On these fissures the southeast side is the down throw.

In general, on the east-west faults the north side has moved to the west on the northwest faults, the southwest side is the down throw and movement was to the east. There is one north-south fault on the 700-ft. level on which the west, or foot-wall side is the down throw. This

over this varies from 1 to 3 ft. in thickness. This may make a total of 7 to 8 ft. between the foot and hanging. The intermediate band of white limestone may be more or less replaced by ore. Near the fissures, the ore sometimes extends from 10 to 15 ft. above the bedded deposits into the limestone.

NATURE OF THE ORE

The chief valuable metals are silver and lead, with copper and some gold. In shipment lots the ore assays approximately 21 per cent. lead, 76 oz. silver, 0.05 oz. gold, 2.25 per cent. copper. It carries an excess of iron, and brings net smeltery returns between \$40 and \$50 per ton. A considerable tonnage of lower grade ore has also been developed. Galena and pyrite are the chief ore minerals. The former occurs both coarsely crystalline and fine-grained. There is also some cerusite, anglesite and tetrahedrite (gray copper). Oxidation has extended to below the 700-ft. level, so that sul-

²"The Stratigraphy and Structure of the Park City Mining District," *Journ. of Geol.*, July-August, 1907, p. 434.

phide and carbonate ore occur together. The galena often remains in lumps and nodules in otherwise oxidized ore. Silver occurs principally with the galena and gray copper. The latter, where oxidized, colors the ore blue and green, with azurite and malachite. Where these minerals are present, the ore often assays high in silver. The gold probably occurs with the pyrite, which is now largely oxidized to hematite and limonite. This is present in appreciable quantity, giving the ores a reddish-brown color. There is also a varying amount of manganese staining. In only a few places is pyrite seen fresh and unaltered, and then in silicious material surrounding the orebodies. Zinc sulphide is not common, but is occasionally noted in small quan-

Fig. 3 shows a part of the 700-ft. level where ore was discovered, with fissuring and some of the displacements. It will be seen that the prevailing fissuring here is approximately parallel to the Little Bell fissure, on which Raise 1 and Raise 2 are driven, and dips to the south. There have been two or more periods of faulting, one nearly east and west, and one approximately north and south. The latter is the older. Its continuation cannot be found on the north side of the Little Bell fissure.

Sections AB and CD (Fig. 4) are on either side of the Little Bell fissure, and show the position of the orebodies here as far as developed in September, 1906. On the north side of the fissure (section AB), the ore follows the contact with

sure, and in the fissure itself, sometimes making into the limestone several sets wide along the contact of the Ontario quartzite.

Mining is carried on in the usual manner. The ground holds well and but little timbering is required. Stulls are used in the stopes and square sets where the ore is of sufficient thickness. Ore is hoisted at the Little Bell shaft and passes through a sorting-house on the way to the bins. Some of the ore is sorted, and a part put on the second-class dump. A mill with a capacity of 100 tons daily has been built to treat this material which has accumulated and also the ores of milling grade developed in the mine. Electric power is furnished by the Snake Creek Power Company.

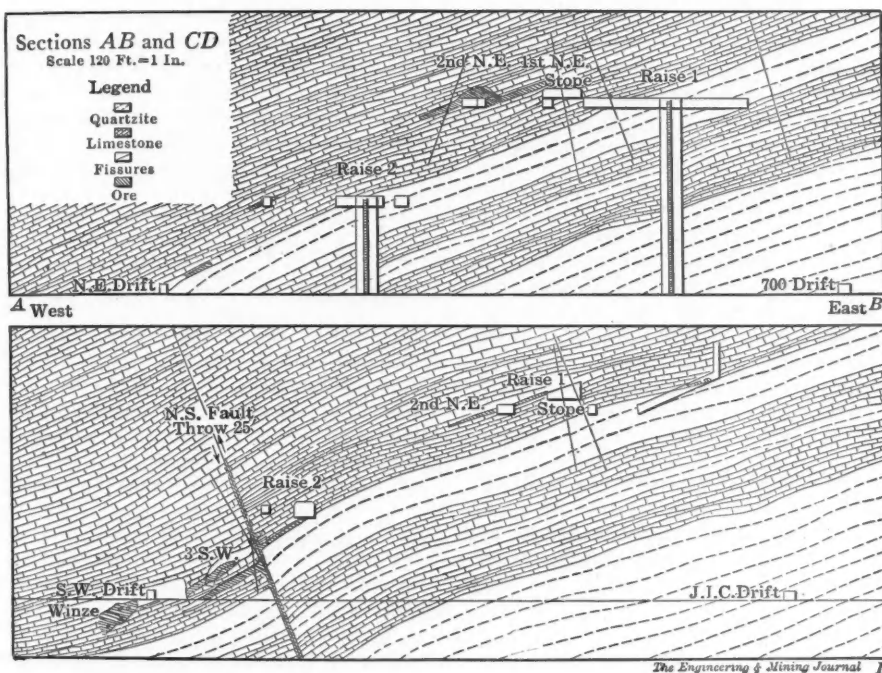


FIG. 4. SECTIONS OF 700-FT. LEVEL, LITTLE BELL MINE

tity. It is not present in large enough amounts to show in the smelter returns. Quartz and calcite are the principal gangue minerals.

The first ore discovered was found in the Little Bell fissure, which was cut on the 700-ft. level in drifting from the shaft toward the West Quincy (J. I. C.). Where cut, the fissure carried streaks of ore running well in silver with some lead in iron and manganese stained vein-matter. It was followed westerly a short distance, and opened into galena ore when the contact was reached. Some galena also occurred in the fissure itself. The strike is north 80 deg. west, and dip 76 deg. south. It is 3 to 7 ft. between walls, and carries galena and lead carbonate with much iron staining. The south side, or hanging has dropped and moved to the east. There are a number of similar displacements of small throw along south-dipping fissures on the 700-ft. level. In most cases the south side has moved to the east.

the intermediate quartzite, and also makes in the limestone 20 to 30 ft. above the contact. On the south side of the fissure (section CD) ore also occurs in a north-south fault, and makes out from this fault in the limestone, and along the contact.

THE MINE WORKINGS

A winze has been sunk on the Little Bell fissure from the 700-ft. level and connections made with the 900-ft. level of the Daly West. This secures good ventilation and drainage by way of the Ontario tunnel. Before this, the water was drained from the 700-ft. level by means of sumps sunk in fractured quartzite. Arrangements have been made with the Daly West to furnish compressed air. Two levels were opened from the winze below the 700-ft. level and ore is hoisted by a donkey engine and sent out to the Little Bell shaft. The ore below the 700 has been found on both sides of the fis-

Determination of Tin in Presence of Antimony

J. A. Sanchez describes (*Bull. de la Soc. Chim. de France* of Oct. 5, 1910) a method for the estimation of tin in the presence of antimony, which is rapid, and, in cases where the tin is present in relatively small amount, accurate. The method depends on the fact that ferric chloride oxidizes stannous chloride to stannic chloride, while it is without action on antimonious chloride. Therefore, if stannous and antimonious chlorides occur together in solution, the tin may, in the absence of interfering salts, be titrated directly by means of a ferric-chloride solution of known strength, the end-point of the titration being indicated by the appearance of a persistent greenish-yellow color.

When tin and antimony have been separated from other metals as sulphides the following method is recommended. The sulphides are dissolved by heating with concentrated hydrochloric acid with the addition of a gram or two of powdered potassium chlorate, added a little at a time, and the solution is diluted with an equal bulk of hot water and filtered from particles of unoxidized sulphur. The filtrate is next warmed with some aluminum wire in a flask fitted with a Bunsen valve. A violent disengagement of gas takes place, and the whole of the antimony is precipitated as metal, the tin being reduced to the stannous state. When action has ceased, the solution is diluted somewhat with boiling water, filtered, and the filtrate titrated hot with ferric chloride after addition of more hydrochloric acid. The metallic antimony is dissolved in hydrochloric acid (1:1) with addition of a little iodine solution, from time to time, and the antimony precipitated as sulphide. Large quantities of tin cannot be estimated in this manner without possibility of errors which may exceed 0.5 per cent., but where the total amount of tin is only some 1 or 2 per cent., the method is said to be as accurate as can reasonably be required.

The Management of Mexican Labor

By Evan Fraser-Campbell *

The most intelligent laborers are found among the machinists and mechanics. At mines the greatest efficiency is attained by assigning tasks and small contracts.

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tically a small benevolent association with the company paying the bills.

MANNER OF LETTING CONTRACTS

In drifting there are two general ways of letting the contract, either by the distance driven or by the length of hole actually drilled. In the latter case no account is taken of the advance. Under the first of these systems the contract is given to an individual who provides his labor, pays for the supplies used, does the necessary mucking and tramming and is responsible to the shift boss for the progress of the work. In the other case each pair of men work under a separate contract, so that in a given face there may be two or three different contracts, each independent of the others. Under this system, the shift boss has to ascertain at the beginning of his shift the number of pairs of men he needs and assign them to the various working faces.

As soon as possible thereafter he must visit them underground and point their holes, thus assuring himself that the work will be done to the best advantage and again measure the amount drilled by each pair at the end of the shift, so that, unless he is provided with several assistants, a considerable amount of time is lost at the beginning and end of each shift. In addition extra men may be needed to load and fire the holes after they have been measured, for with this form of contract the responsibility of the contractors ends when the holes have been put in, the cost of the powder required being borne by the company. In this way, with experienced men the cost of explosives is reduced to a minimum. Finally there is the added trouble of getting sufficient men to make up the full quota of the shift, and this is indeed a serious drawback, as anyone conversant with Mexican labor will appreciate, for a native, recognized by his countrymen as a leader, can daily bring a hundred men to work where the alien shift boss can collect but half that number with any regularity.

Under the first system the time of the shift boss is not taken up with the innumerable details outlined above and he can devote his energies to keeping the

To manage Mexican labor successfully it is necessary at the outset to take into consideration the fact that the Mexican peon is of a race whose habits and characteristics are those of a simple-minded people, accustomed for generations to conditions not far removed from actual servitude and who have not yet learned to act on their own initiative. These conditions are gradually changing, due to the increase in educational facilities and the influences of modern civilization. The successful manager is the one who understands the limitations of the people and is willing to adapt his methods to their capabilities. Above all he must have unlimited patience.

It is safe to say that in the mining industry at least, the most intelligent laborers are found in the mechanical department. Here the standard of work and efficiency is rapidly increasing and it is quite possible now to get native mechanics who are fully capable of performing satisfactorily the daily run of small repairs at any large mine, though it is still considered necessary to employ a foreigner to direct and systematize the work and assume the responsibility of the more important undertakings.

MANAGEMENT OF THE INEFFICIENT

On the other hand the ordinary miner is an uncertain quantity. Generally, this class of labor inefficient and therefore cheap, and with this in mind it is readily understood that some ingenuity is required on the part of the superintendent in order to treat the men in a fair-minded way and at the same time protect the interests of the company. The best solution of this problem seems to be some method of contracting for every possible class of underground work. By a close adherence to this principle the underground superintendent of a well known mining company reduced his working costs 20 per cent. in three months. This man had studied the Mexican peon and knew his points of weakness.

Of course, there are special cases where it is impossible to contract for the required work, but as a general rule the only way to keep the costs within reasonable limits, is to have all drifting, stoping, sinking, timbering, filling, tramming, track-laying and even hoisting done by contract.

All contracts should be terminated at the end of every week for the system of weekly *prestamos* necessary with contracts running for a fortnight or longer is liable to frequent abuses, as in many cases under this system, the contractor is such in name only, every man with him sharing equally in the profits or losses, and the contract becomes prac-

general routine of work running smoothly and the other duties of his position. The contractor knows his working face and hence little time is lost at the beginning and end of each shift, and finally the number of men required to oversee the work is reduced to a minimum. However, the cost of explosives is apt to reach startling proportions, for comparatively few Mexican miners understand the placing of holes to produce the best results, or have any conception of the amount of powder required for a given burden. Opposed to these advantages is the fact that under the second plan the work is accomplished much more efficiently and economically.

It will be seen, therefore, that both these methods possess distinct advantages. Local conditions would have to be considered before adopting either method, but as a general rule at a small mine the second system will give more satisfactory results, whereas in a mine where there are many workings the first system should be adopted. It frequently happens in outlying districts that the available supply of labor is controlled by one man, whose good will once obtained, will settle the labor question for the superintendent.

Where the contract is let by the length of hole drilled, it is generally advisable to set a separate contract at a per car price for tramming the broken rock.

CONTRACTS FOR STOPING

In stoping there are several methods of letting contracts. The shift boss may set a price per linear meter depending on the cubical contents of the strip to be removed and the fact that extra men must be supplied by the contractor to throw the ore into the chutes. Occasionally a separate contract is let for this purpose, but seldom with satisfactory results. Sometimes a contract is let for the meter of hole drilled, but this necessitates the unsatisfactory method of another contract for throwing the ore into the chutes, as well as the numerous disadvantages that have already been mentioned. Perhaps the best plan is to let the contract for a given stope to one man at so much a car, the amount paid the contractor being determined by the number of cars of ore drawn from the stope and delivered at the station. Each contractor is provided with metal tags marked with the number of his stope, one of which he places in every car. This tag is removed at the surface and the total number placed to the credit of the contractor. By comparing this record with that from underground a good check is obtained. The usual precautions are necessary to prevent the contractor from mixing waste with ore.

All timbering, whether square set or drift set, should be paid for by the set in place and, as is usual in all contract work, should be thoroughly inspected before being credited to the contractor for the reason that few Mexicans understand the art or the necessity for good timbering and are inclined to be careless in framing the sets and putting them in place. It is best to have all timber framed outside the mine.

FILLING STOPES

It is always difficult in most mines to have the filling keep pace with the stopping, but the following method has always proved satisfactory where judiciously used. A daily contract is let to a gang of men for filling a given space, the amount to be filled depending on the number of men in the gang and the number of cubic yards of dirt a man can move in a day under the existing conditions, which amount can only be determined by experience. The understanding is that as soon as the stipulated amount is done the men can come to the surface receiving a full day's wage for the work. The prospect of a short day at full pay is a great incentive, but as the work accomplished is usually much more than would be done under other conditions the company does not lose by the transaction. Occasionally little leniency in the amount to be done does no harm and when the system is established the results are astonishing. This system of giving a *tarea* or task is generally acceptable to Mexican workmen.

TRAMMING AND SINKING

With regard to tramping, it is best to put the trammers on contract at so much a car delivered at the shaft. A good head carman will see that the ore is trammed impartially from every chute. The tally for each carman may be kept by the man in charge of the station. A slightly higher rate may be paid for cars filled by shovel from the floor as in the case of cleaning out old headings.

In hoisting, where the output is sufficiently large it is well to give a contract to the cage or skip tenders of a few centavos a car based on the average daily run, with a bonus for every car above a stipulated number. This system tends to keep the hoist working to full capacity and hence economically, it being perfectly clear to all hands that time wasted is money out of pocket.

In sinking winzes or small shafts it is rare that a contract whereby the contractor is paid for the advance he makes is satisfactory to the mine foreman, for the average Mexican knows little or nothing about down holes. The best method is to engage as many pairs of miners as necessary and set them a contract per meter of hole actually drilled, each pair working independently of all others. Poor workers are thus easily recognized and can be removed. A responsible head

man is necessary who will point the holes and be otherwise directly responsible to the shift boss who measures the holes and superintends the loading and firing which may be done at convenient intervals. The muck is hoisted and paid for by the bucket, but during the period when mucking is in progress all the men participate equally in the amount earned. Men can make good wages by this method and the costs are kept as low as possible. The timbering is contracted for separately. The chief advantage of this method is that only work actually done is paid for and the time that may be spent doing it does not enter into the calculation.

All track work should be done by the *tarea* system, which gives better results than any other way.

The basic principle to be observed in all dealings with the native of the land of *mañana* is to so define his work that the amount of compensation he receives depends directly upon actual results obtained, thus making the time required a negligible factor in the calculation.

Determination of Alumina

BY T. W. CAVERS

The method of determining alumina in ores, slags, etc., described below, has been in use at the Tennessee Copper Company for some time and has given greater satisfaction than either the phosphate or the electrolytic method. This method was suggested by the qualitative test for alumina in the presence of iron and chromium, described by H. H. Willard, of the University of Michigan, with modifications to make it practicable for quantitative work.

For ores containing only iron and alumina of the metals of the third group, the regular scheme of analysis is followed. The sample is fused with carbonates, silica removed and iron and aluminum precipitated with ammonia. The iron and aluminum are then separated by treatment with hydrogen peroxide and a weak solution of sodium hydroxide. If the ore contains manganese, it must be removed. The iron, aluminum and chromium if present, are thrown down by means of barium carbonate, after the removal of the silica, and the separation of the iron and aluminum made as before. Any chromium present goes into solution as sodium chromate along with the aluminum. The solution containing aluminum and chromium is made acid with nitric acid and the aluminum precipitated with ammonia, the chromium remaining in solution.

PROCEDURE—MANGANESE ABSENT

The procedure, when manganese is not present, is as follows: Digest 0.5 gram of the sample with HNO_3 or HCl , as the nature of the ore requires,

*Tennessee Copper Company, Copperhill, Tenn.

filter, fuse the residue with sodium and potassium carbonates, take up with HCl , add the filtrate and take the whole to dryness. Moisten with water and take to dryness a second time. Take up with HCl , boil, then filter off the silica. Make the filtrate from the SiO_2 just alkaline with NH_4OH , add 5 grams NH_4Cl and bring to a boil. Filter and wash twice with hot water. Reserve the filtrate for CaO and MgO .

Transfer the precipitated hydroxides to a beaker with as little water as possible, add 10 c.c. H_2O_2 and 10 c.c. normal (approximately) NaOH and bring to a boil. Filter through the paper from which the hydroxides were washed. Wash twice with hot water, with the addition, each time, of 1 c.c. NaOH solution and 1 c.c. H_2O_2 , to the funnel. Transfer the precipitate again to the beaker and repeat the treatment with H_2O_2 and NaOH . The iron remains quantitatively on the paper as $\text{Fe}(\text{OH})_3$ and is determined by the bichromate or permanganate method. The filtrate contains the aluminum. Make the filtrate distinctly acid with HCl , and take to dryness to render any SiO_2 which may have been introduced in the NaOH solution insoluble. Take up with 2 or 3 c.c. HCl and water, filter off the silica and from the filtrate precipitate the aluminum as $\text{Al}(\text{OH})_3$ by the addition of 5 grams NH_4Cl and a slight excess of ammonia. Boil, filter, wash the precipitate well with hot water, ignite and weigh as Al_2O_3 . The filtrate from the $\text{Al}(\text{OH})_3$, generally contains a little lime and magnesia, held up by the heavy hydroxide precipitate, so it is added to the filtrate from the first precipitation of the iron and aluminum, and CaO and MgO determined in the usual manner.

PROCEDURE—MANGANESE PRESENT

The procedure, when manganese is present, is as follows: Make the filtrate from SiO_2 , above, almost neutral with Na_2CO_3 and precipitate Fe , Al and Cr if present, with BaCO_3 emulsion. Allow to stand in stoppered flask for three or four hours. Shake frequently. Filter and wash well by decantation. The filtrate contains Mn (Co , Ni , Zn), Ca and Mg . Treat the precipitate containing Fe , Al , etc., with NaOH and H_2O_2 and determine Al_2O_3 as described above, but make the filtrate from the $\text{Fe}(\text{OH})_3$ precipitate acid with HNO_3 instead of HCl , before precipitating with NH_4OH . To the filtrate from the BaCO_3 precipitation, add a little NH_4OH and throw down Mn and the remaining metals of the third group, with $(\text{NH}_4)_2\text{S}$. Filter off the sulphides, make the filtrate acid with HCl , boil, precipitate the excess of barium as sulphate and proceed for CaO and MgO as usual. Blanks must be run on the H_2O_2 and NaOH solution in the manner described for alumina above, to determine the necessary correction.

Ore Reduction in the Harz—I

By O. H. Hahn*

A district noted for its refractory ores and complicated treatment processes. A new zinc-recovery process—the Pape-Witter-Babe—insures work for a long time in the retreatment of old slag.

*Metallurgist, Schillerstrasse 6, Jena, Germany.

The Harz mountains, in which are situated metal mines famous for their antiquity and productiveness, are an aggregate of hills ranging in height from 2000 to 3500 ft. in the northwestern part of Germany and cover an area of about 770 square miles. The part west of the Brocken group of mountains constitutes what is geographically designated as the Upper Harz in distinction to the eastern part, which is called the Lower Harz. Administratively, but not conforming to the geographical designation, a small strip of territory in the extreme northwestern part of the Upper Harz wherein the town of Goslar is situated is called the "Communion Unterharz" (Lower Harz Community). The mines and reduction works of this territory are owned jointly by Prussia and the duchy of Brunswick, the former owning four-sevenths and the latter a three-sevenths interest.

The Harz mountains are encompassed by trunk lines of the Prussian state railways, from which feeders run up the most important valleys. The Lower Harz is more conspicuous for the beauty and grandeur of its scenery, while the Upper Harz attained its fame through its mineral wealth. Only one mile south of the town of Goslar we have the Rammelsberg with its great deposit of low-grade lead and copper ores and farther to the south, on the table land of Clausthal, the whole country is mineralized, which gave rise to the seven mining towns of Lautenthal, Wildemann, Grund, Zellerfeld, Clausthal, Altenau and St. Andreasberg.

RAMMELSBURG ORE DEPOSITS

The ore deposit of the Rammelsberg has been definitely identified as a regular stratum in the Goslar slate of the Devonian era, having followed all its foldings and faultings, and even containing index petrifications of that slate. During the folding process the strata have been tilted, so that what was originally the hanging- is now the foot-wall and *vice versa*. By a transverse fault about the middle of its longitudinal extent the ore deposit has been divided into a southwestern or "old lode" and a northeastern or "new lode." Owing to the foldings the width of the lode varies from 50 to 65 ft. and upward. Its total developed length is 3936 ft. The mine is now worked through three shafts and a main adit; a number of ancient shafts have been utilized for ventilation. All the ore extracted is raised to the level of the main adit and trammed over trestles to the several ore dumps. A second adit having its mouth below the town of Goslar drains the mine. Electrically driven pumping machin-

ery discharges the water from the lower levels into this adit. The greatest depth attained by the main hoisting shaft is 1312 ft. below the level of the valley.

The ores of the Rammelsberg mines are not notable for their richness, but for their abundance and their refractory character. According to the order in which they are deposited in the lode from hanging- to foot-wall Professor Klochmann,¹ of Aix-la-Chapelle, enumerates: (1) *Kupferkniest*, that is, clay slate impregnated with copper and iron pyrites, assaying about 4 per cent. of copper; (2) a dense aggregate of copper pyrites and iron pyrites with a slight admixture of arsenical pyrites, and sphalerite assaying from 5 to 25 per cent. copper; (3) in the center of the lode the so called *meliert* ores (mixed ores), i. e., extremely fine layers of copper pyrites and galena, intimately blended with sphalerite, assaying about 12 per cent. in lead and 5 per cent. copper; (4) lead ores proper, that is fine-grained aggregates of galena, sphalerite, iron pyrites and barite, with 12 per cent. lead and up to 24 per cent. zinc.

The silver content varies between 3 and 6 oz. per ton. There is also a slight amount of gold in the ores which has been indirectly computed from the doré bullion produced, at from 30 to 60c. per ton. A variety of other metallic minerals, such as nickel, cobalt, bismuth, make their presence known in the subsequent metallurgical operations. Quartz is scarce and only found in visible quantity in fissures and cracks through the country rock, while barytes is abundant.

WATER CONCENTRATION A FAILURE

All attempts at concentrating these ores by water having proved futile, technically as well as financially, a rough hand dressing in the mine had to be resorted to.

¹"Das Berg- und Hüttenwesen des Oberharzes." Herausgegeben von H. Banniza, F. Klockmann, A. Lengemann, A. Lymphner, Stuttgart, 1895.

The smalls are sent above ground and dumped over a grizzly. The fine stuff from there goes to a rotating picking table where, by a spray of water from a rose, it is washed clean and a number of boys engage in sorting out the different classes. The finest material is passed through jigs.

The *meliert* copper ore and the *kupferkniest* go to the Okerhütte for reduction, the lead ores to Juliusshütte and Sophienhütte, all three belonging to the Lower Harz Community. The ore is hauled in wagons directly to the reduction works as a matter of policy and economy, instead of taking it to the railroad depot at Goslar and loading it on cars.

LEAD SMELTING AT JULIUSHUETTE

Juliusshütte is situated on the line of the state railway from Goslar to Seesen. It was originally built in 1575, but has undergone so many alterations that there is nothing ancient about it now but the outlines of the metallurgical process. I did not see any sampling arrangements, but I presume that the ore is now sampled. Under the old regime, prior to 1866, this was not the case, for as Kerl² has it, "owing to the wide fluctuations in the composition of the ores, no results fit for checking the metallurgical operations could be obtained by assaying them."

Mr. Bräuning, general manager of the Oker works, has computed the mineralogical composition of the lead ores³ from analyses made at his laboratory and gives it as follows: Sphalerite, 36 per cent.; iron pyrite, 24; barite, 16; galena, 14; copper pyrites, 1.5; gangue, 8.5 per cent.

HEAP ROASTING STILL PRACTISED

As a preliminary to smelting, the ore is first roasted in heaps of 400 or 500 tons on a bed of pine cordwood in the open. Flues are left in this bed to provide for draft, but no chimney as formerly. The heaps are prepared with great care, and the sides and top are covered with fines from a former roast. As this method of roasting, crude as it is, has been practised for more than 250 years, it is quite natural that it should be understood to perfection.

The roasting process is conducted in such a manner that sulphates and not oxides are formed from the metallic sulphides present; hence the tem-

²Kerl. "Die Rammelsberger Hüttenprozesse am Communion Unterharz." 2 Auflage. Clausthal, 1861.

³"Vorkommen und Gewinnung der Rammelsberger Erze und die Unterharzer Hüttenprozesse." F. W. Wimmer and J. Bräuning. *Zeitschrift für das Berg-, Hütten- und Salinenwesen im Preussischen Staate*, Vol. *Preuss. Zeit. f. B., H. u. S.*, Vol. XXV, 1877.

perature must be kept low, not exceeding 500 deg. C. The first fire lasts eight to nine months, after which the heap is taken apart.

The lump ore is broken up with sledge hammers and at once consigned to the second fire. The fine material from the interior of the heap is especially rich in sulphates and goes to the leaching plant for the purpose of extracting all the soluble zinc sulphate. The *deckenerz* (covering ore) is not fit for leaching on account of its crude state nor for re-roasting on account of its fineness. It is left to weather in the open and later on goes directly into the smelting charge.

No screening is done in taking apart a roast heap to avoid the raising of dust, out of consideration for the health of the workmen, but rakes and tools like coke forks are used to separate the coarse from the fine. The second and third

ROASTED ORE LEACHED IN BARRELS

In the leaching plant the fine ore is first revolved with water in rotating barrels provided with T-shaped iron stirrers and curved guide plates to dissolve the sulphates. After the lapse of five hours the solution is drained off into a system of settling tanks to allow impurities to subside, heated in a lead pan to precipitate all the basic salts of iron and manganese, and finally pumped into crystallizing vats where the pure zinc-vitriol crystallizes out. This is subsequently calcined to get rid of most of the combined water and is now ready for the trade. It is used in cotton-printing factories, but more largely for the manufacture of lithopone, a white paint composed of zinc sulphide and barium sulphate, much in demand for inside painting.

The leached ore is dried in reverberatory furnaces and then goes to the charge floor where it is mixed with the roasted

made of brasque composed of three parts coke slack and one of loam.

SMOKE-CONDENSING APPARATUS

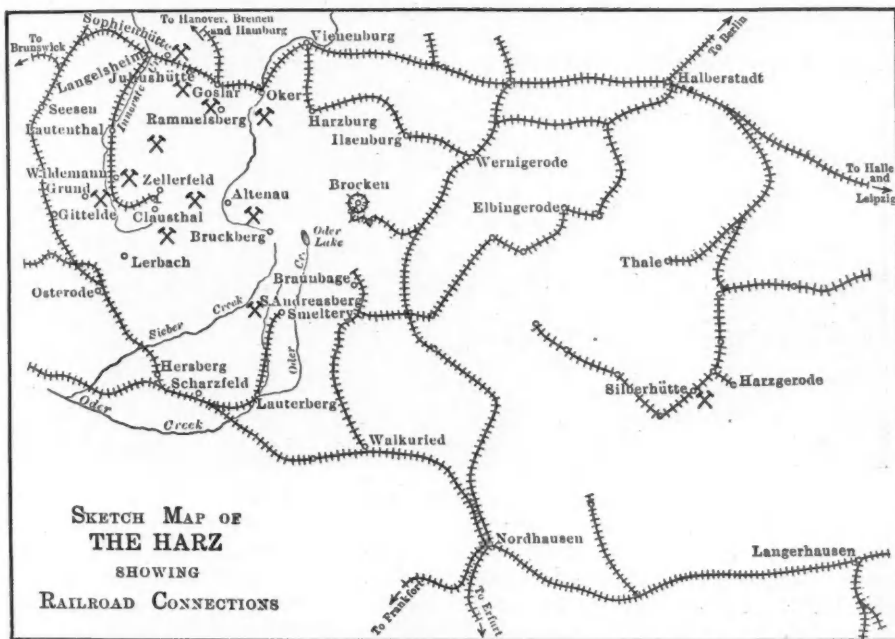
The smoke is drawn off through a central tube inserted in the open top of the furnace and joined to a downcast that runs into a dust chamber connected with a brick stack about 100 ft. high. The fumes of the slag tap and the lead tap are drawn into hoods, which connect through a long tube with a separate stack 105 ft. high and of 3 ft. 3 in. opening at the top. To prevent contrary winds from driving the fumes back into the tube and through that into the furnace building, the crown of the chimney is provided with a Johns' patent hood (made at a machine shop near Erfurt), which has been found to check efficiently that annoyance and at the same time not impede the draft. This ventilating arrangement was devised by the present manager, who was opposed to the installation of exhaust fans with their attendant whirring noises and breakdowns, and gives entire satisfaction. There are 10 circular furnaces in the establishment, the capacity of which is rated at 15 tons of charge, or 10 tons of ore each per 24 hours. The blast is derived from Enke blowers and kept at a pressure of 1 in. of mercury.

It is sought to make a slag with 12 per cent. SiO_2 , which is said to hold the oxides of zinc and barium in solution, its corroding action on the walls of the furnace brings, however, the SiO_2 higher, as will be seen from the subjoined analysis taken from Wimmer & Bräuning's monograph: SiO_2 , 16.9; FeO , 35.05; ZnO , 19.64; $BaSO_4$, 10.24; Al_2O_3 , 6.31; CaO , 6.05 per cent.

The slag is run into conical pots, broken up after cooling and sent to Oker to be dezinkified by the Pape process.⁴ Although the ore is not dead roasted, there is no matte perceptible in the slag, nor on the lead bullion tapped from the furnaces. The slag is heavy, of a brownish black, earthy color and full of air holes. The lead bullion is tapped at fixed intervals from the forehearth of the furnace into a cast-iron tap basin and ladled into flat, round molds. The disk-like cakes of lead bullion are carted to Okerhütte for refining. The flue dust saved is as light as tinder and of a grayish color. It is leached and smelted along with the ore.

Owing to the formation of unavoidable zinc incrustations in the crucible and of accretions in the shaft of the furnace, and owing to the corrosive nature of the basic slag, the furnaces make only short runs of six weeks' duration, when they require barring out and repairing. All the machinery with the exception of that of the leaching plant, as boilers, engines, turbines, dynamos, blower and pumps, is assembled in one central building.

⁴ENG AND MIN. JOURN., Vol. 89, p. 819.



SKETCH MAP OF THE HARZ SHOWING RAILROAD CONNECTIONS

The Engineering & Mining Journal

fires are effected under roofs in sheds, the second lasting four months, the third six weeks. The sulphur content of the roasted ore then still amounts to 4 or 5 per cent.

A peculiarity of the process as carried on here is the winning of sulphur as a byproduct. This is presumably the free atom of sulphur of the pyrites which escapes oxidation and sublimes to the surface of the heap, where it is collected in hollow places made for that purpose and dipped out into molds. Subsequently it is refined by melting it and skimming off the impurities. Kerl states that in the year 1850, as much as 90 tons of crude sulphur were thus saved and figured out that it almost paid for the cost of roasting. If it were not for the fact that the country in the immediate vicinity of the works is unfit for agricultural or pastoral purposes, the roasting in heaps would not be tolerated.

lump ore and properly fluxed for smelting with quartzose material, slag from Okerhütte and iron in the shape of mill cinder, iron-refinery slag, spent pyrites, etc. The charge is smelted with 22 per cent. of coke in circular blast furnaces, 16 ft. 4 in. high from smeltery floor to top and provided with five water-cooled, cast-iron tuyeres arranged symmetrically around the furnace, leaving only the front bare. These furnaces differ in shape from Pilz furnaces in that they are cylindrical in the upper half, widen out gradually to within a foot above the tuyeres, thus forming a truncated cone, and then narrow down again. This shape has been found to suit the particular smelting material best. The breast of the furnaces is kept open, they are what the Germans call *sumpföfen* (sump furnaces or open-breasted furnaces). They are built entirely of masonry, the fireproof material being clay slate. The crucible is

SOPHIENHUETTE

Sophienhütte was built in 1556. It is also situated on the line of the state railway from Goslar to Seesen, two miles west of Juliushütte and is almost an exact counterpart of the latter, but has only seven blast furnaces instead of 10. Being under the same management as Juliushütte, the operations carried on there apply equally to the former. The ore is hauled in wagons from the Rammelsberg to the reduction works and the lead bullion produced, by the same conveyance, to Okerhütte. The slag is, however, trammed from the furnaces to an elevator and dumped from there directly into railroad cars to be taken to Okerhütte. The elevators on the Harz are all of simple construction, the load being raised by means of a counterweight in the shape of an iron box filled with water. On arriving at the ground floor the water is automatically discharged through a valve at the bottom of the box bumping against a resistance which raises it. The cage and car in descending now raises the empty water box to the top floor, both being filled again to undergo the same operation.

A ditch, tapping a confluent of Innerste creek, furnishes the water for running the elevators, and two turbines driving the pumps, blower and dynamo. A steam engine is kept in reserve for power in case there should be a scarcity of water. The surplus current is stored in a battery of accumulators for electric lighting at night.

OKERHUETTE

Okerhütte was originally built in 1527, but has, of course, like the preceding works seen many alterations and improvements since. It is situated on the Goslar-Halberstadt line of the Prussian state railways, $2\frac{1}{2}$ miles east of Goslar. The treatment of the *meliert* and copper ores, the desilverization of the lead bullion from all the Community works and the dezinkification of the slags, new and old, produced by them, indicates what an extensive establishment the Okerhütte is. In former times its scope of work was still larger as may be seen from Kerl's treatise on the "Rammelsberger Hütten-prosesse." At the present day it is restricted to the production of electrolytic copper, refined lead, fine silver, fine gold, sulphuric acid, bluestone, copperas, sodium sulphate, yellow paint and zinc dust. Mr. Bräuning who has been at the helm now for more than 30 years, gives the mineralogical composition of the *meliert* ores, as follows: Sphalerite, 28 per cent., iron pyrites, 25; copper pyrites, 15; galena, 11; barite, 14; other gangue 7 per cent.

These ores are roasted in kilns down to 10 or 12 per cent. sulphur, utilizing the sulphur dioxide for the manufacture of sulphuric acid, and then twice more in

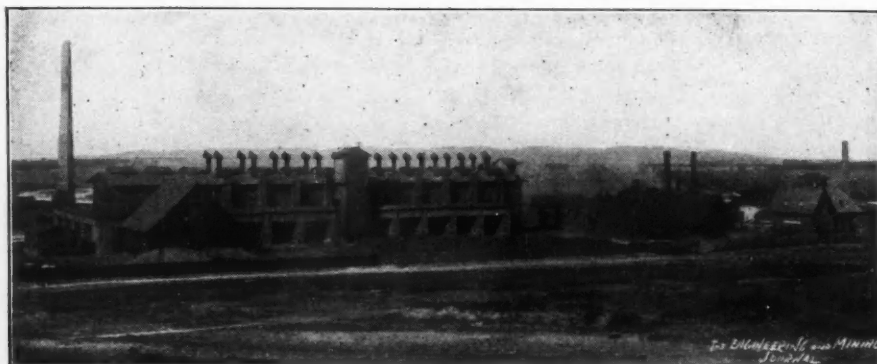
heaps under roof when they should not retain more than 6 per cent. sulphur. They are then smelted with a low pressure of blast (1-in. mercury) in furnaces of the same pattern as at Juliushütte. One or two of the furnaces are, however, larger, carrying eight tuyeres instead of five. They are charged with alternate layers of smelting mixture and coke and are run with a dark top. When I saw them last, in 1889, they were run with top fire to promote the volatilization of the zinc, but it seems that this practice has been abolished. A five-tuyere furnace will smelt 27 tons of charge or, say 10 to 11 tons of *meliert* ore in 24 hours while the eight-tuyere one consumes 50 tons of charge, or 20 tons of ore, in the same space of time. The products are a coppery-lead bullion and a so called lead matte. The slag which is quite free from matte is composed of the following constituents according to Mr. Bräuning: SiO_2 , 19.0 per cent.; FeO , 37.7; ZnO , 11.9; BaS , 9.56; Al_2O_3 , 12.10; CaO , 6.84; Pb , 0.3; Cu , 0.75 per cent. The unavoidable formation of zinc incrustations

TREATMENT OF THE LEAD MATTE

The lead matte which is tapped out with the lead bullion is, more properly speaking, a copper matte to judge by its composition. Its principal components are: Fe , 30.53 per cent.; Zn , 16.35; Cu , 16.81; Pb , 5.09; S , 16.38 per cent. As and Sb not given.

It is roasted in heaps twice, the roastings being of short duration and smelted with twice-roasted *kupferkniest* as silicious flux in a blast furnace, yielding an impure black copper or rather, a copper speiss with 60 to 70 per cent. copper and a concentrated copper matte with 40 per cent. copper. The resulting slag is composed as follows: SiO_2 , 26.95 per cent.; FeO , 42.91; ZnO , 2.68; Al_2O_3 , 14.21; CaO , 5.08; Cu , 0.5 per cent. The large amount of alumina is due to the *kupferkniest*. The fuel consumed amounts to 33 per cent. of the smelting mixture.

The copper speiss is subjected to an oxidizing smelting in a furnace called *spleissofen* which has the shape of a German cupelling furnace, but is provided with a bottom of brasque to guard it from



THE JULIUSHUETTE, HARZ DISTRICT, GERMANY

and the basicity of the slag cause short furnace campaigns though slightly longer ones than in the case of the lead ores proper.

LEAD REFINING PROCESS

The lead bullion from the above operation as well as that from the two sister reduction-works is treated in essentially the same manner as in the United States. It first goes through a softening furnace and is then desilverized by zinc in cast-iron pots. The dried alloy is retorted in a Faber du Faur tilting furnace and the resulting rich lead cupelled in a German cupelling furnace.

The doré bullion from this operation runs about 950 fine in silver and 7.5 in gold and is, therefore, worth about 68 cents per oz. Troy. It is refined on a test and parted by the sulphuric-acid process. The desilverized lead is not dezinkified in a calciner or refining furnace, but is poled by steam in the market pot to attain the same end. The market pot dross produced by this operation is freed from adhering granules of lead by sluicing it on a canvas buddle and sold as yellow paint.

being cut out by the slag. Through two port holes over the fire bridge, air is blown on the surface of the metal by which lead, iron, arsenic and antimony are oxidized and go into the slag which is run off on an incline and saved. After having reached a certain pitch the copper is tapped into a vat filled with water and granulated by turning a jet of water across the stream of copper. These granules will then have the proper shell-like shape for dissolving in dilute sulphuric acid preparatory to the manufacture of copper sulphate or bluestone of the trade. Soft coal is the fuel and a forced draft is used.

RETREATMENT OF REVERBERATORY SLAG

The slag from the above oxidizing operation is smelted with raw pyritic ore for a speiss and copper matte. By roasting this speiss (coarsely crushed) with pyrites in a long hearth furnace and again smelting a speiss is obtained which contains the nickel and cobalt sufficiently concentrated to become marketable. The copper dross from the softening furnace after the adhering lead has been removed

as much as possible by liqutation, is also smelted with raw pyritic ore in a blast furnace whereby lead bullion with about 50 oz. silver, copper matte and cupriferous speiss are obtained. The latter is treated like the speiss before mentioned or sold outright. The treatment of other furnace and refinery byproducts is more or less similar to that practised in the United States and does not offer any special features.

TREATMENT OF COPPER ORES

The copper ores were formerly separated into two and even three classes. Mr. Bräuning gives the mineralogical composition of two classes as follows: First class ore, sphalerite, 12 per cent.; iron pyrites, 25; copper pyrites, 45; galena, 5; barite, 7; other gangue 6 per cent. Second class ore, pyrites, 60 per cent.; copper pyrites, 23; sphalerite, 6; galena, 2; gangue, 9 per cent.

As it was found that the ore rich in copper pyrites and poor in iron pyrites was not easily amenable to roasting as it has the property of decrepitating into a fine powder in the heat and in that condition caused mischief in the kilns as well as in the roast heaps, it was smelted raw in conjunction with roasted second- and third-class ore. By making but one class of the copper ore a method seems to have been found of roasting the lump ore successfully in kilns connected with acid chambers. The *schlichs* or fine ore are roasted in Rhenania furnaces, an improvement upon the Hasenclever, the muffles of which are also connected with acid chambers.

The roasted ore is smelted with 20 per cent. roasted *kupferkniest* and 60 per cent. basic slag in a circular four-tuyere blast furnace with forehearth. The consumption of coke is 20 per cent. of the smelting mixture, the pressure of blast 1 in. of mercury. The resulting slag has about 25 per cent. silica and from 0.3 to 0.5 per cent. copper. The zinc of the ore passes mostly into the slag and the matte and so does not bother with incrustations. Hence the furnaces are able to make campaigns of nine months or a year.

FIRST MATTE IS KILN ROASTED

The product is a first matte with 35 to 45 per cent. copper. This is roasted in kilns connected with the acid factory and smelted with the concentrated matte from the *meliert* ores in a Welsh reverberatory for white metal of 65 to 75 per cent. copper. The white metal is roasted in a Rhenania furnace and smelted for blister copper, which is cast into anodes and electrolyzed. The electrolytic plant is not open to inspection, but it may be assumed that the residues carrying the precious metals are treated as in other places, that is, passed through a filter press and added to a charge in the cupel-

ling furnace for the recovery of gold and silver.

The impure coppers from the *spleiss-ofen* and the bottoms of the matte concentration are used for making blue-stone⁵. The sediment containing silver and gold besides gypsum, lead oxide, arsenic and antimony is mixed with litharge and cow's hair and formed into balls, which are dried and smelted with an addition of litharge and slag from the copper-matte smelting. The resulting rich lead is added to a charge in the cupelling furnace and the speiss goes back to the ore smelting.

SULPHURIC-ACID PLANT

The sulphuric-acid factory is extensive. It is built on the chamber principle, but brought into accord with modern views by the addition of Gas-Lussac and Glover towers. There are 14 or more units of three chambers each. The kilns in which the sulphur-bearing material (ore or matte) is roasted are of two kinds: Shaft furnaces with inverted V-shaped bottoms to facilitate discharging on opposite sides, and they carry a column of ore 4 ft. 3 in. high, broken to 2½-in. size and are used for ores poor in sulphur; and kilns with shaking grates which carry only about 18 in. of an ore column, but the ore is smaller in size, say, about 1 in. They are used for ores rich in sulphur, which would sinter in the shaft furnaces.

The roasting capacity of both is small, not exceeding one ton of roasted ore in 24 hours. Between each pair of kilns there is a cast-iron box in which vessels containing the niter and sulphuric acid for the generation of nitric anhydride are placed. The cast-iron box communicates by an opening overhead with the main flue through which the gases flow into the lead chambers.

There are three kinds of acid made: Crude acid of 50 deg. and of 60 deg. Be., and refined of 66 deg. Be. The latter is made by causing 48-deg. acid to trickle through an atmosphere of H₂S, whereby As and Sb are eliminated, and concentrating the weak acid in platinum retorts to the required strength. Part of the crude acid is used at the works, the largest portion is shipped in lead tanks, the refined in carboys to consumers. Incidentally sodium sulphate and copperas are produced, the former finding a ready market in glass works. The precipitate of As₂S₃ and Sb₂S₃ from the purification of the acid is not utilized for want of takers.

The parting plant is not shown to visitors; it is antiquated, according to Mr. Bräuning, who gives a description of it in his monograph, but answers the purposes of a small production of doré bullion.

⁵Cf. Percy, "Metallurgy of Silver and Gold." Part I, p. 491.

THE PAPE-WITTER-BABE ZINC PROCESS

The most interesting branch of the Oker works and one which promises to turn out a veritable bonanza is the plant for the extraction of zinc from the slag by the Pape-Witter-Babe process. There are immense old slag dumps near the three Community reduction works that await treatment besides the new slag produced every day, which will keep the de-zinkifying plant going with present capacity as long as the Rammelsberg mine lasts. The process, having passed the experimental stage, is now in regular running order, producing, it is stated, at the rate of 10,000 tons of zinc oxide annually with 13 oxide furnaces going. This plant is built substantially of brick and iron, and is said to have cost with all its preliminaries and appendages two million marks (\$500,000).

The furnaces are constructed of fire-brick incased in iron plate. While in operation they are kept closed entirely with the exception of the bottom, which consists of hollow grates cooled by water. The molten slag trickles through the openings in the grates into iron cars underneath, while the zinc reduced and any lead that may be present burns up to oxide, which is carried off through flues into precipitating tanks and bag chambers by the suction of exhaust fans. The smelting column is naturally kept low, as the object is to volatilize the metal to be extracted. I estimate the smelting capacity of each furnace at 10 tons a day, which would correspond to the consumption of about 43,000 tons of material for 330 working days per year. The exhausted slag is said to retain 3 per cent. zinc oxide, and is returned to the blast furnaces for the recovery of the copper it contains in a slightly enriched state.

EXPERIMENTS WITH BRIQUETTED ORE

Mr. Bräuning has experimented on the smelting of *meliert* ores briquetted in the same manner as the slag worked by the Pape process, and feels confident that he will be able to smelt 80 tons per day of this briquetted material in an eight-tuyere blast furnace, as against 50 tons now, which would lead to a considerable reduction of smelting costs. The known briquetting methods heretofore tried have been unsatisfactory, as the breakage and attrition in the furnaces interfere with good work.

The arrangements for saving flue dust are nearly all alike in the government smelting works and do not present any novelties. The power required for moving the machinery, such as blowers, elevators, pumps, ball mills, machine shops, etc., is derived from turbines, steam engines and dynamos. Steam boilers are scattered all over the premises, as steam is used for various purposes. Water is taken through a ditch from Oker creek, a mountain stream which gives an abun-

dant supply all the year round. As the ground is not altogether favorable for railroad tracks, two aerial ropeways are in use to move material to places not otherwise accessible.

The production of the Rammelsberg mine in 1909, according to official statistics was: Dressed lead ore, 39,157.2 metric tons; dressed copper ore, 22,467.2; dressed pyrite ore, 4099.3; other sulphur ores, 105.7; total, 65,829.4 metric tons.

The money values of these ores, not including, however, their silver and gold content which I could not separate from the official figures of the administrative district of Clausthal, I calculate to be 1,011,974 marks, or \$252,993, approximately.

Thermit Repairs at Mines

No other industries are so dependent upon their own resources as are mining plants and it is for this reason that any process that will enable them quickly to repair heavy machine parts, is one which they can not afford to overlook. During the last few years a number of welding processes have been developed: The electric-welding; the oxyacetylene; and the thermit process. Each is adapted to special requirements, but as the thermit process is particularly adapted to welding heavy sections, such as locomotive frames, crank shafts, gear wheels, etc., it is probably more generally useful around a mining plant than a process that can be used on light work only.

Thermit consists of a mixture of finely divided aluminum and iron oxide and when heated enough, the aluminum combines with the oxygen in the iron oxide and sets the iron free. The reaction develops a high temperature so that the metal comes down in the form of a superheated-liquid steel at a temperature of approximately 5400 deg. F. (nearly twice the temperature of ordinary molten steel). This reaction has been known to chemists for many years, but it is only within the last six or seven years that it has been put to any commercial service.

In practice the broken parts are thoroughly cleaned and a space cut out between them so as to allow a free flow of thermit steel into and around the fracture. A pattern of yellow wax is then formed around the broken pieces, allowing for a collar usually four to five in. wide by $\frac{3}{4}$ to one in. thick at the center, and tapering to each side, the general shape being that of a segment of a circle. A sheet-iron mold box is then placed in position and rammed with a special molding material consisting of a mixture of equal parts of fire clay, ground firebrick and fire sand, provision being made for a pouring gate, a riser directly over the top of the fracture, and a small preheating hole at the bottom. Wooden patterns are used for these various openings. When the mold is complete the flame of

a gasolene compressed-air torch is directed into the lower opening and the heating continued until the wax is entirely melted out and the sections to be welded have been brought to a bright-red heat. In the meantime a cone-shaped crucible is suspended over the pouring gate of the mold and filled with the welding portion of thermit. As soon as the parts are red-hot the torch is withdrawn, the lower opening plugged up and the thermit in the crucible ignited. At the end of the reaction the thermit steel is tapped into the mold where it flows into the space formerly occupied by the wax. About twice as much steel is provided as is required for the mold proper and this excess steel is forced into the riser where it remains liquid for some time and serves to fill any shrinkage openings. This thermit steel, owing to its high temperature, dissolves the metal with which it comes in contact and amalgamates with it to form a single homogeneous mass when cooled.

The fact that all the necessary materials are easily portable enables thermit welds to be made at any point desired and it is usually possible to repair heavy sections without removing them from their working position. This applies particularly to locomotive frames which are welded without dismantling the engine, at a tremendous saving over other methods. The only outside power required is a small amount of compressed air for the operation of the preheating torch.

The process is particularly useful for welding wrought-iron and steel sections, but it is not so easy to weld cast iron, owing to the great difficulty of overcoming shrinkage stresses which develop during the cooling of the welds. A number of companies, however, have recently had success with cast-iron repairs, one of the most important of which was the welding of some cast-iron cylinders by the H. C. Frick Coal and Coke Company at Everson, Penn., under the direction of James L. Reynolds.

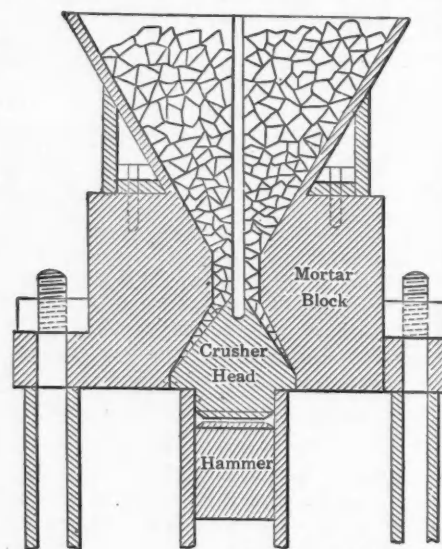
The repair consisted in welding two cast-iron cylinders, each 5 ft. long and 18 in. in diameter. They were badly broken and one had a piece completely broken out, causing a fracture about 48 in. long in the shape of a horseshoe. The other was a straight fracture about 12 in. long but of such a nature as to require 160 lb. of thermit metal to repair it. Both had been previously brazed, one twice and the other three times. It was finally decided to try the repair with thermit, and both proved to be perfect welds so that the saving effected in repairing them by the thermit process was considerable. The cylinders were valued when new at about \$300 each, while the cost of the repair was only about \$100 each.

A thermit weld on a Janesville pump cylinder 14x48 in. was also executed by Mr. Reynolds. The fracture occurred

around the cylinder close to the flange, the length being about 18 in. It then ran straight out to the end of the cylinder a distance of 18 in., making a total length of 36 in. This cylinder when new cost about \$400 while the expense of repairing it with thermit amounted to only \$75. It will be seen that mining companies can use this process to great advantage for their general repair work. It is controlled in the United States by the Goldschmidt Thermit Company, 90 West street, New York.

Rankin Quartz Mill

A recent invention of H. S. Rankin, of Cripple Creek, Colo., is a rock crusher which consists of an air hammer turned upside down. This hammer striking upward hits a crushing head which fits inside a mortar block. Their faces are both cones, the inner of which has the less inclination. The ore is fed into the space between them and is crushed by the impact, then falls out as soon as fine



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THE RANKIN CRUSHER

enough to pass through the opening left by the crushing head as it falls away from the mortar block. The arrangement of the crusher parts is shown in an accompanying illustration.

South Australia's Mining Area

On Dec. 31, 1910, the following areas were held under the South Australia mining acts: Mineral leases, 14,999 acres; mineral claims, 9993 acres; coal claims, 19,220 acres; gold leases, 1304 acres; gold-dredging leases, 34 acres; gold claims, 15 acres; miscellaneous leases, 7584 acres; occupation licenses, 105 acres; search licenses, 144,460 acres; total, 197,714 acres.

The number of men employed in mining and reduction work on Dec. 31, 1910, was: Copper, 4150; gold, 950; salt, 450; silver-lead, 60; other minerals, 570; total, 6180 men.

Coal Mining Department

Mine Explosion at Elk Garden, W. Va.

By JOHN LAING*

An explosion occurred at the No. 20 mine, near Elk Garden, Mineral county, W. Va., on April 24, at 8:30 o'clock a.m., causing the death of 24 persons. This mine is owned by the Davis Coal and Coke Company, and is operated in the Lower Kittanning seam. The plant is situated on the Western Maryland railroad. The coal is about 4½ ft. high; the seam is irregular and is full of rolls, clay veins, etc. The mine is dry and dusty and explosive gas was given off in some sections. This was local, however, and at no time was the mine known to liberate gas in dangerous quantities.

Immediately after the explosion, a rescue party was organized by Superintendent Robert Grant and work was begun to repair the mine and reach the entombed men; five miners escaped from the mine after the explosion. These five men were working in a section near the crop and almost one mile distant from where the explosion occurred, and by reason of the mine's being quite wet between where they were working and where the explosion occurred, it had the effect of stopping the explosion before it reached them, and they were enabled to reach the surface in safety.

THE FAN WAS NOT DESTROYED

The fan was not damaged, so that the rescue party were able to proceed without hindrance—it being a force fan—however, it was some time before the rescue party could enter the mine, as it was not deemed advisable to reverse the air current for fear that some of the men might be on the airway.

Deputy Mine Inspector Plaster reached the mine on Monday night and assisted with the rescue work. Inspectors Connor and Martin reached the mine on Tuesday morning and also assisted in recovering the bodies. On the morning of April 27, sixteen expert mining men accompanied me and made a detailed examination of the mine for the purpose of investigation and determining, if possible, the origin and cause of the explosion.

On arriving at the working face of what is known as the Dean air course, we discovered a shot had been fired in the left side of said air course, and that a hole had been drilled directly in the solid. This air course had struck a "fault" and the intention in drilling the hole was to make a mining in the rock so that the top slate could be blasted down afterward.

*Chief mine inspector, Charleston, W. Va.

The Important News
Of Coal Mining.
New Appliances,
New Methods. New
Fields, Colliery
Engineering

Where the hole was drilled there was a streak of coal about 2 in. thick and they had bored the hole in this coal; when the shot went off, it blew this coal straight back into the airway, which was heavily charged with fine coal dust, as shots had been fired a few minutes previous to this one in this entry, causing this dust to be already in suspension; after the shot above mentioned was fired, it blew out this fine coal dust and the flame from the powder ignited the gases and had the effect of burning the dust as it went, until it traveled over the whole working part of the mine.

As evidence that this shot had just been fired and was the cause of the explosion, there was one of the men who worked in this entry found lying with his hands still gripped to the battery, which was to explode the shots; the wires from the battery were traced directly to where the shot had been fired. This man was quite badly burned and showed signs that he had been killed almost instantly when the shot went off. The force of the explosion was easily traced from this point through the entire mine, as all the brattices, mine cars, etc., were thrown toward the outside from this point and in no other part of the mine were there any signs of flame or of an explosion having occurred.

THE MINE WAS NOT PROPERLY WATERED

After a thorough examination of the mine by the experts who were present, it was easily determined that had the workings been damp, or had the mine been sufficiently watered, as it should have been, the disaster would not have been as widespread as it was; and there is no doubt in the minds of any who investigated the explosion but what dust was the main factor in the disaster. It was quite evident that gas was not the cause of the explosion, as the men had been at work with naked lights at the face of their working places.

The rules of the company were that no black powder be used in the mine and that a permissible explosive known

as "Monobelle" was the only explosive permitted by the district mine inspector and the company, and while it would be unfair, perhaps, to say that black powder was used in the shot that caused the explosion, there was every reason to believe that it had been, as black powder was found in the mine, which was proof that the miners were using it even against the advice of the district mine inspector and the rules of the company. My own convictions are, that if the hole referred to had been properly charged and a permissible explosive used exclusively, the accident would not have happened; and because of the violation of instructions, this man took his own life and the lives of 23 others, some of whom no doubt, were practising the same violations as himself.

The only possible way the department can avoid accidents of this kind is to prohibit absolutely all shooting in mines (that are dry and dusty) during the day or while men are at work, and require that expert shotfirers be employed for the purpose of doing all blasting after all men have left the mine.

A ruling of this kind will for a short time work more or less hardship on the miners and perhaps curtail the output of the mine, but it is the only way that I see to prevent a repetition of the accident, and I have issued a circular letter to each of the inspectors of the different districts to put such a ruling into force at once; we cannot permit dangers of this kind to exist where every man's life is depending on the most reckless miner.

I expect to meet with some complaints against this order, but propose to execute it regardless of how it may be approved by either miners or operators.

Cost of Overcoming Mine Fire

Chief Mine Inspector Roderick, of Pennsylvania, estimates that it will cost \$232,500 to isolate and overcome the mine fire that has been burning for a number of years at Carbondale, Penn. The fire has already caused the financial ruin of a company engaged in mining coal. The report says that the only sure way to control the fire is by digging a channel 6100 ft. in length and having an average depth of 50 ft. In the construction of such a channel, 355,000 cu.yd. of earth will have to be removed. The cost of moving the dirt is placed at 50c. per cubic yard; this total will be increased by \$55,000 which must be paid for condemned properties. The commission appointed to investigate the Carbondale fire, has recommended that \$100,000 be appropriated to this cause immediately.

Coal Mining in Spitzbergen

By F. A. Talbot *

An American company, operating within the Arctic circle where navigation is open only two or three months each year, has largely overcome the unusual difficulties by constructing an aerial tramway.

*15 Wilbury Crescent, Hove, England.

The mineral wealth of Spitzbergen, especially in regard to coal, has long been known, but the difficulties attending its profitable exploitation, owing to the extreme northern situation of the coal-field have militated against development considerably. The great obstacle was the transportation problem from the mines to tidewater for shipment, the configuration of the country being against cheap construction of a surface railroad.

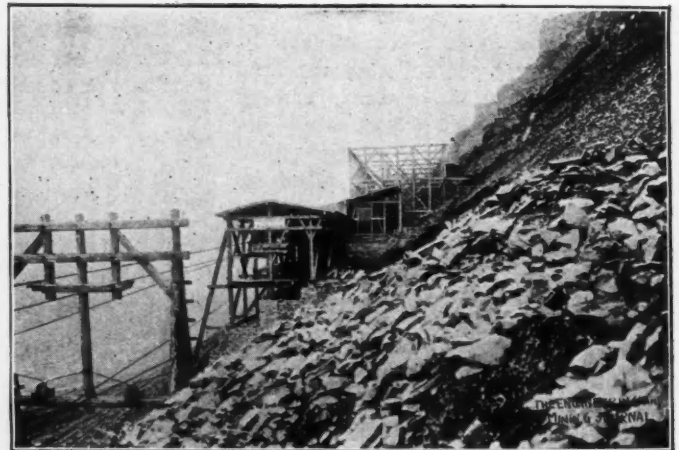
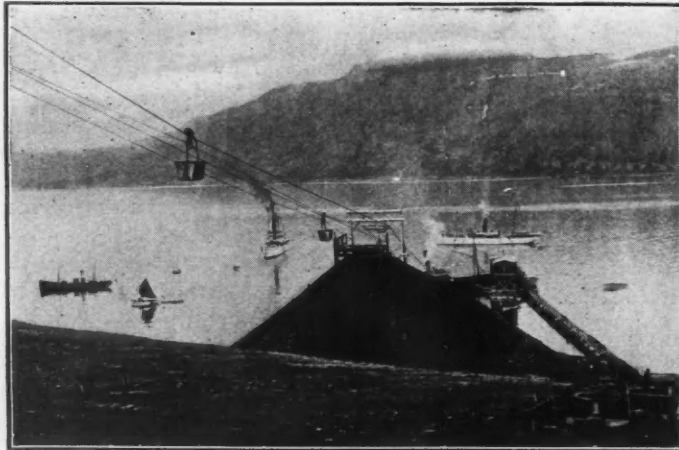
At last, however, a company was formed to develop the coal resources under United States auspices, and the requisite preliminary development was carried out satisfactorily by the American Arctic Coal Company. When the drifts were driven into the mountainside, the question of conveying the coal to the shipping berth in Advent bay arose. Owing to the country being ice bound for the greater part of the year, it was essential that, during the short season when the bay is free from ice, the vessels loading

ft. in length, while the difference in levels between the terminal stations at the mine and shipping berths respectively is 660 feet.

In the designing of the plant, special attention had to be devoted to automatic

tion. The coal depot is situated at the mouth of the adit on the hillside, in the form of a silo fitted with chutes whereby the ropeway cars can be loaded automatically. Two persons suffice for the operation of the railway at the loading station, their work being confined to guiding the returning empty cars to the coal depot, and the opening of the chutes charging the cars. At the unloading station only two men are likewise necessary, their duties being to guide the incoming loaded cars around the loop to discharge the coal into a hopper when the vessels alongside are filled, the disengaging of the lock levers of the cars, and the manipulation of the telescopic chute fitted to the hopper. As the single loads which follow in quick succession are small, three or four men suffice to distribute the coal to the ship's holds without delaying the task of loading in the slightest degree.

The telescopic chutes can be set to any



VIEW OF ADVENT BAY, SHOWING THE UNLOADING STATION

THE LOADING STATION IS SITUATED ON A STEEP MOUNTAINSIDE

coal should be able to make the maximum number of trips; it was thought advisable, therefore, to have the transporting system between the collieries and tidewater, of the most economical description. Thorough investigation of this problem revealed the fact that an aerial cableway would offer the best solution of the problem, and accordingly, the firm of Adolf Bleichert & Co., of London and Leipzig, to whom I am indebted for the accompanying illustrations, were requested to carry out the essential surveys, and subsequently to construct the line.

NUMEROUS OBSTACLES ENCOUNTERED

This installation is of distinct interest, not on account of its length, but in view of the fact that it is well within the Arctic circle, and that its realization entailed the subjugation of enormous and peculiar difficulties. The line is only 4400

loading of the vessels, so as to reduce the length of this operation as much as possible; it was also desired to reduce manual labor to a minimum. This latter was a most important factor inasmuch as Spitzbergen has no native population, every workman having to be brought over from Norway at great expense. The necessity for rendering the line workable by the smallest number of men is consequently obvious. As a result it was decided that instead of dumping the coal from the cableway into lighters at the water's edge, which in turn should proceed out to the mooring stations in the bay, the cableway should be carried out to sea so as to be able to discharge direct into the vessels' holds, the ships mooring alongside the unloading station.

The extent to which manual labor has been saved on this plant is distinctly interesting, constituting in fact one of the most pronounced features of the installa-

desired position so that the distribution of the coal in the ships' holds is greatly facilitated. When it is required to move the vessel fore or aft to bring another hold beneath the chutes, an electric-bell signal is sent to the loading station to stop the working of the line until the vessel is in a position to enable loading to be resumed. The movement of the vessel itself is facilitated by special arrangements provided for this purpose, so that the interruption in the loading task is reduced to a minimum.

STEAMSHIP CAN BE LOADED IN 12 HOURS

The success of the system has been complete in every respect. So long as the depot at the loading station is kept well filled with coal, a steamer can be loaded in from 6 to 12 hours, according to its size. A conclusive idea of the perfection of this installation is evidenced by comparison with the experience at the

English Flangen mines on the other side of Advent bay which, possessing no modern transporting plant, requires several days to load a vessel.

The difficulties arising from the rigors of the climate and character of the country in the work of constructing the line

the construction material as best they could. During the winter months all work perforcedly had to be suspended.

Every particle of material employed on the task—nails, timber, cement and such like—had to be carried over from the mainland, together with the pony required for

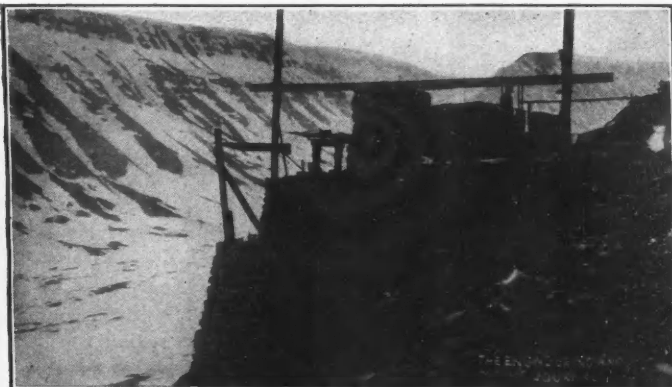
and the line is relatively of short length, it was not until the end of 1909 that the task was completed.

CABLEWAY OPERATED BY GRAVITY

The gradient between the coal depot and the loading station is quite



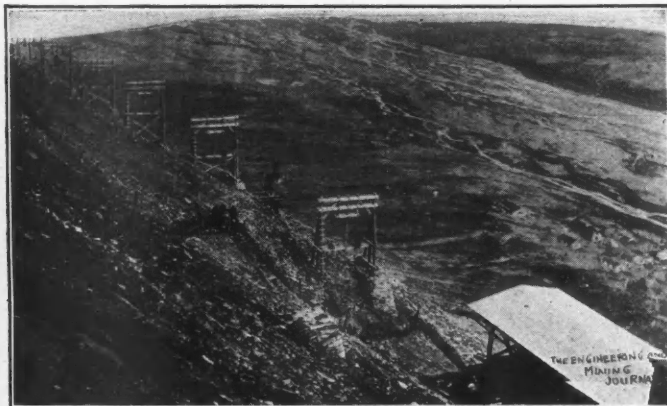
THE LANDING STATION WHERE CONSTRUCTION MATERIALS WERE FIRST LANDED



SHOWING SILO AND LOADING STATION WHILE UNDER CONSTRUCTION



THE MOUNTAIN BACK OF THE UNLOADING STATION, VIEWED FROM CENTER OF BAY



SHOWING TIMBER SUPPORTS USED IN THE CONSTRUCTION OF THE TRAMWAY LINE



SIDE VIEW OF THE AERIAL TRAMWAY, SHOWING BARREN CHARACTER OF LAND



THE MINE MOUTH AND LONGYEAR CITY IN VALLEY BELOW

were unique. The task commenced early in 1907, but when the engineers reached the bay, they could not effect a landing, owing to unfavorable ice conditions, until the summer was well advanced. Even then they had to make a forced march of several miles over the pack ice, hauling

haulage and the workmen, the sea journey being of several days' duration. Then as the ground is always frozen solid, excavation work to carry the supports for the line was tedious, being only found feasible by dynamite. Although the undertaking was commenced in 1907,

steep so that the cableway can be operated entirely by gravity without the aid of any driving power whatever. Indeed, an excess of power is produced which has to be absorbed by a Schrieder hydraulic-brake regulator. The coal is brought from the mine adit and dumped

down a slide into the silo at the loading station. The coal falls through the silo into pockets which terminate in lock shoots, along the mouth of which extends the cableway so that the cars can be brought directly before them for loading. There is a short length of cableway used as a side track for cars not in service. The loaded cars are pushed by hand over the end return or over the intermediate switch to the station exit, where they couple automatically to the traction rope which is constantly moving.

Owing to the steepness of the mountain side, which was furthermore littered with massive sandstone boulders, the erection of the loading station and its requisite facilities was accompanied by considerable difficulty. The rock, owing to the frozen condition of the ground, had to be blasted out by dynamite. Bricks were unavailable, so the loose boulders had to be pressed into service as a building material. Moreover, in order to insure the stones binding together under the action of the cement, it was necessary to keep a large fire going in which the stones were heated before being laid, since the temperature only rises slightly above the freezing point under the direct rays of the sun. Owing to the absence of timber, great economy had to be exercised in the maintenance of the necessary fire. For the purpose of hauling the requisite material from the beach to the erection level, an inclined lift was laid down, up which a car was hauled by the aid of a winch.

Care also had to be observed in the erection of the cable-carrying supports. Each support had to be provided with a foundation on the outer side for the purposes of safety, and these in some cases were of an extensive character.

Upon reaching tidewater, the line is carried seaward until it gains a point where there is sufficient depth of water to enable the vessels entering Advent bay to anchor. The sea end of the line is carried on piling. The latter has a platform on the outer end on which the return sheave is fitted. As the cars arrive at the outermost point they are automatically uncoupled, are pushed round the loop by hand and their contents tipped into the hopper. Then the coal passes through the telescopic chute into the hold of the vessel moored alongside. The cableway is carried over the water to the unloading station in a single span of 800 ft. from the beach, and the last land support is appreciably strengthened by a refuse dump which has been piled around it. The line measures about 4400 ft. from end to end, is carried upon 15 supports; during the season it carries over 1000 tons a day, according to the tonnage of the vessel to be loaded.

ONLY THREE MONTHS SHIPPING

Transportation between mines and ship is restricted to but two or three months

during the summer, when work has to be carried on at high pressure to make the greatest avail of the short length of time the bay is open to navigation. During the winter, no ships can approach the landing stage. Moreover the silo at the mouth of the mine is quite inadequate to contain the whole of the coal brought to the surface during the winter. As a result, a supplementary storage is provided in the form of a dump by automatically disengaging the cars on the open track. To take up coal during the summer from this dump there is a short surface line running on a piled bridge to the ship-loading station where the trucks are tipped by hand into chutes over the ships' holds.

The provision of this comparatively simple means of transport has enabled the resources of Spitzbergen to be turned to greater commercial account than formerly, and bearing in mind the unique conditions prevailing in regard to extreme northern latitude, this aerial railway is distinctly interesting.

Costly Fire in West Virginia Mine

SPECIAL CORRESPONDENCE

A fire broke out in the drift coal mine of the Hutchinson Coal and Coke Company at Kingmont, W. Va., on Saturday, May 20. It is supposed that the fire started in a pile of rubbish near the outcrop and occupied several weeks in creeping around through the coal to the airway near its exit. At this latter point it burst out at 3 p.m. on May 20, and soon had destroyed the wooden casing of the intake fan nearby. The men were about all out of the mine then so no lives were lost, but little headway was made against the flames till help arrived from Fairmont at 6 o'clock on Sunday morning.

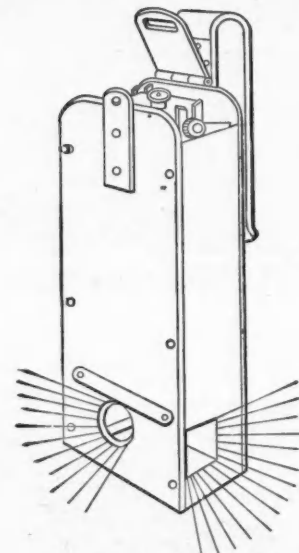
The greater part of Sunday was spent in erecting a 4-ft. electric fan (obtained from the adjoining mine) in the second left with the idea of forcing out the flames, which were then advancing inward, and bratticing them off from the workings. Unfortunately this plan could not be carried out for the air at the brattices became so foul with smoke, that the men lost their lights and were forced to flee outside.

On Monday at 3 p.m. the U. S. rescue car arrived from Pittsburg with Mine-Rescue Foreman Roberts, and First-Aid Foreman Robbins, and several assistants.

After a reconnaissance, it was seen that nothing could be done inside the mine so it was decided to seal up its three openings. The sealing was done with brick masonry and concrete. Meanwhile a water pipe had been laid to the nearest creek and pumps had been rigged up there to force up water to flood the workings. Flooding the mine seems to be the only solution.

An Electric Tail Lamp

The Pilley Manufacturing Company, 608 South Third street, St. Louis, Mo., has designed an electric tail lamp for mine use. The light will burn 14 hours without recharging, and costs only about 1c. per day. The lamp, which can be arranged to show all white, or red lights, or both, is made with a heavy iron and oak frame and its chief advantage is that



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ELECTRIC TAIL LAMP FOR USE IN MINES

it cannot be extinguished by the jolting or colliding of cars. The lamp radiates light on three sides.

Coke Production in Colorado and Utah

The U. S. Geological Survey figures show that the production of coke in Utah and Colorado in 1910 amounted to 1,346,211 short tons, valued at \$4,273,579, against 1,251,805 short tons, valued at \$4,135,931, in 1909—an increase of 94,406 short tons, or 7.5 per cent. in quantity, and \$137,648, or 3.3 per cent. in value. The smaller increase in value was due to the decline in the average price per ton, from \$3.30 in 1909 to \$3.17 in 1910, but this decline does not appear to be assignable to any particular cause, unless it be to the larger proportion of slack coal used in the ovens in 1910. In that year nearly 50 per cent. of the coal used for coke-making was slack, whereas in 1909 the quantity of slack coal made into coke represented only 35 per cent.

All the ovens in use in Colorado and Utah are of the beehive type. They are distributed among 18 establishments, 16 in Colorado and 2 in Utah. There were 235 ovens abandoned in 1910, reducing the total number from 4700 to 4465. Six of the 18 establishments (5 in Colorado and 1 in Utah) were idle throughout 1910. The six idle establishments represented a total of 666 ovens.

Mine Explosion at Mineral, Kansas

By C. M. Young *

It is generally easy enough to tell how it happened after it is all over. It would have been easy to prevent it if we had known what was to happen. We thought we had taken all proper precautions, but somewhere something somehow happened that was not expected, so there was an explosion and many good men lost their lives. Frequently our explanations do not all agree, but this is the common history of mine explosions.

So it was in this case. This is the story of a mine explosion, written with no idea of bringing out any new facts or theories, but with the hope that it may help miners to keep in mind the fact that things are not always as we expect them to be, that there is always a possible danger and that only provision for all possible conditions will enable us to live and work in reasonable safety. Even then it sometimes happens that things go wrong.

The Missouri, Kansas & Texas mine No. 16 is at Mineral, in southeast Kansas. It is wet and free from dust. It is also free from gas, as far as experience goes. In my opinion, it is doubtful whether any coal mine is absolutely free from gas; but no gas had ever been detected here. The miners had no fear of gas or dust explosions and many of them knew nothing of the dangers of gas or of the use of safety lamps.

On the evening of March 18, while the shotfirers were at work, there was a slight explosion. This was thought to be a windy shot—nothing uncommon where much powder is used. Mr. Jopling, the mine superintendent, immediately went down to see whether any harm had come to the shotfirers. He carried a naked lamp, as did all the miners and the shotfirers.

THE MINE SUPERINTENDENT KILLED

He found nothing out of the ordinary until he reached the beginning of the "Little North" entry. There he was suddenly enveloped in flame and fell dead, a victim of the unexpected. A miner, who was about 100 ft. behind, ran to him and dragged him back for a few feet, until himself overcome by afterdamp. Another miner following this one succeeded in getting both men back to good air. The one overcome by afterdamp revived.

This explosion was a violent one and the sound was heard for some distance. A party at once went underground, again with naked lamps, knowing that there was no gas in the mine. Their knowledge was mistaken, the gas was lighted again and two more men died because things were not as they were supposed to be. Three men were dead and the two shotfirers who had gone to the end of the "Little North" were missing.

It is evident there were violations of several laws, especially those with reference to the use of powder and the law requiring drill holes in advance of entry faces. Carelessness in early investigations.

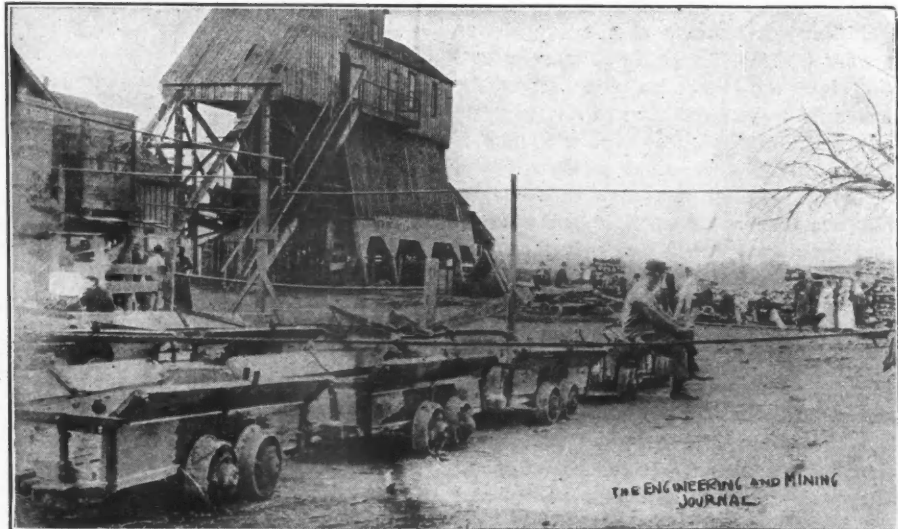
*Associate professor of mining engineering, University of Kansas, Lawrence, Kan.

This is the outline of events as they were known immediately after the ex-

ploded the fan, because the gas would thus have a shorter path to travel to the upcast and would be blown out more quickly. A curtain was placed about 10 ft. south of the main shaft to shut off the south side of the mine and the speed of the fan was increased to twice the usual rate.

It was found that the door at the first crossover between the Little North main and the back entries had been blown out. A curtain was put in to send the air up the west side. Under these conditions gas was found in explosive quantities at the south end of the Little North back entry, 18 hours after the beginning of the attempt to sweep it out. It was evident that a large supply of gas had been tapped and the Inspector started a systematic search for the source.

The conditions which made it possible



GENERAL VIEW OF TIPPLE BUILDING AT MISSOURI, KANSAS & TEXAS RAILROAD MINE No. 16

plosion. The State mine inspector, Frank Gilday, was not far away and he reached the mine during the night and immediately commenced the task of finding the cause of the trouble and searching for the two shotfirers.

SYSTEMATIC RESCUE WORK BEGUN

Using safety lamps, he went into the mine with a party of miners and went out the Main North and the Fourth East to the beginning of the Little North. Here his lamp showed firedamp in large quantities.

During this time the direction of the air current had been down the air shaft, out to the Little North, up the east side and down the west side of this entry, across to the west side of the mine and back to the main shaft.

Knowing now that the gas was coming from the Little North, the inspector re-

to break into this large body of gas and which gave the gas its high pressure are as follows. Lying to the north of No. 16 is the Old No. 7 mine. The shafts are possibly a mile apart, the exact distance is of no importance. The shaft of Old No. 7 is about 50 ft. deeper than that of No. 16, the difference being due to the dip of the coal. It is said also that there is a low place in the old mine, between the shaft and the point at which No. 16 cut into it. If this is true it means only that the accumulating gas was confined in a smaller part of the mine. This old mine had been abandoned for some years and was known to be full of water, at least at the shaft. It is seen that the highest part of the old mine is nearest to No. 16. It is reported that this old mine had been cut into by another mine some time previously and that blackdamp had been found, with no firedamp.

A PROBABLE EXPLANATION

It is easy to see now, after the tapping of this body of gas, that a water-seal had been formed at the shaft and that any gas given off by the coal or the neighboring rocks would accumulate until an opening had been made through the rock or coal, or until the pressure had become great enough to break the water-seal in the shaft. In the latter case, gas would have escaped until the pressure had been reduced to that due to the head of water in the shaft. This escape of gas would have occurred intermittently as long as the gas was generated. It is even conceivable that the gas might be due to the decay of mine timbers under water, but it is more probable that it came from the coal. The fact that no gas was found when the mine was cut into before, is probably due to the fact that there was no water-seal to confine the gas and it was given off too slowly to be noticeable unless it had accumulated for some time. This accumulation may have been going on for several months or years.

Little North entry was being driven toward Old No. 7 with the purpose of cutting into the old mine and letting the water from the north part of No. 16 drain into it. A fire had destroyed the maps of the old mine some time previously and the place where it would be reached was not accurately known. It was known that the entry would reach it soon, but nothing except blackdamp had been found there and it was thought that there would be no danger. So no drill hole was kept in advance of the entry. If this precaution, seemingly so useless, had been taken there would have been no trouble.

To return to the story of the explosion; it was found that the gas was not swept out as easily as was expected and the inspector started a systematic ventilation of the rooms. A curtain was placed in Little North entry, so as to drive the air into the first room. When this was free from gas the curtain was moved to the next room, and so on until all the rooms on the west side of the entry had been ventilated and examined. The stoppings between the main and back entries had been blown out and the curtains were put in.

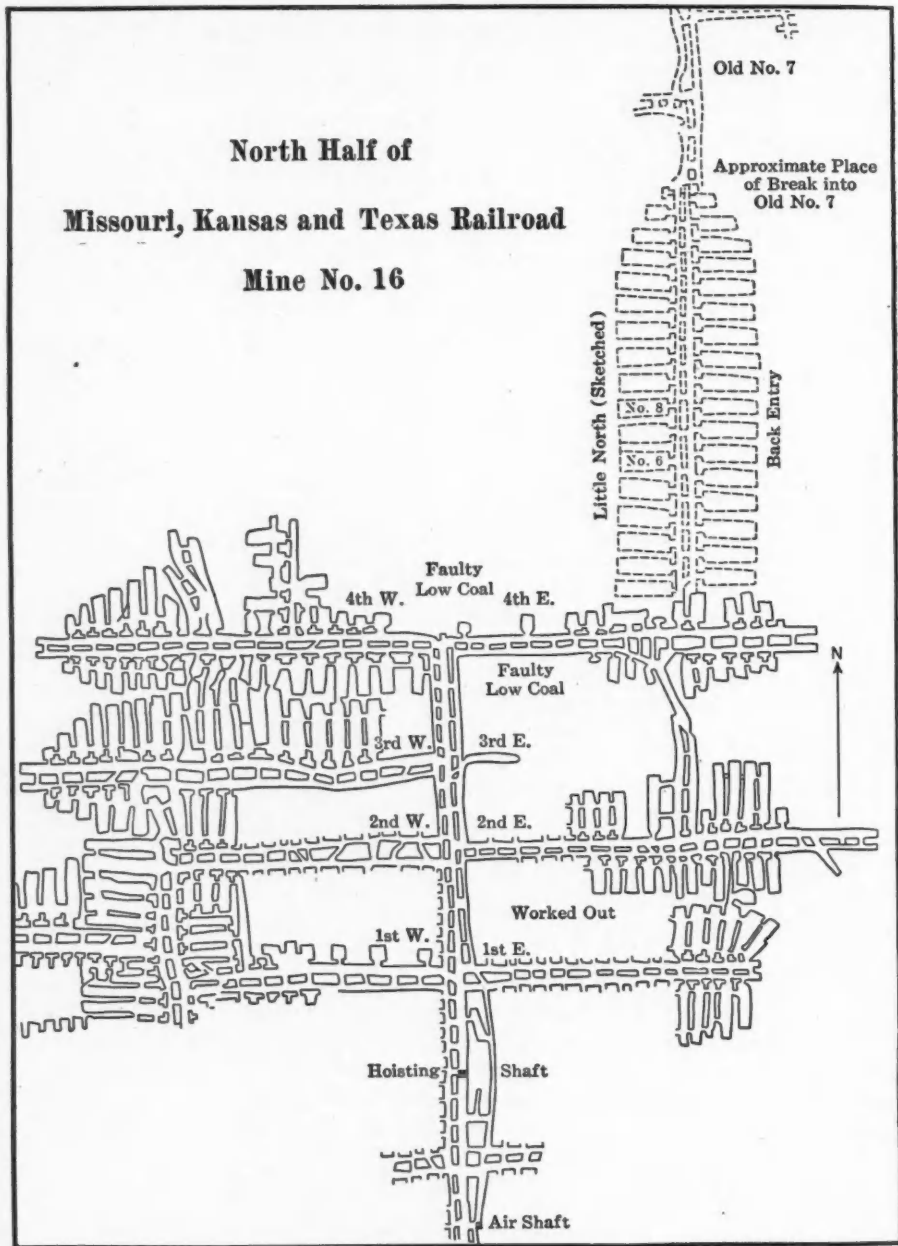
During all this time, while the search for the gas was going on, many of the miners held firmly to their belief that the mine contained no gas. Once when the inspector, weak and exhausted from the effects of hard work and bad air, had crawled under a curtain in the breakthrough near the head of the entry and, with his lamp nine inches from the bottom, had found gas that flamed in the lamp, men with naked lamps disobeyed his orders and went up the main entry. It is no wonder that he used language that was eloquent because it was forceful enough to drive them back.

Omitting details, it was found that a

hole had been made in the end of the back entry, about nine inches wide and two and a half feet high. Through this a strong current of gas was coming, so strong that it blew away the wet straw with which the inspector tried to plug it. Finally, working in the dark, he filled it with wet straw, canvas and broken coal and built a wall of coal in front of it. Then the rooms on the east side were swept out and the search for the missing shotfirer was resumed. Probably the escape of gas had reduced the pressure so

fired on the east side was the more rapid of the two and on this occasion all of the 17 rooms had been fired. This shotfirer had been found in the crossover between the two entries, so burned that he would hardly have been recognized as a human being. Probably he had been burned by the second and third explosions and possibly by the first.

The second shotfirer had fired all rooms from 17 to 6. Nos. 8 and 6 had not been worked that day and there were no shots in them. In No. 6 the cap and



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that it was less difficult to stop the hole than it would have been at first.

THE BODIES ARE FOUND

As was said, two shotfirers worked on this entry, one on each side. On each side were 17 rooms. The men started at the head of the entry and fired back to the Fourth East, where they crossed each other's paths, the one who had been on the east side, going to the west side of the mine, and *vice versa*. The man who

lamp of the shotfirer were found, but there was no trace of the man. A systematic search was commenced. This man was known to be careful and cool-headed. It was thought that he might have been uninjured by the first explosion and that he had hurried to the east side to escape the afterdamp and reach fresh air. He was not found here. All parts of the mine were searched with no result. Then the men were provided with iron rods having hooks on the ends to

probe the bodies of water in the old parts of the mine. Nothing was found here. Meanwhile the falls of roof and coal were shoveled over until no place remained unsearched except a very large fall in room No. 8. Here the body was found on the morning of March 24. The head was turned toward room No. 9. The body was badly burned. Whether he became confused and went through the breakthrough to this place, or was blown there by an explosion, is not definitely known.

Thus six deaths were the result of omitting the precaution of keeping a bore hole in advance of the entry as it approached the old mine, a precaution required by the laws of most States and one that would seem to need no law to prevent its omission. The men and the mine management observed all precautions that seemed necessary. Those who died were not the victims of greed or of ignorance of mine work. They failed to prepare for the improbable but possible danger. The accident will be a lesson in this district, and I hope that it may have some meaning for other districts.

In company with Mr. Gilday, State mine inspector, Mr. Smith, of the U. S. Mine-Rescue Station at McAlistier, Oklahoma, and Mr. Harrigan, a miner, I went to the end of the Little North on March 21. The ground was covered with debris. Powder cans were prominent and some of them contained powder. This is certain proof of the fact that miners do not always obey the rule forbidding the keeping of powder in the mines. I believe that Mr. Gilday followed the wisest course in his efforts to find the cause of the trouble and prevent further disaster.

CAUSED BY A WINDY SHOT

In conclusion, I wish to express my belief that the first explosion was what was originally supposed to be, a windy shot. That there was no gas in the entry before the shots were fired is proved by the fact that the shotfirers had just been to the end of the entry with naked lamps. One of the shots in the head of the entry made an opening in the old mine. This shot must have been one of the first to explode. The gas was under considerable pressure, being confined by the water in the old mine. If it had been ignited by one of the shots it would seem that it should have burned as a torch, projecting its flame into the entry. There is no evidence of such an occurrence. Probably it was not ignited at this time, but was first ignited by the lamp of the superintendent. It has been thoroughly proved that black powder, fired in the presence of coal, frequently produces combustible gases which, being mixed with air and ignited, explode. This happens with especial frequency where large charges of powder are used, as is the case in this field. It is my opinion that it occurred in this case.

The Treatment of Mine Fires

BY HERBERT M. WILSON*

Fires in mines are a far greater menace to life and property than is generally appreciated. Two of the most serious disasters in coal mines within the last two years—one at Cherry, Ill., and the other at the Pancoast mine, near Scranton, Penn., originated from trivial causes. Two of the most destructive disasters in metal mines in the last year—Tonopah, Nev., and Copperhill, Tenn., resulted from similar causes. At Deadwood, S. D., \$1,000,000 has been spent in fighting a metal mine fire.

The nature of the combustible material found in metal mines offers varying but usually good opportunities for the spreading of a fire. While the progress of a fire might, at first, be slow, in some cases it may spread quickly and involve a large area and result in tremendous damage if not promptly extinguished.

I believe that the introduction of comparatively inexpensive fire-fighting appliances, the adoption of proper regulations, and the institution of a reasonable system of fire drills will minimize fires and confine others to a brief period of time with little damage to life and property.

CAUSES OF MINE FIRES

Among the most fruitful causes of mine fires are, in approximate order of importance, the ignition of timbers, wooden stoppings and brattice cloths; hay or oil-soaked materials by open torches; the ignition of coal by blown-out shots or explosions of firedamp or coal dust, or the improper use of explosives. Surface fires communicated to the mine through the shaft or tunnel; underground furnaces and boiler plants; ignition by friction on oily, wooden rollers or rope haulageways, fires occasioned by spontaneous combustion of coal, timber or greasy waste.

The engineers of the Bureau of Mines have adopted as the most effective means of exploring and in the earlier stage of combatting mine fires, the use of the oxygen helmet. By the use of such apparatus a number of fires have, within the last few years been promptly extinguished which would doubtless otherwise have spread and perhaps extended beyond control.

The Bureau of Mines encourages the treatment of wood and brattice cloths and other inflammable materials with fire-proofing substances. Chemistry, through the quick analysis of gases sampled at frequent intervals in the neighborhood of the fire has proved a most useful adjunct in fighting fires. By this means it is found

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Note—Abstract of lecture delivered before the National Fire Protection Association at its annual meeting in New York, May 25.

possible to stop off the fire and by pumping in carbonic acid or smothering it with water, to determine by the progress of the analysis, the condition of combustion; thus ascertaining with assurance the time when the fire may have been extinguished or may call for further combatting.

To a body of men familiar with the subject as you are, it seems unnecessary to call attention to the necessity of providing at each mine ample storage supplies of water under proper head and properly conveyed in protected pipes to possible danger points. To the desirability of employing larger amounts of noninflammable material in place of wooden mine timbering or wooden doors; the proper regulation of the disposal of waste; cleanliness, whereby grease or oil-soaked material shall not be permitted; proper inspection of steam pipes and boiler plants to insure their insulation; fireproof manways and air shafts; proper fire protection and the use of noninflammable material so far as possible in all top works and other surface structures within 50 to 100 ft. of the main opening.

SUGGESTED PREVENTIVE MEASURES

Aside from these well-known measures there are others which the engineers of the Bureau of Mines would suggest, such as careful examination of the working face after firing each shot; keeping barrels of water or boxes of sand convenient to points at which explosives are being used; keeping open lights away from the working face for some time after firing the shot; disconnection of electric wires before shot firing; proper attention to all electric wires and their insulation at danger points; examination of the manner of liberation of explosive gases; use of safety lamps or lanterns instead of open lamps in the neighborhood of all inflammable materials when engaged on repairing wooden stoppings or examining for air leakage.

A proper system of fire-alarm signals should be installed in every mine and should be tested at suitable intervals, and underground employees should be familiar with the signals through frequent drills. The water supply for mines is usually such as to render desirable the use of nozzles of as small diameter as one-half to three-quarters of an inch. As high pressure as is reasonably attainable, say not under 50 lb. per square inch should be furnished, for the reason that the trajectory of the jet of water must be very low, since the hose must be used in tunnels often under 5 ft. and rarely over 6 or 7 ft. in height. In consequence, the nozzle can be elevated only at a very low angle and the jet can be thrown a comparatively short distance. By test under 20 lb. pressure, only 23 ft.; under 30 lb. pressure, 30 ft.; 40 lb., 34 feet.

Electricity at Alabama Coal Mines—I

By A. F. Elliott*

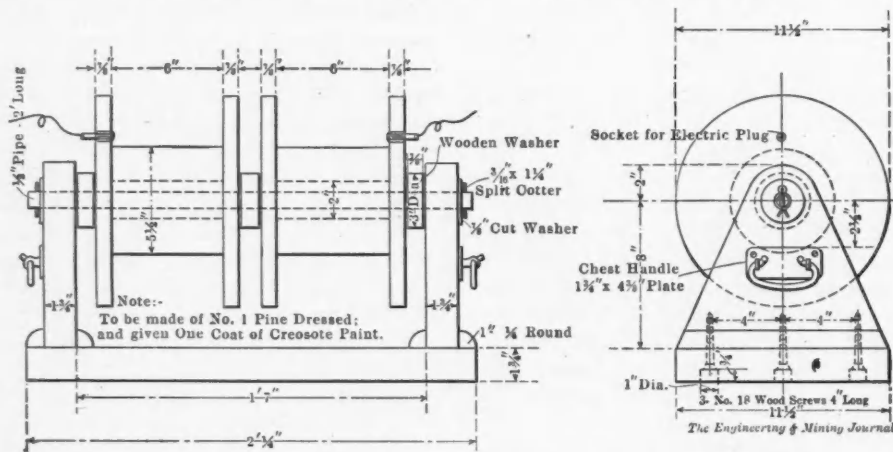
Electricity was first installed in the mines of the Tennessee Coal, Iron and Railroad Company about seven years ago, since which time the system has been gradually extended until it now embraces 16 different mines supplied by 11 power stations. Some of the mines are completely electrified so far as is possible with the present state of the art. The coal not only is mined and hauled by electric machinery, but electric motors drive the pumps for unwatering the mines; electric fans are used for ventilating; electric machinery for hoisting and lowering men and material; for drilling rock in the headings; handling the loaded and empty cars about the bottom; for heating tally shacks, and oil houses, where steam is not available and where there is danger from fire. In addition, there are electric shotfiring systems whereby all of the shots in the mine are exploded simultaneously when the men have left the workings. Also, there are complete telephone and signal systems and electric lighting. The company is now experimenting with an electric-driven centrifugal drier to remove the moisture from the crushed coal

Details of electric equipment at several mines belonging to the Tennessee Coal, Iron and Railroad Company. The coal is undercut, shot and hauled by electric machines, while pumps and fans are also operated by electricity.

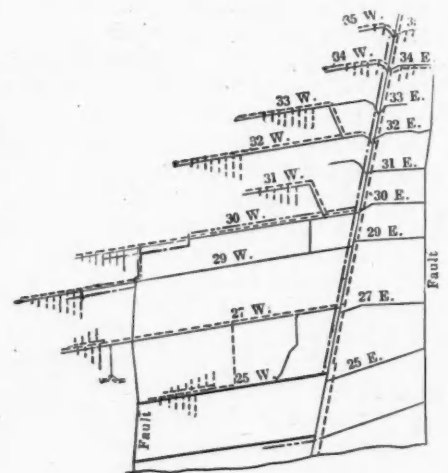
*Chief electrician, Tennessee Coal, Iron and Railroad Company, Ensley, Ala.

is in the famous Pratt Seam of coal which averages a little more than 4 ft. in thickness and is of a fine coking quality. The seam outcrops at the surface on a pitch of about 15 deg., which gradually decreases for a distance of approximately one mile when it becomes practically flat and continues for some miles to the other outcrop. The seam underlies a splendid roof and is practically free

capacity of 800 gal. per min. and driven by a 90-h.p. General Electric motor, stands as a reserve for use during an unusually wet period. The mine is ventilated by a 5½x11 ft., Capell reversible fan, with a capacity of 200,000 cu.ft. of air per minute. This fan is driven by two 100-h.p., Northern Electric Company motors, one of which is belted to each end of the fan shaft, one motor being used to drive the fan while the other stands idle, for use in case of accident. The fan is situated at an air shaft two miles from the pit mouth. The air shaft is equipped with double cages for hoisting and lowering men and is operated by a double-drum electric hoist driven by a 40-h.p. Westinghouse motor.



SHOWING REEL FOR ROOM SHOTFIRING WIRES



Legend
 Electric Shot Firing Lines
 Pipe with Hose Attachment for Sprinkling
 Pipe with Patent Nozzle Spray

The Engineering & Mining Journal

LAYOUT FOR ELECTRIC SHOTFIRING AND SPRINKLING SYSTEMS

before it is put into the coke ovens. In fact nearly everything is done through the agency of electricity except the supervision and shoveling the loose coal into the mine cars.

THE ORIGINAL INSTALLATION

The original installation was made in No. 3 Pratt mine and consisted of three 150-kw. 500-volt, 500-r.p.m. Jeffrey compound-wound generators, belted to 18x20-in. 200-r.p.m. Skinner automatic engines, housed in a substantial brick building, together with a 750-h.p. Webster, Camp & Lane hoisting engine. Steam for this plant is supplied by four Wickes vertical water-tube boilers, with an aggregate of 1250 h.p. The boilers are fired by waste gases from a battery of beehive coke ovens. The No. 3 mine

from gas. The main haulways have 40-lb. steel rails, while 30-lb. rails are used in the cross headings. These rails are all rolled at the company's own mills at Bessemer, Ala. The original underground equipment consisted of two 10-ton and four 6-ton Jeffery electric locomotives, which equipment has since been increased by one 13-ton, three 10-ton, one 8-ton and five 6-ton locomotives; also seventeen 17A Jeffrey breast mine machines.

The water in the mine gravitates to one large sump where it is pumped to the surface against the vertical head of 330 ft. by a 10x18-in., 1200-gal. per min. triplex Connellsville pump, driven through gearing and flexible coupling by a 150-h.p. Northern motor. Another 8x18-in. triplex Connellsville pump with a ca-

The cages have self-closing gates and an auxiliary safety rope, also detachable sockets which release the cage in the event of an overwind. The motor is equipped with an electric time-limit switch controlled by the drum, which cuts off the current should the operator fail to shut off the controller or should he start the cage in the wrong direction. Power is transmitted to the mine by two independent feed lines, one underground, and the other on a pole line overhead,

so that it is possible to operate the pumps, fans, etc., even after a serious disturbance of normal conditions. The underground line consists of a 450,000 circ. mils. weatherproof cable supported on the mine timbering and roof, and the overhead line consists of a 600,000 circ. mils. and a 400,000 circ. mils. weatherproof cable run on the pole line which also carries the telephone lines to the air shaft. There is also a 600,000 circ. mils. feed and return line, from the air shaft 8000 ft. distant to an air shaft in the No. 4 mine; this latter line provides for running the pumps and fans at both mines by power supplied from either one of the

by the gathering locomotives. These 20-car trips are delivered to the main slope locomotive which hauls them to the foot of the engine plane where they are hoisted to the tippie. There they are uncoupled and dumped and again made up into trips of 20 cars each for return to the mine. The 20-car trips are handled by all of the locomotives and the cars are never uncoupled except on the tippie and at the room necks. Different size locomotives handle the same trips over the different grades. The nearest coal mined is $2\frac{1}{4}$ miles from the tippie. The mine has a capacity of 1600 tons per day, but is now producing 1200 tons per day.

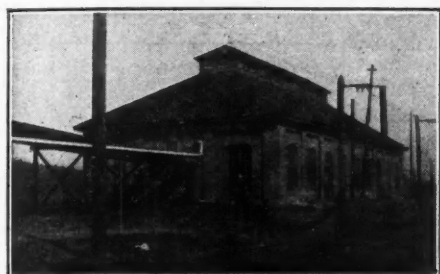
ft. apart along each side of the batteries and a No. 3 hard-drawn copper span wire put up with double strain insulators. The trolley wires were then attached to these span wires by the regular feed-in ears, no effort being made to insulate the trolley wires from the span wires. This system was installed two years ago and seems to be the better type of construction where the conditions are such that it can be used. All of the trolley wires used underground are shielded on both sides by 1x7-in. creosoted pine boards, held in place by shielding hanger attached to the regular mine trolley hanger as shown in the accompanying sketch. There are more than seven miles of such shielded trolley wire in this mine alone.

One of the other illustrations shows a view from the tippie at this mine which is of some interest, it being the Ensley furnace plant of the Tennessee Coal, Iron and Railroad Company. It is possible to stand on this tippie and see the coal being hauled out and delivered to the by-product coke ovens nearby; from there it is hauled steaming hot by electric locomotives to the coke bins at the furnace, where it goes into the charging cars and into the furnace stack with the ore from the iron mines owned by the company a few miles distant. The iron is carried in a molten state to the converter and through the various processes of steel making and comes out a finished steel rail laid down within 200 yd. of the tippie of the No. 4 mine. On a test run the ore has been taken out of the mines on Red Mountain, and delivered as a finished steel rail at Ensley within 24 hours time.

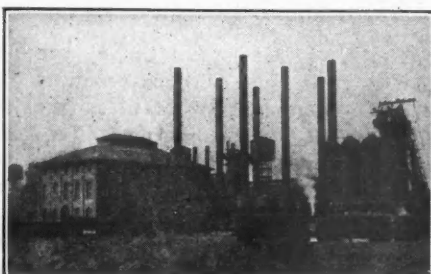
THE NO. 4 MINE

The No. 4 mine is located $1\frac{1}{4}$ miles south of No. 3 mine and is in the same seam of coal. It was originally supplied with power from the plant at No. 3 mine, but has now an independent power plant. The generating station consists of two 150-kw. 500-volt Northern generators, direct connected to 20x16-in., 200-r.p.m. American Ball engines as shown in illustration. The company has eleven of these units in service at the various mines. The No. 4 mine is similar in many respects to No. 3 mine. The coal is all mined by 7 Sullivan continuous-cutting chain machines. The coal is hauled in trips of 21 cars, each car holding 3000 lb., to the foot of the engine plane where it is hoisted to the top in trips of 7 cars each. These trips are hauled from 2 to $2\frac{3}{4}$ miles by three 15-ton and one 10-ton Jeffrey locomotives against a maximum grade of 4 per cent. The coal is gathered by one 6-ton and four 4-ton Jeffrey locomotives. The plant has a capacity of 1000 tons per day.

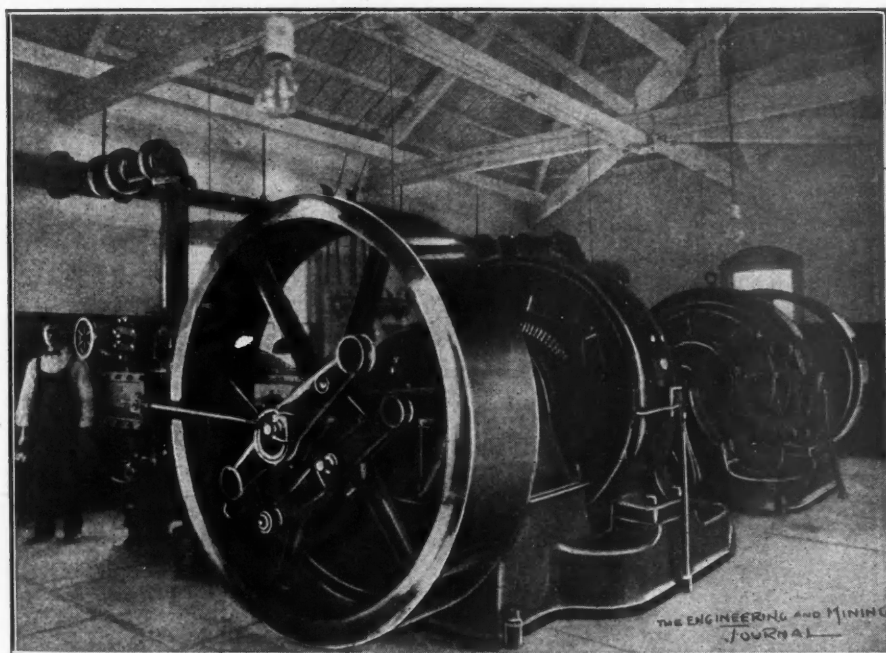
The mine is ventilated by a Capell 4x8-ft. fan, having a capacity of 60,000 cu.ft. and placed on the sur-



PRATT NO. 3 POWER STATION



THE ENSLEY FURNACE PLANT OF THE TENNESSEE COMPANY



INTERIOR VIEW OF GENERATING STATION AT NO. 4 MINE

two power stations, in case of a serious accident at one of the plants, and while it has never been necessary to use it for this purpose, it is a good insurance and is convenient when making repairs or alterations at either plant. Double-throw switches are provided so that the pumps or fans may be thrown on to either plant as the load conditions may demand.

METHOD OF HAULAGE

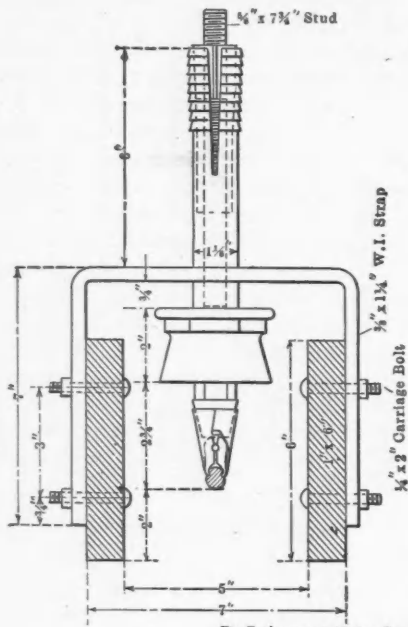
After the coal is undercut and blasted down by permissible explosives, it is loaded into 3000-lb. capacity cars, which are made up into trips of 20 cars each,

The coal is charged into the ovens by electric larries after being crushed in the usual way, but it may be of interest to mention the trolley system used on the ovens. The trolley wires were originally put on $1\frac{1}{2}$ -in. pipe brackets set in concrete. These soon rusted out, either at the top of the concrete or where they were threaded for connection. Also the heat from the ovens, with the sulphur fumes and gases rapidly softened and decomposed the insulating material used in the trolley hangers, causing them to burn out and ground. To overcome this difficulty a line of 30-ft. poles was set 75

face at an air shaft one mile from the pit mouth. The fan is driven by a 60-h.p. Northern Electric motor, which may be operated from either No. 3 or No. 4 power station. The water is pumped from the mine by two 8x18-in. triplex 800 gal. per min. Connellsville pumps, driven by 90-h.p. G. E. motors, and a 6x18-in. triplex 400-gal. pump driven by a 60-h.p. motor. The latter pump also supplies water for the spray lines throughout the mines, there being more than 200 sprays in use in this mine.

No. 5 MINE

No. 5 mine is also in the same seam of coal and is equipped with an exact duplicate of the plant at No. 4 mine. This was the first mine in the South to be equipped with an electric shotfiring system. The layout for this system, together with the sprinkling system, is shown in the accompanying drawing. A pair of



The Engineering & Mining Journal

SKETCH SHOWING TROLLEY-WIRE HANGER

No. 6 copper weatherproof insulated wires are run on overhead pole lines to the air shaft, 6000 ft. distant from the power station, where they go underground, and No. 10 and No. 12 weatherproof copper wire is used in the headings. Rooms are wired with No. 14 weatherproof copper wire. Instead of extending the room wiring from time to time, a shotfiring reel, shown in accompanying sketch, has been adopted for use in the rooms. This consists of two independent reels, each holding 300 ft. of No. 14 weatherproof wire located at the room neck, or end of the permanent wire. No. 5 1/2 porcelain knobs are attached to the room props in such a way as to allow the wires to be strung through the hole in the insulator. The wires are pulled through as the room advances. This results in a considerable saving in wire and prevents the numerous splices necessary when extending the wires by

the former method. A pair of face wires are used over and over again for connecting the shots across the face of the room.

In the No. 8 Pratt mine, which was the last to be equipped for electric shot firing, No. 10 insulated iron wire was used instead of the No. 12 and No. 14 copper wire, and has been found to be much better for this work on account of its greater mechanical strength, beside being cheaper than the copper wire. More than 20 miles of this wire was required to equip the mine for electric shot firing. *(To be concluded)*

Alabama Coke Production

The U. S. Geological Survey reports that in 1910, West Virginia produced 3,803,881 short tons of coke, as against Alabama's 3,249,027 short tons. Yet Alabama received \$1,810,588 more for its coke than West Virginia did. This was not because the West Virginia coke was inferior, but because Alabama enjoys the advantage of having, in the iron-making district of Birmingham, a home market for the State's coke output. West Virginia, on the contrary, probably ships 98 per cent. of its coke out of the State to furnish fuel to distant iron works.

The most significant feature of the coke-making industry in Alabama, as in most of the coke-producing States in 1910, was the advance in values. The quantity of coke produced in 1910 was not materially larger than in 1909, the increase being only 163,203 short tons, or 5.3 per cent., but with the improved demand prices advanced from an average of \$2.61 a ton in 1909 to \$2.82 in 1910, and the total value increased from \$8,068,267 to \$9,165,821, a gain of \$1,097,554, or 13.6 per cent. In quantity the production of coke in Alabama in 1910 was the largest ever attained; the value of the 1910 product, however, was about \$50,000 less than that of 1907.

The following table shows the growth of the coke-making industry in Alabama:

Year	Short tons
1880	60,781
1890	1,072,942
1900	2,110,837
1905	2,576,986
1906	3,034,501
1907	3,021,794
1908	2,362,666
1909	3,085,824
1910	3,249,027

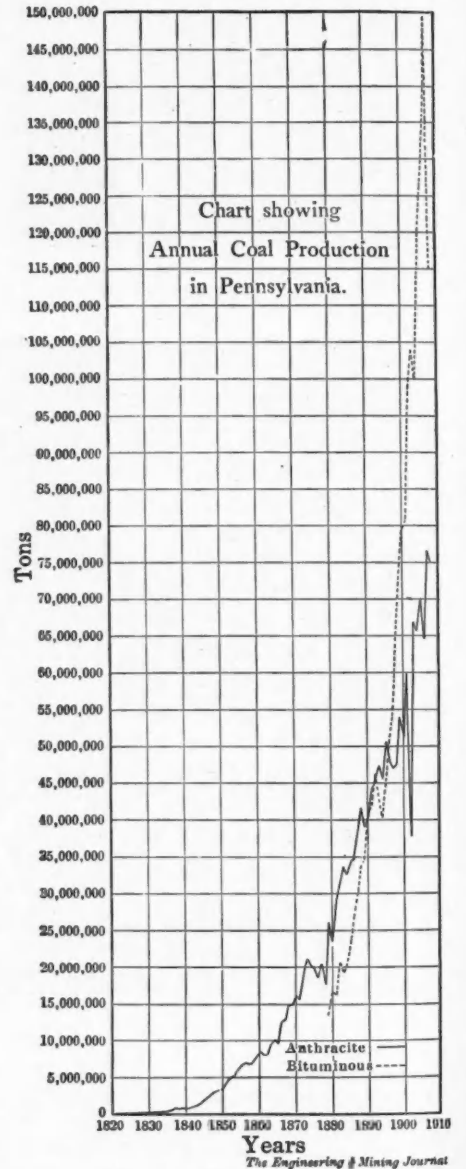
Of the total quantity of coke made in 1910 in Alabama, 557,148 short tons were produced in by-product retort ovens, of which there are 280 in the State, at two establishments. The quantity of coal used in the retort ovens was 769,212 short tons, and the yield of coke of this kind was, therefore, 72.4 per cent. During 1910 construction was begun on a bank of 60 Koppers by-product recovery ovens at Woodward by the Woodward Iron Company.

There were 43 coke-making establishments in Alabama in 1910, the same num-

ber as in 1909, but the total number of ovens increased from 10,061 in 1909 to 10,132 in 1910, exclusive of the 60 Koppers ovens under construction at the close of 1910. Of these, 9614 ovens were in operation in 1910, with an average production of 338 short tons each. In 1909 the average production per oven was 330 tons.

Growth of Pennsylvania Coal Industry

The accompanying chart illustrates plainly the phenomenal growth of coal production in Pennsylvania since mining began in that State. It is quite probable



that anthracite production will never greatly exceed the maximum already attained, for no new fields have been discovered, and the beds now being worked are becoming more difficult to mine each succeeding year. Bituminous production, however, will undoubtedly reach new totals, for virgin fields still remain to be developed. It is also a fact that all of the bituminous mines have never worked to capacity.

Spassky Copper Mines Ltd.

LONDON CORRESPONDENCE

The report of the Spassky Copper Mines, Limited, for the year ended Sept. 30, 1910, has just been issued, and it is a case of "making hay while the sun shines." The usual time that is necessary to prepare the report is nearly twelve months, but as further capital is needed; namely, £100,000 to purchase an interest in the Atbasar copper mines and as the share transactions in Russian mines are active at present, it is no doubt deemed a good opportunity to raise the additional capital.

The accounts show a profit of £91,258 from which interest on £242,450 debentures have been paid leaving a net balance of £73,021. A dividend of 2s. 6d. was paid last November, and a further dividend of 2s. 6d. will be paid in June. During the year 2384 tons of copper were sold for £188,243 with an average price of £78 18s. 10d. The average cost per ton was £37 15s. 10d. The stock pile at surface has been nearly doubled and was estimated at 16,284 tons.

The stocks have since increased to 22,790 tons. In a drive west from the 490-ft. level, the lode for the full width of the drive is said to assay 18 per cent. copper. The outlook for the current year seems most hopeful as the mine is developing well and by the use of the rock drills the orebodies should be opened quickly, and the costs for producing copper should be lower.

Power at Porcupine

SPECIAL CORRESPONDENCE

The new gold camp of Porcupine will be exceptionally well situated with regard to power, and it is estimated that before the end of the year, two custom plants will be ready to serve the district. At present there is one plant under construction at Sandy falls, and all the necessary material and machinery are on the ground, having been brought in over the winter roads. The equipment for another plant has now been ordered, although the machinery will not arrive on the ground until after the completion of the railroad. This plant will be erected at Wawaitan falls, on the Mattagami river, by the British-Canadian Power Company, which is successfully operating a combined electric and compressed-air power plant, at Cobalt.

The main dam will allow for a total head of 123 ft., and the water will be carried to the turbines by two steel penstocks, each 8 ft. in diameter. The two turbines will be capable of generating 3450 h.p. each, and will be direct connected to the generators, having a total capacity of 4000 kw. The power house will be so arranged that additional units may be added. The current generated

will be three-phase, 25-cycle, and at a pressure of 12,000 volts, a distributing station will be built in the vicinity of the Hollinger mine, from which lines will radiate to the different properties.

The construction of these power plants will be of great economic importance to the new district and will probably prove to be a big factor in making it a success. At the present time, of course, the only fuel available is wood, but this supply will not last long, and forest fires can be depended upon to destroy a large portion of the standing timber. When the railroad is completed, coal can be brought in, but the cost, laid down at the mines, will be high, and judging from the experience at Cobalt, the cost of power generated by coal would probably be about \$175 per horsepower-year. No rates for the electric power are as yet available, but they will probably be about the same as at similar plants at Cobalt, \$50 per horsepower-year.

April Operations at Goldfield Consolidated

During April, 1911, the total production of the Goldfield Consolidated Mines Company was 28,253 tons, containing \$1,061,497, or an average of \$37.57 per ton, the average extraction being \$35.75 per ton, or 95.16 per cent. The total net profit was \$796,151, or \$28.18 per ton.

During the month 3961 ft. of development work was done. At the Clermont mine a winze was started from the 604 orebody to connect with a raise from the 1200-ft. level of the Grizzly Bear. This was started in the hanging wall and was

APRIL OPERATING COSTS AT GOLD-FIELD CONSOLIDATED

Mining:		
Development	\$1.11	
Stoping	2.21	\$3.32
Transportation		0.09
Milling		2.22
Marketing		1.10
General expense		0.37
Bullion tax		0.52
Construction		0.06
Total cost of operation		\$7.68

low grade, but is now down 50 ft. and is in \$50 ore. It is hoped to complete this winze by June 1, after which development will be pushed on the 1200-ft. level. Two hanging-wall crosscuts are now being driven on this level, one north and one south from the Grizzly Bear shaft, and the quartz mass is being found wider and stronger than on the 1000-ft. level of the Clermont. The 700-C. hanging-wall raise, which is practically a crosscut on the 1200-ft. level 200 ft. south of the shaft, cut 6 or 7 ft. of ore that averaged \$12 per ton. The air on this level has been bad, and until the winze and raise are connected not much work on this orebody can be done.

At the Combination mine 330 tons of ore were mined from the sill floor of the 136 stope on the second level, averaging

\$200 per ton. An orebody was cut 50 ft. west of the 136 stope which will probably connect with the main stope, giving a stope 75 ft. long by 10 or 15 ft. wide. In the Mohawk mine the 260 sill floor on the second level, and the 354 sill floor on the third level were considerably extended, and 1223 tons of ore that averaged \$30 per ton were mined from the 354 sill. The 384 and 385 drifts on the third level on the footwall of the 354 stope were extended 100 ft. through ore that averaged \$20 per ton. The footwall was not exposed, but the indications are that the orebody will be about 10 ft. wide, and is now opened up 200 ft. in length; the face of the south drift still being in ore. The mines are producing about 940 tons per day.

Zinc Corporation Ltd.

LONDON CORRESPONDENCE

The Zinc Corporation, Ltd., according to its recent report, has had a successful year; the total sales amounted to £324,020 as compared with £292,095 for the preceding year, an increase of nearly £32,000. The number of tons of tailings treated from the Broken Hill mines was 270,637, and yielded 85,625 tons of zinc concentrates averaging 46.71 per cent. zinc, 5.4 per cent. lead and 11.4 oz. silver; also lead concentrates to the amount of 9,319 tons assaying 56.65 per cent. lead, 38.39 oz. silver, and 15.95 per cent. zinc. The profit was \$97,906 after deducting working costs, the purchase of tailings at 5s. per ton, and depreciation.

Four dividends of 12½ per cent. on the £1 shares were paid during the year making a total of £89,513. Two dividends were paid in 1909, one dividend in March, 1911, and the eighth dividend will be paid in June making 100 per cent. on the preference shares. Now that the preference shares are paid in full the ordinary shares are entitled to participate in the profits.

An improved process or method is to be tried in the treatment of the tailings. The directors have approached the directors of the Broken Hill South Block with the object of entering into some kind of working arrangement, possibly amalgamation, as the latter has a mine, and the former a process with a limited tonnage reserve. Such a union should tend to longevity provided the zinc corporation does not have to pay too much as the mine made a loss of over £1000 during April.

The seven Scotch shale-oil companies are now said to mine 3,000,000 tons of shale per year. (*Chem. Trade Journ.*, May 13, 1911). Their product is: Burning oils, 20,000,000 gal. per year; naphtha, 5,000,000 gal.; lubricating and gas-making oils, 22,000,000 gal.; paraffin, 25,000 tons; ammonium sulphate, 54,000 tons.

i PERSONAL i

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

Charles Janin, of San Francisco, is making a professional trip in Arizona and Colorado.

F. W. Bradley, of San Francisco, has gone to Alaska, where he will remain for three or four months.

C. L. Constant, of the C. L. Constant Company, New York, is in Cobalt, Ont., on metallurgical work.

Morton Webber, of New York, is engaged in valuation work in eastern Canada for the C. L. Constant Company.

C. R. Pope, who purchased the Burns properties in Porcupine, Ont., for a Chicago syndicate, is making a short visit to the camp.

Dietz & Keedy, of Boston, have recently made some mineral-land examinations in Maine in the interest of New York parties.

H. Mortimer-Lamb, of Montreal, recently attended a meeting of the western branch of the Canadian Mining Institute, held at Trail.

P. E. Van Saun, chief engineer for the Mill and Smelter Engineering Company of New York, has gone west on professional business.

M. Bates has resigned his position as manager of the Foley-O'Brian mine in Porcupine, Ont., and will open offices as consulting engineer.

Quincy A. Shaw and Rudolph Agassiz, of the Calumet & Hecla and subsidiary companies, are at the mines on their semi-annual tour of inspection.

Andrew G. Larson, of Vancouver, B. C., and A. J. McMillan, came to New York lately in connection with a prospective sale of the Le Roi mine at Rossland.

Frank H. Probert, of Weed & Probert, Los Angeles, Cal., recently spent a week in New York, on his return from Mexico. He left May 29, on his way to Arizona.

Albert I. Goodell, of Salt Lake City, Utah, has been seeking business in the Cœur d'Alene district of Idaho for the International Smelting and Refining Company.

Juan B. Carrasco, a mining engineer from Los Angeles, Chile, is visiting the Canadian and American mining districts. He is now in Sudbury, Ont., and will go to Houghton, Michigan.

Robert R. Hedley, of Vancouver, B. C., has been elected chairman of the western branch of the Canadian Mining Institute for the ensuing year, in succession to Wm. Fleet Robertson.

Howland Bancroft has been relieved from active work on the U. S. Geological Survey, and expects to spend the next six months visiting mining districts in Peru, Bolivia and Chile.

Frank E. Marcy, formerly with the Allis-Chalmers Company, has been appointed manager of the branch house of the Mine and Smelter Supply Company at Salt Lake City, Utah.

W. Yolen Williams has returned to Spokane, Wash., from the Hidden Creek Copper mine, Observatory Inlet, B. C., which the Granby company is developing under option of purchase.

Robert H. Stewart, of Trail, B. C., general manager of the Consolidated Mining and Smelting Company, of Canada, Ltd., has been in Toronto lately, conferring with the direction of the company.

John M. Boutwell, consulting geologist for Phelps, Dodge & Co., is making a geological survey of the property of the Moctezuma Copper Company at Pilares de Nacozari, Sonora, Mexico.

Peter Diehn has resigned his position as engineer of construction for the Philadelphia & Reading Coal and Iron Company, and will go to Brussels, Belgium, for the export branch of the Steel Corporation.

Alexander Sharp, mining engineer for P. Burns, who owns mining properties in Mexico, northern Washington, British Columbia and Alberta, is removing his headquarters from Orient, Wash., to Calgary, Alberta.

I. L. Merrill, of Los Angeles, California, president of the Hedley Gold Mining Company, has returned home after having spent several days at the company's gold mine in the Similkameen district, British Columbia.

C. W. Geddes, former consulting engineer for the Foley-O'Brian mine, Porcupine, Ont., has been appointed manager of the property. A. F. Motz, formerly of Coram, Cal., has been appointed superintendent.

+ OBITUARY +

Charles D. Lane died at Palo Alto, Cal., May 24, aged 71 years. He was one of the pioneer gold miners of California, and for many years was a prominent figure in the mining industry of that State and of Alaska. We hope to publish a suitable notice later.

Nathaniel Wright Lord, professor of mineralogy and metallurgy at the Ohio State University, Columbus, Ohio, died at his home in that city May 23, aged 56 years. He was born in Cincinnati. He graduated at the Columbia College School of Mines in 1876; was chemist and engineer of the Monte Grande Gold Mining Company, 1879; chemist in charge of analysis of fertilizers of the Ohio State Board of Agriculture; consulting chemist Ohio Geological Survey; author of "Notes on Metallurgical Analysis," "Iron Manufacture of Ohio," "Natural and Artificial Cements," and numerous reports and pa-

pers for technical societies and scientific and technical journals. He was director of the chemical laboratory, United States fuel-testing plant, St. Louis, Exposition, 1894. He was a high authority on fuel and fuel testing and for eight years past had been chief chemist or consulting expert of the technologic branch of the U. S. Geological Survey, now a part of the Bureau of Mines.

Dr. Robert Wheelock Ells died at Ottawa, May 23, aged 66 years. He was born at Cornwallis, N. S., and educated at Acadia College and McGill University, graduating from McGill in 1872 with first-class honors and the Logan gold medal in geology and natural history. He joined the staff of the Geological Survey in the same year and had been ever since—39 years—steadily engaged in geological work in that branch of the service. He was a fellow of the Royal Society of Canada and of the American Geological Society and a member of the Canadian Mining Institute. For a number of years past he had represented the province of Ontario on the corporation of McGill University. He was the author of many able reports on the geology and mineralogy of the Canadian provinces in addition to numerous papers for the various scientific bodies with which he was connected. Doctor Ells was probably most widely known in recent years for his researches in connection with the problem of the utilization of the oil shales of Eastern Canada, which did much to attract attention to the value of these deposits. His memoir on the subject, which was published in 1910, is regarded as a standard authority on the question.

SOCIETIES and TECHNICAL SCHOOLS

Colorado School of Mines—The annual commencement was held at Golden, Colo., May 26, when a class of 35 received degrees.

American Institute of Mining Engineers—The second local meeting of members and guests of the Institute was held May 26, in the assembly room of the United Engineering Society building, New York. Dr. James Douglas gave a lecture, illustrated by lantern slides, on the Copper Queen Mine, Bisbee, Arizona. The meeting was preceeded by an informal dinner at the Engineers' Club.

Utah Society of Engineers—At the monthly meeting at Salt Lake City, May 19, the annual reports of the officers were presented. The paper of the evening was "Notes on the Construction of a Large Concrete Diverting Dam," illustrated by lantern slides, by George M. Bacon. This was followed by the introduction of the new president by the retiring president, Mr. Honnold, and the inaugural address by M. D. Grosh, president.

Editorial Correspondence

San Francisco

May 24—The executive committee of the Independent Agency is considering a plan for the organization of a storage company to include the Union with a view of providing tankage sufficient to handle about 14,000,000 bbl. The plan contemplates a \$5,000,000 capitalization, the financing to be done almost exclusively by agency members and the Union, which will include a \$4,000,000 bond issue at 8 per cent. to run ten years. Of this amount it is the purpose to issue \$2,250,000 at once, and to pay to the Union Oil Company \$1,000,000 of such first issue in consideration for the 4,000,000 bbl. steel tankage it now owns. The balance of the first issue is to be employed in the construction of concrete reservoirs with a total capacity of 10,000,000 bbl. This new construction and the present steel tankage of the Union, together with the pipe-line storage stations now in operation, will make the aggregate storage of the agency 19,000,000 bbl. The result of the consummation of such a plan would be a direct saving to the independents in storage costs, reducing them from the 6c. per bbl. now paid the Union to about 1.7c. per bbl., per month. The independents, both at Bakersfield and Coalinga, are reported to be strongly in favor of this storage idea, considering it a surer and more economic solution of the difficulties that arise in the effort to hold the agency intact than any that has been suggested.

The law relating to the conservation of minerals in the streams and lakes and providing a method of leasing and operating has had an early result in the incorporation of a \$5,000,000 organization known as the United States Soda Company, which announces as its purpose the exploitation of soda deposits known to occur particularly in Inyo and Mono counties. The company has not announced the locality of its intended operations or prospecting, nor does it declare the names of capitalists who are claimed to be behind the scheme and ready for practical operation and actual production to follow successful exploitation. The company just incorporated is composed of San Francisco men, Luther Elkins, A. H. Jarman, Oliver B. Wyman, George W. Mordecai, N. Schmukowitz, L. L. Dunne, S. Canham, E. del Valle and Henry H. Rolph, who claim to be acting merely for the unnamed backers of the project. As none of the stock is offered for sale the genuineness of the undertaking is the more favorably regarded. There has been for a long time the opportunity for exploitation and production of the various saline deposits of the State, but it seems to have been either neglected

Reports from our own
Representatives on
Important Events from
Many Important Mining
Centers of the
World



or improperly taken. At any rate no large successful operation has resulted, although both the Geological Survey and the State Mining Bureau have issued bulletins setting forth the character, value, situation and extent of the various deposits that would yield commercial profit. It was the direct purpose of the proponents of the conservation law respecting such minerals to bring about just the results that may be attained by the company now incorporated, and by other such organizations.

Denver

May 26—The Camp Bird company is negotiating for the purchase of the Revenue-Virginus property at Ouray in the Sneffle's district; also, for the acquiring of the San Pedro property between the Camp Bird and the Revenue. The Revenue is owned by A. E. Reynolds, of Denver, and has a large production to its credit. While the Revenue is still worked on the original vein it is said that there is practically a new mine in the Montana vein which is cut by a tunnel that comes out of the mountain on the Telluride side. It is now stated that the Revenue management will push work on the Montana claims and a number of others. P. H. Sheldon left Ouray last week to complete plans for the opening of a boarding house for the men at the Ophir end of the tunnel. The Montana vein is a gold-copper producer. At a recent run of a quantity of this ore in the Camp Bird mill about 95 per cent. of the gold was recovered.

The San Pedro owns a large and practically unexplored territory. If either or both properties can furnish profitable ores to the Camp Bird mill, it will be a splendid move to acquire them. The Camp Bird has earned and is earning a steady profit from its present territory, but it has been recognized that the question of diminishing ore reserve was becoming of pressing importance. Camp Bird expects to have the Santa Gertrudis mine in Mexico on a profitable basis soon.

The Denver Republican is starting what is termed by them, "A Prospecting Fund," in order to get the old-time prospector and his burro back to the mountains again. This fund is subscribed to by business, as well as mining men, throughout the State. Many an old-time prospector will gladly go into the mountains again with his grubstake.

Butte

May 24—The case of Mills v. Olsen decided by the supreme court of Montana is one of the most important cases decided by that tribunal in recent years as affecting the laboring classes. The laws of the State provide that any miner, mechanic or other laborer who performs work upon any real property shall be entitled to a mechanics' lien upon such property for the value of the work done provided he file a notice of such lien in the county clerk's office of the county in which the property is situated. The statutes also provide that in a suit brought to enforce such a lien the plaintiff shall be entitled to a reasonable attorney's fee as part of the costs of the case. In the case referred to, the supreme court holds that part of the law providing for attorney's fees to be unconstitutional and void. The filing of mechanics' liens has been a popular method of enforcing such claims, owing to the provision giving the lienor his attorney's fees, but in view of this decision it is doubtful whether in the future the procedure will be used to the same extent since its method of enforcement is extremely technical.

At the last annual meeting of the stockholders of the Anaconda Copper Mining Company, held May 17, at Anaconda, the following were elected directors for the ensuing year: B. B. Thayer, William Rockefeller, John D. Ryan, H. H. Rogers, F. P. Addicks, Urban H. Broughton, and George H. Church. President Thayer presented an exhaustive report of the condition of the company's properties. Comment is made on the fact that the concentration of the management of the various subsidiary companies of the Amalgamated, through the acquisition by the Anaconda company of all the properties, has produced a reduction in the cost of mining and general operation. During the last year the mines produced 3,326,227 tons of ore, 4413 tons of precipitates, or a total of 3,330,640 tons. The Parrot and Little Mina shafts have already been abandoned for hoisting purposes and are now used merely for ventilation. It is the company's intention to do the same with the shafts of the Rarus, Never Sweat, and East Gray Rock mines as soon as practicable.

Salt Lake City

May 26—A number of improvements on railroad lines in the State and neighboring territory are projected or in progress, which will benefit Salt Lake City and Utah, generally. It has been announced that the new owners of the Mof-fat road are to issue bonds to complete the line from its present western terminus at Steamboat Springs, Colo., to Salt Lake City. Contracts have been let and work started for the completion of the double-tracking of the Oregon Short Line from Farmington to Ogden and from Ogden to West Weber on the Southern Pacific. A road is also being built by the Oregon Short Line from Burley, Idaho, to Kelton Summit, a distance of 58 miles through the Raft river country in southern Idaho, which will probably be extended to Salina, Utah, on the main line of the Southern Pacific west of Ogden.

The San Pedro, Los Angeles & Salt Lake railroad has begun the construction of a new road from Moapa on its main line between Salt Lake and Los Angeles, south through the Moapa melon country to St. Thomas, Nev., a distance of 22 miles. The roadbed of the main line between Barclay and Moapa through Caliente is being changed to a higher position along the sides of the cañon, which should keep an open line to Los Angeles the entire year. The distance is 84 miles, and the work is nearly completed. A new road from Washington county, Utah, to the eastern boundary of Union county, N. M., is projected by Eastern and New Mexican people and the Taos, Sierra Nevada & San Francisco Railroad Company with a capitalization of \$800,000, filed articles of incorporation in Salt Lake, May 22. It is proposed to reconstruct the old Jordan Valley railroad running from Sandy to Wasatch near the mouth of Little Cottonwood cañon.

A lease has been secured from the Denver & Rio Grande by J. G. Jacobs and a number of others. The Denver & Rio Grande has a branch line from Midvale to Sandy, which is not used much at present, and its standard gage formerly ran to the mouth of Little Cottonwood and connected with the old narrow gage. The distance from Sandy to Wasatch is about six miles and the roadbed is in fairly good condition. This is the part of the line to be rebuilt. Rails are on the ground, but new ties must be laid throughout and some grading will be necessary. If this road is put through to Wasatch, it will reduce the cost of ore hauling from Alta and the road will be used in hauling sand from the large deposits east of Sandy and possibly granite from the Cottonwoods. The line will connect with the Denver & Rio Grande, and San Pedro, Los Angeles & Salt Lake at Sandy.

Duluth

May 25—Rumors have been persistent for some time that the International Harvester Company was contemplating the erection of a washing plant at some point on the Mesabi range, to treat the low-grade ores which form an appreciable percentage of the total in some of the mines owned by the company on this range. That these rumors were well founded is evidenced by the fact that work is actually in progress at the Hawkins mine, near Nashwauk. Not long since, the company purchased a large tract of land in the vicinity north of the State, at prices averaging about \$60 per acre. The plant will probably be erected at O'Brien lake, to which railroad tracks are now being laid, and while nothing definite has been given out, it is supposed that the plant will, in its essential features, be modeled after the Coleraine plant of the Steel Corporation. The ore at the Hawkins mine contains a large percentage of sand, and for this reason the mine has not been operated steadily for the last five years. It is this class of ore, however, that the washing plant at Coleraine is designed to treat, particularly, and with the completion of the new plant of the International Harvester Company, at Nashwauk, the Hawkins mine will undoubtedly become a large and steady producer.

Work on the Minnesota Steel Company's plant, at West Duluth, has progressed to such a point that the ultimate size and capacity of the plant is well established. During the year 1910, the Steel Corporation expended about \$1,750,000 at this plant and work is now going on with a force of from 400 to 500 men. The amount of work done from July, 1910, up to the present time gives some idea of the size of the undertaking. During that time the amount of concrete used totaled 150,000 cu.yd., of which 40,000 cu.yd. went into foundations; 3100 ft. of sewers were constructed, and 3000 ft. of tile sewers, the latter at an average depth of 30 ft. below surface. Seven miles of railroad track were built, and the foundations for five buildings, including machine shop, forge shop, blacksmith shop, power house and storage building. These vary in size from 100x40 to 280x140 ft. Twelve miles of copper wire for power-transmission purposes have been strung and 250,000 cement blocks have been made. Machinery, consisting of a 1,000,000-gal. centrifugal pump, 800-h.p. boilers and a 500-kw. electric generator, has been installed. A large consignment of structural steel is expected to arrive early in June and the working force will be increased at that time. Bids on contracts for the erection of two blast furnaces are now being received.

The Mesabi Railway Company was incorporated some months ago, and the plans provided for an electric passenger and freight railway connecting all of the important range towns—a service that has long been needed. Two other minor companies are planning to build shorter local lines connecting two or three towns, one running from Virginia to Gilbert and the other to the west end of the range.

Cobalt

May 26—Attention has lately been drawn to the discoveries of gold in the Elk Lake district, where finds have been reported in seven different places during the last few weeks. This district has, however, been known for several years, and discoveries of gold were made long before the Porcupine district was opened up. So far the work done has not been productive of very satisfactory results, and caution will be necessary in dealing with these latest discoveries.

During the last week six new mining companies have been incorporated to operate in the Porcupine district. Track laying on the railroad has reached Frederickhouse landing and the track-laying machine has been taken across the river. The railroad is expected to be in operation by July 1, when the facilities for transportation will materially aid in the replacement of machinery damaged by the recent fire.

Toronto

May 26—Hon. C. R. Devlin, minister of mines for Quebec, states that never before has the number of mining licenses issued by his department been so large as during the last three months. He attributes the increased interest taken in the industry to the new mining laws and anticipates a mining boom before the end of the year. In regard to the report of the Chibougamou exploration party, which was regarded as adverse to the district, Mr. Devlin said that the conclusion of the explorers was not against the quality of the minerals found in the region—they merely found that conditions were not such as to justify the construction of a railroad at enormous expense. The department was satisfied with the exploration of Chibougamou and Temiskaming, and for this reason will send out another exploring party which will leave by the middle of June for the Canton Bousquet, halfway between Ville Marie and the Grand Trunk Pacific railway.

The Ontario government has detailed A. L. Parsons, lecturer in mineralogy in Toronto University, to make an investigation of the goldfields in the Lake of the Woods district, the latest strikes in which have attracted attention among mining men and prospectors. A. J. Burrows, of the Ontario Bureau of Mines, will be in charge of the field work.

The Mining News

Alaska

It is officially announced that the United States Mining, Smelting and Refining Company will open offices in Seattle, with A. P. Anderson in charge. It is the intention of this company to thoroughly explore Alaska.

A recent snowslide on the claims of Gantzler & Williams, and of the Ibx Mining Company, near Valdez, disclosed a quantity of ore, which may prove to be as good as that of the celebrated Cliff mine in the same district.

Cliff—The additional stamps installed on this property will soon be in operation. B. F. Millard, Valdez, is president.

Gold Bullion—A body of rich ore was recently struck on this property. Several stamps will be in operation this summer. F. G. Bartholf, Seattle, is president.

Kenai Mining and Milling—This company, under the direction of F. H. Bryant, has made extensive preparations for operations during the coming season.

Wibble—This property has been bonded to Finch & Campbell, of Spokane, who will do considerable work during the summer. This is a placer mine.

Arizona

Officers of Phelps, Dodge & Co. say that no plans are under consideration for extension of the El Paso & Southwestern system westward into California and to the Pacific coast. The extension of the El Paso from Benson to Tucson, surveys for which are now being made, will bring the Phelps-Dodge lines 50 miles nearer the western seaboard. At present freight on the El Paso & Southwestern bound for Tucson is transferred to the Southern Pacific at Benson, and poor facilities for transfer at this point is one of the reasons for the extension to Tucson. The Southern Pacific is building from the south in Mexico to Nacozari and to Douglas, both of which points are served from the north by the Phelps-Dodge system.

GILA COUNTY

Arizona Commercial—No water has been encountered on the footwall of the vein, although considerable was found in the hanging wall. The flow of water is decreasing and the mine now makes less than 2,000,000 gal. daily.

Summit—On account of low copper prices only ore from development work is being shipped.

Inspiration—Plans are being made for the new mill, which will be of 5000 tons capacity. Pending completion of the mill plans, underground work has been cur-

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tailed, but churn-drill work is being continued.

Live Oak—The No. 2 shaft is being sunk by contract at an average rate of 6 ft. daily.

YAVAPAI COUNTY

Consolidated Arizona—Since A. H. Wethey assumed the position of general manager, many property improvements have been made. Shipments now amount to 10 cars per month, while production is about 600,000 lb. per month.

California

ALAMEDA COUNTY

The completion of the standard rig by the installation of a 25-h.p. engine on the property of the W. M. & S. Oil Company near Livermore has revived interest in the oil prospects of this county.

AMADOR COUNTY

Argonaut—The new vein on the 3400-ft. level, north, is reported to be 600 ft. long. The foundation for the new hoist is about completed.

Alpine—This mine at Plymouth has recently been reopened and a good strike of ore on the 700-ft. level is reported. John L. Henry is superintendent.

Johnson Copper—A 15-h.p. gasolene engine for hoisting and a compressor for driving air drills will be installed at this mine. John S. Garbarini is owner.

BUTTE COUNTY

Channel Mining Company—Considerable interest is manifested in the prospecting of this company's property near Magalia, from the fact that representatives of the Associated Oil and other big mercantile interests of Sacramento are giving it financial attention.

CALAVERAS COUNTY

Lightner—The 200- and 300-ton orebins at the No. 1 and 2 levels are filled and ore is being hoisted to the 500-ton bin at surface. Electric connections have been made with the mill and by June 20 the 40 stamps are to be ready to drop.

DEL NORTE COUNTY

A large deposit of gold-bearing ore on a contact of gray porphyry and slate is reported to have been found on Smith river 45 miles northeast of Crescent City. The property is not easily accessible. Fred M. Law, Yreka (Siskiyou county), one of the owners, reports that an open-cut 30 ft. deep indicates a large low-grade prospect.

ELDORADO COUNTY

Ribbon Rock—Development continues on this mine, near Eldorado. At 130 ft. in the shaft the vein has been crosscut, showing milling ore of good grade. H. A. Harper, superintendent.

HUMBOLDT COUNTY

Horse Mountain Mining Company—This company is driving the fourth tunnel on its copper property on Horse mountain to tap at 300 ft. depth the orebody which was disclosed in the upper tunnels.

LAKE COUNTY

Sulphurbank—This quicksilver mine in the Clear Lake district, it is reported will be reopened by W. S. Tevis, of San Francisco; and that the sinking and drifting method of development and extraction will be superseded by stripping and open-face excavation or quarrying. The mine is an old producer, but has recently been idle and in litigation.

MARIPOSA COUNTY

Merced—This mine near Coulterville has been purchased by George C. Pardee, and associates. Electric power will be installed.

MONTEREY COUNTY

Pitts Quicksilver Mining Company—Deposits of cinnabar are reported six miles northeast of Parkfield, and this company has been organized in Monterey to develop 5 claims located by William Zinkand and others. Two tunnels have been driven at a depth of 450 ft. and following a hanging wall of serpentine. The erection of a Scott furnace is contemplated should further development warrant continued operation.

PLACER COUNTY

Golden Sheaf—It is reported that Superintendent Thompson is opening good ground that will warrant the installation of a mill.

Cash Rock Dredge—This dredge, which has been operating on the tailings from the mills along the American river, is now at the mouth of Buckeye cañon on the Eldorado county side of the river, and will work up to Dardanelles cañon on the Placer side when the present work is completed.

Colorado

CLEAR CREEK COUNTY

Josephine—At 1400 ft. from the adit portal, 5 ft. of rich lead-silver ore was recently uncovered.

Saratoga—The Argentine Central railroad will soon be open for traffic, when shipments of ore will start to the smeltery at Golden.

Central Capital—This property on Griffith mountain is being developed by the owner, L. Hoery. Drifting is in progress and a body of lead-zinc ore is being followed. This ore, being complex in character, is left standing pending the completion of the Malm electro-chemical plant.

Capital—During April there was shipped 176 tons of concentrates.

Pelican—The mill has been started on night shifts and an average of 200 tons of ore is being treated daily.

LAKE COUNTY—LEADVILLE

The Sugar Loaf district is rapidly becoming the leader of the outlying camps. The Dinero tunnel is working a body of gold ore; the Siwash tunnel is being driven at the rate of 8 ft. per day. An increased production is anticipated from this district.

One of the most interesting developments in many months in Leadville is the opening of ore deposits in the granite in the mines of Big Evans gulch. New Monarch has gone down 65 ft. into the granite and the vein continues as strong and as rich as above.

Progressive—This shaft, operated by the Mound City Mining Company, is again unwatered and a force of men are engaged in cleaning out the débris from the drifts. The small streak of rich ore that was opened some time ago and which contains native silver, is being thoroughly prospected.

Crown Point—The lessees on the Crown Point and Pinnacle have found a streak of zinc carbonate ore in one of the lower levels.

Columbia—George Craemer and partners, leasing on the Columbia, California gulch, have uncovered silver ore. The shipments at present average 200 tons per month and will be increased.

OURAY COUNTY

It is now reported that the erection of the smeltery by the Mono-Baltic company will be pushed ahead as soon as the weather permits.

Joker Tunnel—Lumburg Brothers leasers, are shipping three cars per week. When the railroad is open in July this ore will be shipped to Durango via Silverton.

PITKIN COUNTY

The three electric pumps at the Free Silver mine in the Aspen camp have been started on a trial test. These are the

most powerful pumps built for mining purposes and will force the water in a straight line 1200 ft. to the surface. The Janesville pump at the bottom of the shaft will be held in reserve, and will be connected with the main water column so that in case of a shutdown of the electric pumps there will be no interference with operations in the lower workings caused by an accumulation of water.

SAN JUAN REGION

Camp Bird—The net profit was £13,110 from April operations.

Gold King—After a season of development this mine at Gladstone has resumed production. The mill is now running at full capacity, the output amounting to about three cars of concentrate per day.

TELLER COUNTY

The flow which passes through the portal of the Roosevelt tunnel has diminished until it is now about 5800 gal. per min., due to decrease in head.

Stratton Estate—With the renewed rumor that a custom mill will be erected to treat low-grade ore here, comes the report that the Stratton estate is contemplating the immediate erection of a large plant for the treatment of dump rock. The plant will no doubt be patterned after the Portland's new mill.

Stratton Independence—After drifting 180 ft. on the black dike, which goes through the Isabella estate from the school section on the north slope of Bull hill, an oreshoot was encountered which promises to prove persistent. This is the first oreshoot of any consequence opened in Isabella ground by the School Section Leasing Company. The vein intersects the dike at this point and it is said to be a new shoot, not found in the workings of the Lee shaft.

Indiana

GILSON COUNTY

Bicknell Coal Company—This company, at Bicknell, has increased its capital stock from \$25,000 to \$40,000 to make extensive improvements and open additional mines. T. M. Byers is president.

GREENE COUNTY

Ogle Land Company—This recently incorporated company has acquired 1400 acres of land for both agricultural and mining purposes. A. M. Ogle, of Terre Haute, president of the Vandalia Coal Company and the Monon Coal Company, is president.

SULLIVAN COUNTY

About 600 miners, who refused to deposit with the company their qualification certificates issued by the county board of examiners, were refused entrance to two mines near Hymera. The law provides a penalty for operating a mine by other than licensed miners. The matter has

been referred to State officials of the miners and operators for settlement.

PARKE COUNTY

Suit has been filed in the circuit court at Rockville, asking for the appointment of a receiver for the Wabash Valley Coal Company, which owns large coalfields in Florida township.

Michigan

COPPER

Calumet & Hecla—Shaft sinking on the St. Louis tract has been started. Several drill cores were cut recently from a lode thought to be a continuation from the Mayflower.

Oneco—Operations are confined to the deepening of the old shaft on the Oneco lode. The shaft is down over 700 ft. and will be sunk to 1000 ft. depth.

Ojibway—This property is being stoped at three points tributary to No. 1 shaft, all opening good ground. Sinking is being done in both shafts, No. 1 is down about 1550 ft. and No. 2 about 1850 ft. This property is rapidly getting in a position to begin production.

Tamarack—A fire broke out at the 72d level of the No. 5 shaft on May 24. All the men were taken out without any fatality and the shaft closed in hopes of smothering the fire.

IRON—MARQUETTE RANGE

Hartford—The shaft at this mine, which was recently the scene of a bad mine fire, has been found to be more seriously damaged than was at first supposed. Hoisting will not be resumed for at least a month. After examining many witnesses, the coroner's jury returned a verdict censuring the Republic Iron and Steel Company, which operates the property, for not having a ladderway in No. 1 shaft. The absence of ladders prevented the men from making their escape. The fire occurred in No. 2 shaft. Most of the men got out through the adjoining Cambria mine. The jury's verdict states that the seven men who were victims of the fire were asphyxiated and that the water that was poured into the burning shaft was largely responsible for forcing the smoke and gas upon the men.

Breitung—It is expected that shipments this season will be nearly as large as last year.

Mass—The production for this season from this mine of the Cleveland Cliffs Company, at Negaunee, will be curtailed to permit of reconstruction of the shaft, which will be lined with concrete a distance of 190 ft.; three months more will be required to complete it, so that hoisting may be resumed. About 100 ft. has been finished to date.

IRON—MENOMINEE RANGE

The Cascade district will have three shipping mines this season, the Volunteer, the Empire, which is an Oglebay-

Norton property, and the Richmond, operated by the M. A. Hanna Company. There are two other developed mines which have not shipped for several years, the Moore, which is a Steel Corporation property, and the Star, owned by the Corrigan-McKinney company. The district generally has been in disfavor because of the high silica content of the ores, but the recent find of bessemer ore at the Volunteer mine has stimulated interest and it is probable that a considerable amount of exploration work will be done in the future. Indications are that it will be necessary to attain a greater depth in searching than heretofore.

IRON—MENOMINEE RANGE

Gleason—The Jones & Laughlin Steel Company has taken an option on the leases held by the Gleason Exploration Company, at the western end of the range, and are preparing to explore the tract with diamond drills.

Purcell—This 80-acre tract in S 14-T 43-R 25 has recently been optioned by the Wickwire company, a New York corporation with furnaces at Buffalo. A contract has been made with the Cole & McDonald Exploration Company, who will immediately start drilling operations.

Minnesota

CUYUNA RANGE

Thompson—This shaft of the Inland Steel Company, in S. 11-T 46-R 29, has been dredged to a depth of 46 ft., and the caisson work will be started soon. The overburden is about 90 ft., and the shaft will be lined with concrete.

MESABI RANGE

Hill Mine—This is an open-pit, and is near the town of Calumet, on the west end of the Mesabi range. Much drilling is being done and arrangements are being made to ship about 1,500,000 tons this year; last year's output was 800,000 tons. This is to be accomplished with little or no addition to the present equipment, but by transferring the steam shovels from stripping, to mining ore. It is expected that about two-thirds of the amount to be shipped will be clean ore, the rest will require treatment in the washing plant at Coleraine.

Section 9—This mine is owned by the Pickands-Mather Company, and is one mile north of Calumet. It will be an open-pit mine, and Winston & Dear, who have the stripping contract, will place four shovels in operation at once.

Brainerd Mine—This mine, near Hibbing, has ordered the Duluth, Missabe & Northern railroad to remove its tracks from the property, so as to permit commencement of stripping operations.

VERMILION RANGE

Vermilion Iron Development Company—The last reports are that the Pine Island shaft is bottomed at 180 ft. in hard

hematite ore high in iron and low in phosphorus. This shaft was planned for a permanent hoisting shaft and with that object in view was sunk in the footwall of the formation. At a depth of approximately 40 ft. the ore came in and the shaft has been in it most of the time since, with higher iron and lower phosphorus content at increasing depth.

Vermilion Iron and Steel—The shaft, which is being sunk vertically on the line between this company's property and that of the Vermilion Steel and Iron Extension, has reached a depth of 230 ft. and is bottomed in greenstone, jasper and iron ore. Crosscutting will probably be done at a depth of 280 ft. A new strike was recently made at a depth of about 6 ft. in another part of the property, a vein of ore being uncovered for a distance of 30 ft. Drills will be placed immediately to explore the new find. Due to the fires which burned over this region last summer, a formation of considerable width and consisting of mixed ore and jasper was uncovered on a 40-acre tract of this company's property, heretofore believed to be valueless for minerals.

Missouri

Senator Mining Company—This company of Joplin has been incorporated with a capital stock of \$100,000 by James Shirley and associates. The company has extensive leases at Seneca and east of Joplin.

JOPLIN DISTRICT

Chapman & Lennon—The 200-ton mill at Thoms Station is nearly completed.

Mattes Brothers—A rich strike of ore has been made on the Connor land in the Thoms Station camp.

Merton Park Land and Leasing Company—This company composed of English people has purchased 200 acres of land north of Joplin near the Thoms Station camp, from the B. W. Realty Company.

Madison Land and Leasing Company—The company has bought a 60-acre tract from the B. W. Realty Company at Thoms Station. This was formerly known as the Murphy tract.

United Lehigh—A 500-ton mill is being built on the company's 200-acre lease at Lehigh.

Federated—This company, which has taken over the Lost Forty property of the Mexico & Joplin Land Company at Thoms Station, has done some drilling, sunk a shaft, and is now erecting a mill. The company is also drilling near the Sitting Bull mine.

Adam Scott—Adam Scott and associates have drilled a 10-acre lease of the Mexico and Joplin Land Company directly west of the Sitting Bull mine at Thoms Station and are now sinking a shaft.

Montana

BUTTE DISTRICT

Considerable activity has been evidenced recently in the Blacktail Park and Highland districts, near Butte. The Golden Surprise Mining Company has recently opened a vein of ore. About 3000 ft. of development work has been completed and a mill has been built. Other mines in the vicinity which give promise are the Hirenian, Nerkely and Andhunla.

Butte & Ballaklava—Stockholders holding a majority of the stock have entered into a pooling agreement for one year, to end April 30, 1912. The certificates have been placed in the City National Bank, of Duluth. The company has recently brought suit against the Anaconda Copper Mining Company to recover damages in the sum of \$1,376,095 for ore alleged to have been extracted by the defendant company from the plaintiff's Burke claim. Four causes of action are set forth in the complaint. It is alleged that prior to June 25, 1905, the Anaconda company abstracted ore valued at \$400,000 and at various subsequent times took additional ore, making up the total value asked for in the complaint. Some time ago the Anaconda company began an action against the Butte & Ballaklava for a similar cause and obtained an injunction *pendente lite*, which is still in force.

CASCADE COUNTY

Great Falls Power Company—This company recently issued \$15,000,000 worth of first mortgage 5 per cent. bonds secured by its property in Cascade, Silver Bow and other counties in the State.

LEWIS & CLARK COUNTY

Prickly Pear Mining Company—The company has been incorporated with a capital of \$500,000, for the purpose of operating a group of seven claims near Silver. Enos Carhean is president and W. H. Nichols vice-president.

PARK COUNTY

A. M. Downing, representing Chicago people, has arrived at Jardine, where he is making arrangements for the opening of the gold mines and mill.

Nevada

CLARK COUNTY

Yellow Pine—The mine workings have reached a depth of 500 ft. on an inclination of 45 deg. Lead-zinc ore has been developed on the lower levels. Part of the surface plant is to be electrified, and no further sinking will be done until after the installation of an electric hoist. Electric lights and telephones are also to be installed throughout the mine. The 60-ton concentrating mill is completed but will not be operated at full capacity until after the completion of the narrow-gauge railroad. About six miles of steel

have been laid on the railroad and the work is being rushed to completion. Gasolene locomotives, manufactured by the Milwaukee Locomotive Works, are to be used for motive power, and the road should be in operation by the last of July.

Potosi—This mine continues to ship about four carloads of zinc ore per week. Two makes of gasolene tractors have been tried out in hauling the ore from the mine to Arden on the San Pedro railroad, a distance of about 20 miles, but proved unsuccessful, owing to the excessive grades; the hauling is still done by teams.

Prairie Flower—Zinc ore has been encountered on the third level and the mine will resume shipping in the near future.

Star—The Riverside Zinc Company, recently incorporated to operate the Star group, made its initial shipment last week. Two carloads of zinc ore were shipped to Wisconsin. An extensive surface plant has recently been completed. W. B. Stanley is in charge.

Milford—This property is under lease and bond to H. J. Jarman and associates, and is steadily shipping lead and zinc ore.

South Dakota

CUSTER COUNTY

Cuyahoga—This company is sawing lumber in its own mill for shaft house, bunk house, etc., and will install a steam plant for sinking 100 ft. this summer. F. A. Gira, Custer, is manager.

Westinghouse—This company is again working the New York mica mine full capacity, producing about 4000 lb. per week of sheet and scrap mica. Details have practically been completed for installing full electrical equipment. Power will be secured from the Dakota Power Company plant on Rapid creek, 25 miles distant. It is hoped to have the plant electrified by Sept. 1. Joseph Pine, Custer, is superintendent.

LAWRENCE COUNTY

Imperial—This company is preparing to resume work of drifting from the bottom of the 700-ft. shaft. A contract will be let for advancing the drift, now 1950 ft. in length. The burning out of the fan motor set fire to the station timbers and caused a suspension of work.

Ray—This company is preparing to resume work on its nickel deposit near Nahant. During the winter a number of tests were made proving that the ore carries nickel and gold, and chemists claim that a good saving of both metals can be made at a reasonable cost. The main shaft is to be continued to a depth of 200 ft. H. A. Thompson is manager.

Echo—A shaft is being sunk from a station in the main adit, at a point 600 ft. from the portal and 300 ft. below the

surface. It is proposed to sink 200 ft. A small compressed-air hoist is in use, but an electric hoist will be installed.

Homestake—A wireless telegraph installation will afford communication between the main office at Lead and the power plant on Spearfish creek, the necessary equipment having been received and is now being erected.

PENNINGTON COUNTY

Continental Copper—Superintendent Overpeck has received orders to resume sinking in the 500-ft. shaft, and all employees engaged are nonunion men. Work was suspended a year ago, when the Western Federation demanded recognition.

Tennessee

Continental Coal Corporation—This company has been organized to complete the merger of coal mines in Tennessee recently referred to. Its capital stock is \$6,000,000, of which \$3,000,000 is stock and \$3,000,000 is in bonds. This consolidation includes companies owning about 30,000 acres of land. Its main offices are at Chattanooga; Earl Martin is president and general manager. The consolidation includes Continental Coal Corporation of Tennessee; American Coal Land Company; Black Raven Coal Company; Straight Creek Coal and Coke Company; Straight Creek Collieries Company; Straight Creek Coal and Mining Company; Central Coal Company; Left Fork Company; 11 miles of railroad connecting mines with the Louisville & Nashville railway. W. L. Moss, of Pineville, Ky., will be general superintendent of mining.

Utah

JUAB COUNTY

Eagle & Blue Bell—The orebody on the 1200 has been developed by a winze for 65 ft. below this level.

Shoebidge—Leasers are working on this property near Silver City and have sent out a 20-ton shipment of copper ore.

SEVIER COUNTY

Belnap Aluminum and Power Company—This company is considering the erection of an electric plant in Sevier cañon, six miles north of Marysville. If necessary 8000 h.p. can be developed.

Sevier-Miller Coalition—The old mill will be overhauled and additional machinery including a filter press will be installed. When completed the capacity will be 100 tons of gold ore per day. The property is in the Gold Mountain district near Kimberly.

SUMMIT COUNTY

Park City shipments for the week ended May 5 amounted to 3,979,910 lb.; for the week ended May 12, 3,764,750 pounds.

Silver King Coalition—As a result of the concession made to the millmen, giving them eight-hour instead of ten-hour shifts, the mill hands at the Daly-West, and the Daly-Judge, who have heretofore worked ten hours have been given shorter time since the first of May.

American Flag—A deal for the control of this property at Park City is said to be pending. The mine has been examined by J. W. Finch for Colorado and eastern people. A vein which was opened on the tunnel level some years ago has been cut recently on the 700- and is being driven for on the 1000-ft. level.

Daly West—For the first quarter of 1911, this company reports the sale of 7648 tons of crude ore and concentrates valued at \$194,263. The greater part of this came from stopes on the 1700- and 1800-ft. levels. Some encouraging developments on ore have been made above the 1900-ft. level. Mill operations were hindered in March by cold weather and freezing, which curtailed the output.

New York Bonanza—General Manager McGill states that development work has been handicapped on account of much surface water coming in, which has interrupted the opening of a promising orebody in the winze below the 900. The roads have been in such bad condition from the spring thaws that it has been impossible to begin shipments, although there is considerable ore on hand. An assessment of 2c. per share, delinquent June 8, has been called for. From 14 to 20 in. of ore are reported at three different points.

Quincy-Thompson Consolidated—At a meeting of the directors May 4, it was stated that the Daly-West had driven its 1200 level to the Quincy-Thompson line. The Consolidated will take up the work from this point. The Quincy-Thompson ground is higher than the Daly-West, so that the 1200 level will give several hundred feet additional depth in their territory.

Little Bell—This property was closed down for a few weeks, on account of a large amount of surface water. The roads are in such shape that it is impossible to haul up fuel or send down ore. Work will probably be resumed about the middle of June.

Silver King Consolidated—New ore has been opened in a raise from the 1550 level west of the previous discoveries, and has been exposed for some distance along the bedding. The ore is largely carbonates carrying galena, and runs well is silver.

Snake Creek Tunnel—During April, 140 ft. was driven, giving a total length on May 2 of 3205 ft. The ditch is completed for 3010 ft., track laid for 2985 ft., and ventilating pipe for the same distance. The water will be used at the Snake Creek Power Company's plant.

TOOELE COUNTY

Eureka-Ophir—Operations at this property, between the Dry Cañon mines and Hidden Treasure, are to be resumed shortly.

Cliff—Shipments of 60 tons of silver-lead ore daily have been resumed with the traction outfit between Ophir and St. Johns. During the winter the roads prevented regular shipments. The installation of a new electric hoist in the lower tunnel has been completed, and ore has been followed 100 ft. below this level. Regular shipments will be maintained.

Lion Hill Consolidated—Roads have been broken and two carloads of high-grade ore will be sacked and hauled by wagon to the railroad. This has come from the Chloride Point incline and in places was high in silver. There were shipped 45 tons April 26, and another car is ready. It is proposed to continue shipping two cars per month. The Ophir Hill compressor, from which the Lion Hill obtains power, has been repaired, so that machine drills are again in use.

UTAH COUNTY

Glendale Mining—This company has been incorporated at Spanish Fork, Utah, with a capitalization of \$10,000, to develop the Wall Street group of claims in the Eldorado district.

West Virginia

HARRISON COUNTY

Thermal Coal Company—This is a new company, recently chartered with \$50,000 capital by D. G. Carter and G. H. Earl.

MARION COUNTY

Inspectors Karl Schoew, F. E. Parsons, Bonner Hill and Vaughn, comprising a State examining board, met in Fairmont recently to examine candidates for certification as mine foreman of the first and second grades, and fire boss. Seventy-four candidates took the examination. For first-grade certificate, an applicant must have had five years' experience, of which three years have been in gaseous mines. He must also pass the fire-boss examination. For second-grade foreman the applicant must have had three years' experience in mines not necessarily gaseous. The certificate for fire boss is given to those who are able to pass the tests in gases and the use of safety lamps and have had three years' experience in gaseous mines.

MINGO COUNTY

Red Jacket Consolidated—This company is having a steel, machine-driven coal tippie erected at its Mitchell Branch mine by the Jeffrey Manufacturing Company. It has a daily capacity of 6000 tons, and has four loading tracks and two miles of extra switch.

Canada

NOVA SCOTIA

Nova Scotia Steel & Coal Company—The coal shipments for the first four months of the year were 108,496 tons; 160,665 tons were shipped during the corresponding period of the last year.

Dominion Coal Company—During the first four months of the year 804,028 tons of coal were shipped; the shipments for the same months of last year were 710,127 tons.

ONTARIO

Mikado—Arrangements are being made for the installation of a cyanide plant. The winze being sunk from the fourth to the seventh level is giving good results.

Scramble—This claim, about four miles east of Kenora, in the Lake of the Woods district, has been acquired by the recently organized Canadian Homestake Mining Company, with a capitalization of \$1,000,000, and will be operated with electrical power from Kenora. Charles Brent, of Kenora, is manager.

Dwyer & Elliott—At this iron property, Wilberforce, Haliburton county, a gang of men is at work. Two shafts are down 25 feet.

English Land Company—This company, at Wilberforce, Haliburton county, is opening up a molybdenite mine, and has installed an extensive plant.

ONTARIO—COBALT

The shipments from Cobalt for the week ended May 19 were: La Rose, 146,630; McKinley-Darragh, 109,130; Nipissing, 66,070; Temiskaming, 64,910; Chambers-Ferland, 62,615; Beaver, 62,165; Cobalt Lake, 61,420; Coniagas, 61,000; Kerr Lake, 60,082; total, 694,022 pounds. Bullion shipments were: Nipissing, 47,663; Nova Scotia, 36,200; Temiskaming, 42,023; O'Brien, 9952; total, 135,838 ounces.

Boyd-Gordon—At this mine in Gowganda, the vein that yielded high-grade ore on the 40-ft. level has been cut again by a crosscut at the 75-ft. level. It is 2 in. wide and carries native silver.

Ophir—A shaft is to be sunk 100 ft. on the smaltite vein, recently uncovered at the south end of the property. High-grade ore is being taken out at the 100-ft. level.

ONTARIO—PORCUPINE

West Dome—This company is now operating three shot drills, one of which will be used to explore for the vein at a depth of 1000 ft.

Sherrill—Two new discoveries of good-grade ore have been made on this property.

Foley-O'Brian—It is understood that negotiations are under way whereby Boston and Montreal people will acquire

this property. Several good discoveries have been made and the property is equipped with a complete plant.

Standard—A depth of 60 ft. has been reached in No. 2 shaft, sunk on a contact. A pay shoot in the porphyry dipped out of shaft at 25 ft. When the 100-ft. level is reached a crosscut will be run to pick it up.

Porcupine Power Company—This company has decided to increase its hydroelectric installation at Sandy falls by an additional 2000 h.p. The original plant is nearly completed.

Hollinger—Many of the miners have been paid off and underground work will be suspended until the damage done by the fire can be repaired.

McIntyre—The power house, 25 h.p. boiler and hoist on the north vein having been destroyed by fire on May 20, sinking of the shaft will be continued by hand.

Dome—The headframe at the new shaft is nearing completion, the hoist is in place and three boilers are ready for firing.

Martin—This claim adjoining the property of the Philadelphia Mining and Development syndicate is reported sold for \$35,000 to New York people.

Porcupine Reserve—This company has purchased the Birk-Elliott properties at Tisdale. It is the intention to start development work at once. R. W. Norrington of the Porcupine Imperial company is secretary and treasurer.

Great Northern—Prospecting work on the three claims of this company in the southwest of Whitney township has resulted in the discovery of another quartz orebody, carrying sulphides with free gold in a streak about 3 ft. wide.

Mexico

CHIHUAHUA

Rio Plata—During the month of April 2237 tons were treated at the cyanide plant which contained 84,594 oz. silver. There were recovered 72,534 oz. of silver worth \$36,267 with a cost of \$10,788 for treatment.

DURANGO

It is reported that the American Smelters Securities Company has heard from Velardeña to the effect that the mines and five furnaces have been running without interruptions. The *insurrectos*, when they took possession of the place, appointed an effectual guard for the mines and smeltery.

HIDALGO

Real del Monte—The enlarged mill will soon be in operation and it is expected that the production will be 9,000,000 instead of 6,000,000 oz. of silver per annum.

The Markets

Coal Trade Review

New York, May 31—Very little that is new has developed in the coal trade in the West since our last report. Steam coal demand is reported as improving at some points, but the growth is very slow. Lake trade is still slow, though better than it has been. Most mines in the West are working at somewhere between 50 and 60 per cent. of their capacity. As a general rule shipments have been kept down, so that there have been no bad breaks in prices.

In the East the bituminous trade remains dull, and mines are generally limiting their output. Railroad returns show a considerable falling off in shipments.

The anthracite trade alone reports a good condition. The shipments have been large and seem to be well taken up by consumers.

Lake Coal Rates—The Interstate Commerce Commission has resumed hearings on the complaint of the Pittsburg operators that there is discrimination in rates on coal to Lake Erie ports from different districts. The evidence given was intended to show that the ton-mile rate is much higher on Pittsburg coal than on that from West Virginia mines.

COAL TRAFFIC NOTES

Coal shipments of companies in Southwestern Interstate Coal Operators' Association three months ended March 31, short tons:

	1910	1911	Changes
Missouri.....	935,776	644,716	D. 291,060
Kansas.....	1,781,375	1,221,587	D. 559,788
Arkansas.....	818,089	345,916	D. 472,173
Oklahoma.....	1,016,294	629,358	D. 386,936
Total.....	4,551,534	2,841,577	D. 1,709,957

Total decrease this year 37.6 per cent. In 1910 the shipments were rushed in anticipation of a strike, on April 1. The association reports cover close to 90 per cent. of the coal produced in the States named.

Coal tonnage of Norfolk & Western railway ten months of fiscal year from July 1 to April 30, short tons:

Field	Com-mercial	Com-pany	Total
Pocahontas.....	8,617,038	897,429	9,514,467
Tug River.....	1,382,154	401,319	1,783,473
Thacker.....	1,249,072	519,148	1,768,220
Kenova.....	603,361	131,622	734,983
Clinch Valley.....	781,149	43,616	824,765
Total.....	12,633,774	1,993,134	14,625,908
Total, 1909-10.....	11,527,994	1,955,703	13,483,697

The total increase this year was 1,142,211 tons, or 8.5 per cent.

Coal receipts at St. Louis, three months ended March 31, were 2,978,694 short tons in 1910, and 1,920,808 in 1911; decrease, 1,057,886 tons.

Movement of coal on various waterways, three months ended March 31, short tons:

Current Prices of Metal, Minerals, Coal and Stocks, Conditions and Commercial Statistics



	1910	1911	Changes
Monongahela River, Penn.....	2,686,020	2,805,680	I. 119,660
Great Kanawha, W. V.	322,280	408,780	I. 86,500
Davis Island Dam, O.	835,180	1,293,540	I. 458,360
Louisville Falls, Ohio	404,540	642,028	I. 237,488

The movements at Davis Island dam and Louisville Falls canal duplicate each other to a certain extent.

Receipts of domestic coal at San Francisco, three months ended March 31, were 95,032 long tons in 1910, and 86,211 in 1911; decrease 8821 tons.

Coal shipments over railroads in the Ohio Coal Traffic Association, three months ended March 31, short tons:

	1910	1911	Changes
Hocking Valley.....	1,212,432	737,516	D. 474,916
Toledo & Ohio Cent.	486,478	338,930	D. 147,548
Baltimore & Ohio.....	611,825	444,841	D. 166,984
Wheeling & L. Erie.	940,146	711,543	D. 228,603
Cleve., Lorain & Wh.	797,538	498,740	D. 298,798
Zanesville & Western	385,120	280,442	D. 104,678
Toledo Div., Pen. Co.	672,888	522,545	D. 150,343
L. Erie, Alliance & W.	323,338	324,166	I. 828
Marietta, Col. & Cleve.	41,216	9,151	D. 32,065
Wabash-Pitts. Term.	12,167	18,782	I. 6,615
Kanawha & Mich.....	.....	14,107	I. 14,107
Total.....	5,483,148	3,900,763	D. 1,582,385

Total decrease this year was 28.9 per cent. Baltimore & Ohio tonnage is of the Ohio lines only; main-line tonnage is given elsewhere.

New York

ANTHRACITE

May 31—The trade is quieter, as is to be expected at this season, but business is still active in line and local shipments. Coastwise trade has improved. Steam sizes are going more slowly.

Tomorrow 10c. comes off the summer discounts, making schedule prices of domestic sizes for June \$4.45 for lump, \$4.70 for egg and stove and \$4.95 for chestnut, all f.o.b. New York harbor. On steam sizes quotations are: Pea, \$3@3.25; buckwheat, \$2.30@2.75; No. 2 buckwheat or rice, \$1.80@2.25; barley, \$1.45@1.70; all according to quality, f.o.b. New York harbor.

BITUMINOUS

The soft-coal market is dull as regards spot business, but there has been some activity in the closing of yearly contracts. Most of these are being taken at from 5 to 15c. below 1910 prices. West Virginia coal has firmed up a little.

Prices are a shade off. A fair Miller vein steam coal can be had at \$2.50, f.o.b. New York harbor. Lower grades sell down to \$2.30, and better up to \$2.85. Gas coals are \$1.10 for 3/4-in. at mines, \$1 for run-of-mine and 75@85c. for slack.

From Norfolk off-shore trade is reported better, and this has contributed to the firmer prices on West Virginia coal. Bunker trade at New York is good.

Coastwise trade is quiet and rates are off all around. From Philadelphia large boats get 60@70c. to Boston and Portland. From New York going rates are 55@60c. to Boston and Portland, with 10c. more to the shoalwater ports; 35@40c. to Providence and New Bedford; 25@30c. to Sound ports. From Hampton Roads to Boston, 65@70c. is asked.

Birmingham

May 29—The coal market in Alabama is quiet. The coal production in this State is at a low mark. There are no prospects of an early improvement in the conditions. The price of the product, however, is holding up well. There is steady operation at mines where convicts are employed and at a few of the free-labor mines, but in the majority of instances the mines are working on half and even less time. The coke demand is slack in this State also and wherever possible coke ovens are being shut down. Chief State Mine Inspector Charles Nesbitt has just completed a personal inspection of all mines in this State where convict labor is employed. His six assistants have also completed an inspection of all mines in Alabama and it is announced that the new mining laws of the State will be enforced to the letter.

Chicago

May 30—The coal market is very quiet, with little prospect of anything like activity until the summer period of dullness shall have passed. This condition has been foreseen by the Western operators and their output is fairly regulated to the demand, but occasionally there is a wave of receipts that forces prices down to the profitless point. Fine coals as heretofore have the firmest position in the market. Contract business has been larger than ever this year and has been at low prices with the result of depressing the open market. Eastern coals are fairly strong, compared with Western, but this is rather because they are not coming freely to this market than because of increasing demand; for Eastern as for Western coals, trade conditions are bound to be quiet for several weeks at least, considering the general slackening of business. Anthracite con-

tinues to sell well with the expectation that its sales will fall with the 10c. advance due on the first of June.

Prices show little change, Illinois and Indiana being quoted at \$1.90@2.25 for lump, \$1.70@1.90 for run-of-mine and \$1.55@1.85 for screenings. Smokeless is \$3.40@3.55 for lump and \$3.05@3.15 for run-of-mine, and Hocking at \$3.15 per ton.

Cleveland

May 29—Lake trade is improving a little, but is still rather slow for the season. Steam-coal trade is improving and dealers feel a little more hopeful.

Quotations for Middle district coal, f.o.b. Cleveland, are \$2.15 for 1¼-in., \$1.80 for run-of-mine, \$1.55@1.65 for slack. No. 8 and Cambridge districts, 5 or 10c. higher. Pocahontas, \$3.60 for lump and \$2.60 for run-of-mine.

Indianapolis

May 29—A careful canvass puts the average working of mines in this State at about 60 per cent. of their capacity. On the other hand prices have been pretty well maintained, as the mines have kept down shipments and have not flooded the market. Steam-coal trade continues slow, while domestic trade is good for the season, as an unusual number of consumers are putting in stocks. Operators say that at current prices they are coming out even, but getting little or nothing for the depletion of their coal reserves.

Pittsburg

May 30—The coal movement has slackened down further. The movement up the Lakes is extremely light, and very little tonnage can be moved toward the Lakes on account of the congestion. Local demand is lighter than it was and mine operations are probably averaging considerably less than 50 per cent. There is very little business coming up to test prices, which can be quoted unchanged: Nut, \$1.05@1.15; mine-run, \$1.10@1.15; ¾-in., \$1.20@1.25; 1¼-in., \$1.30@1.35; slack, 75c. per ton at mine.

Connellsville Coke—While no official information is available, it is believed in well informed quarters that the deal has been absolutely completed whereby the United States Steel Corporation acquires the Connellsville coke properties of the Pittsburg Coal Company, comprising about 900 ovens and 7000 acres of coking coal, mostly held by the company's coke subsidiary, the Colonial Coke Company, and probably including some 4000 acres of coking coal held by the Monongahela River Consolidated Coal and Coke Company, in which the Pittsburg Coal Company holds a controlling stock interest. The price is probably based on a rate of between \$2000 and \$2500 an acre for the Connellsville coking coal.

The coke market is absolutely inactive. Very little coke has been forced upon the

market, but as a rule coke could only be sold in the past week at a cut price. We repeat last week's quotations, although they are practically nominal: Prompt furnace, \$1.50@1.55; contract furnace, \$1.75@1.85; prompt foundry, \$1.90@2; contract foundry, \$2@2.25 at ovens.

The *Courier* reports production in the Connellsville and lower Connellsville region in the week ended May 20 at 273,108 tons, a decrease of 5000 tons, and shipments at 3013 cars to Pittsburg, 4894 cars to points West and 594 cars to points East, a total of 8501 cars.

St. Louis

May 29—The market on lump and on all larger sizes is dead slow. The weather has been oppressively warm and the demand from dealers has been almost nothing. The little lump that is being moved is going to a few plants and to the railroads, though a good many plants are buying lump and crushing it, because of screenings being so high.

While the market has seemed very dull all season, yet the coal reports show that the receipts at East St. Louis are heavier than ever before during this month; the receipts up to date being nearly 5000 tons more than any preceding May. The reason the market has seemed so dull is that production has more than kept the pace with the increasing demand. Nearly all of the mines increased their output considerably last year, especially those in the fifth and ninth districts, which ran full time all summer, while the rest of the State was shut down. There are four big mines being put down in these districts this summer, which will be producing coal this fall and which will augment the tonnage in this district 7000 tons daily when completed. All of the new mines are aiming at 2000 tons daily as a minimum, whereas 10 years ago a mine producing 500 tons was considered a very good-sized mine.

Prices in the St. Louis market are unchanged from last week's reports.

Anthracite—Coal is moving fairly well and a good many orders have been received from dealers wishing to get the May price; consequently, more orders have been received this week than during the rest of the month.

FOREIGN COAL TRADE

United States Coal Exports—Exports of coal from United States ports, with coal furnished to steamships in foreign trade, four months ended April 30, long tons:

	1910	1911	Changes
Anthracite.....	950,454	984,014	I. 33,560
Bituminous.....	2,572,512	3,044,786	I. 472,274
Total exports..	3,522,966	4,028,800	I. 505,834
Steamer coal.....	2,049,181	2,087,812	I. 38,631
Total.....	5,572,147	6,116,612	I. 544,465
Coke.....	307,863	349,369	I. 41,506

Canada took this year, 2,885,644 tons of coal, or 71.6 per cent. of the total. The coke went chiefly to Canada and Mexico. Cuba and the West Indies took 490,638 tons of coal.

United States Coal Imports—Imports of bituminous coal and coke into the United States, four months ended April 30, long tons:

	1910	1911	Changes
Bituminous.....	623,150	521,361	D. 101,789
Coke.....	37,460	39,927	I. 2,467
Total.....	660,610	561,288	D. 99,322

Anthracite imports are not reported; they amount to only a few tons. Canada supplied this year 425,678 tons of coal and nearly all the coke; Australia, 66,116 tons coal; Japan, 24,740 tons of coal. Imports are chiefly on the Pacific Coast and in the border States of the North-

Welsh Coal Prices—Messrs. Hull, Blyth & Co., London and Cardiff, report prices of coal on May 5, as follows: Best Welsh steam coal, \$4.26; seconds, \$4.02; thirds, \$3.90; dry coals, \$3.84; best Monmouthshire, \$3.72; seconds, \$3.54; best small steam coal, \$2.52; seconds, \$2.28. All prices are per long ton, f.o.b. shipping port, cash in 30 days, less 2½ per cent. discount.

IRON TRADE REVIEW

New York, May 31—The event of the week was the announcement of the Republic Iron and Steel Company that it would hereafter adopt "a more aggressive policy to secure business." The first step in this policy was to reduce the price of steel bars from 1.40c., Pittsburg base, to 1.25c., a cut of \$3 per ton. This was met by the Steel Corporation subsidiaries and putting the price of steel bars, light angles and similar products down to nearly the level at which iron bars have been selling for some time.

A meeting of the steel men was held in New York on Monday, May 29, and the results are given in the following statement:

Representatives of the leading manufacturers of finished steel (except the Republic) met at luncheon at the Metropolitan Club today and existing conditions were fully discussed. It was the unanimous opinion that coöperation, as heretofore fully explained, should be continued.

Opinions were expressed that recent developments seem to require some changes in prices. Subsidiary companies of the United States Steel Corporation have decided to make adjustments to become effective June 1, and it is believed that these will be generally followed. The commodities affected, with the new prices, are as follows:

Steel bars (15c. per 100 lb. off), \$1.25 base.

Plates and structurals (5c. per 100 lb. off), \$1.35 base.

Black sheets (20c. per 100 lb. off), 2c. per lb. for No. 28 gage.

Galvanized sheets, 3c. per lb. for No. 28 gage.

Blue annealed sheets (10c. per 100 lb. off), 1.50c. per lb. for No. 10 gage.

Steel billets, 4 in. square and larger, \$21 per gross ton.

Sheet Bars, \$22 per gross ton.

All f.o.b., Pittsburg, effective June 1, 1911, for shipment prior to Oct. 1.

The cut on galvanized sheets is the same as on black sheets, 10c. per 100 lb.; on steel billets and sheet bars the cut is \$1 per ton.

The larger independents will undoubtedly follow these cuts; but they may be taken as a declaration of an open market. The cuts are too recent at the present writing to say anything of the results; but the change certainly looks like a wise measure.

The Republic company also cut pig iron from its Alabama merchant furnaces to \$10.50, Birmingham, for No. 2 foundry. This reduction was only a recognition and emphasizing of existing facts, since most Southern furnaces have been for some weeks cutting under the \$11, Birmingham, which some Southern makers have been trying to maintain. Northern furnaces have also been shading to secure business with some success. A number of orders, chiefly small, have been placed for both Northern and Southern pig. Recent estimates of unsold and unused stocks of pig iron put the total at from 2,000,000 to 2,200,000 tons of which perhaps one-third is held by steel companies.

Steel Corporation Investigation—The Congressional committee appointed to investigate the Steel Corporation has spent some time hearing evidence from John W. Gates as to the formation of the corporation, the Tennessee purchase and other matters. Mr. Gates gave some of his testimony in rather a sensational way, but after all told nothing which was not already known. A number of other witnesses have been summoned.

Baltimore

May 29—Exports for the week included 1885 tons rails and 114 tons rail-points to Rosario, Argentina; 1,908,540 lb. steel billets to Liverpool; 5,507,400 lb. steel rails and 486,359 lb. rail fastenings to St. Johns, Newfoundland Imports included 923 tons spiegeleisen from Germany; 50 tons ferromanganese and 171 tons manganese ore from Great Britain; 16,600 tons iron ore from Cuba.

Birmingham

May 29—The pig-iron market in the Southern territory is still dull. There is a quantity of iron going to the yards and if there is no improvement in the

next few weeks further curtailment will be necessary. The prices for the product have been reduced openly, say brokers, \$10.50 per ton, No. 2 foundry, now being asked in some quarters, though \$11 is still given as the general quotation. There have been no contracts made, however, for delivery during the last half of the year so far as can be learned at the lower price. It is understood that iron sold at the new price is for immediate delivery. The sales recently noted are in small lots.

There is no definite date set for the resumption of operations at the steel plant of the Tennessee Coal, Iron and Railroad Company. There is no change in conditions with the machine shops and foundries. Cast-iron pipe is in a fair condition with some good orders pending.

Chicago

May 23—Actual transactions in pig iron, while widely scattered, are small in gross amount, and the general condition of the market shows no indications warranting hope for the immediate future. There are a few sales of more than 500 tons; most of the business still being in small lots. That much iron must yet be sold for second-quarter requirements is hardly to be doubted; inquiries are numerous on last-half needs and point to a close watching of the market by melters. But few result in actual sales, the feeling seeming to be general that it is well to wait a while, in view of no decided turn upward. Southern No. 2 iron is obtainable at \$10.50@10.75, Birmingham, or \$14.85@15.10, Chicago. Northern No. 2 stays nominally at \$15; some sales may be made at 25c. or 50c. under that figure. Production is still ahead of consumption in the opinion of the average melter. Lake Superior charcoal iron is dull at \$17.

The market for iron and steel products does not improve notably; structural materials are in somewhat better demand, but other lines show little activity. Coke is in fairly good condition, owing to restriction of supply, with Connellsville at \$4.75, Chicago.

Cleveland

May 29—Iron-ore movement is slow yet. In fact it may be said that it has hardly started. Sales of some 500,000 tons of ore are reported.

Pig Iron—Some basic has been sold, but only small lots of foundry. Nominally there is no change in prices, but the tone of the market is weaker.

Finished Material—The cut on bars has not affected this market much so far. Sheets are being shaded and there are reports of cutting on wire. Some local contracts for structural steel have been closed.

Philadelphia

May 31—Business in pig iron is still mainly in small lots. The present question is whether Northern furnaces can hold their quotations in view of the break in Southern prices.

Steel Billets—The cut in billets confirms some offers of low prices recently made here.

Bars—The reduction in bars puts steel nearly on a level with iron bars. It is too recent to have affected business yet.

Sheets—Like billets, the new price merely confirms recent low quotations.

Structural Material—Orders keep on coming, chiefly small this week; but bigger ones are in sight.

Plates—The outlook is good, with little change.

Steel Rails—A fair run of orders for light rails is noted.

Scrap—Actual business has been light, but dealers are not disposed to lower their selling prices.

Pittsburg

May 30—On Wednesday afternoon, May 24, the Republic Iron and Steel Company began openly to quote steel bars at 1.25c., a cut of \$3 a ton, at the same time formally announcing its withdrawal from the price agreement on steel products. It did not make other reductions, but intimated that the June settling price on its scale contracts for sheet bars would be lower. Other steel producers met the steel-bar cut but advised their customers to hold off until the situation was clearer, assuring them they would be protected. A general meeting of steel manufacturers was at once called for Monday of this week, the results of which are given elsewhere.

There has been very little finished-steel business booked in the past week. The Republic Iron and Steel Company had booked probably 10,000 or 15,000 tons of bar business at guaranteed prices, before it made its open announcement of the 1.25c. price, but since then neither it nor other companies have booked much business. In other finished-steel products there has been increased hesitancy about specifying, on account of the increased possibility of price reductions.

It is improbable that much business will follow the steel-bar cut and the cuts made on Monday. Apparently the issue is postponed until buyers are really ready to buy, when it will have to be determined whether existing prices are to hold or are to be reduced by an attractive amount.

Pig Iron—The market has been extremely quiet. Without important sales basic iron is quotable at the price reported last week, \$13.10, Valley, but it is quite probable that \$13 could be done. Foundry iron is regarded by buyers as in

line for a drop, and no one wishes to be the first to take hold. Bessemer has been entirely without serious test. We repeat former quotations, except that we reduce malleable 10c. noting that the quotations are practically nominal: Bessemer \$15; basic, \$13.10; foundry, \$13.75; malleable, \$13.25@13.50, all at Valley furnaces, 90c. higher delivered Pittsburg.

Ferromanganese—The market has been without developments and we continue to quote prompt and forward at \$36.50, Baltimore.

Steel—The new prices as developed by Monday's meeting are \$21 on billets and \$22 on sheet bars, f.o.b. maker's mill, Pittsburg or Youngstown. There are not likely to be any sales of consequence, as consumers are covered chiefly by scale contracts, the settlement price on June deliveries being simply the new price instead of the old one. Wire rods were \$29 and may be quoted nominally at this figure in the absence of any action, and no market demand to test the actual position.

Sheets—The new prices are: Black sheets, 28 gage, 2c.; galvanized, 3c.; blue annealed, 10 gage, 1.50c. Former regular prices were 2.20c., 3.20c. and 1.65c. respectively, but there had been some shading. In the case of blue annealed an informal reduction was made about a month ago to 1.60c. The sheet mills have been operating an average of about 50 per cent. of capacity. The market is likely to drag for awhile. Buyers have been showing no interest and sellers will hardly be keen to sell on this new alignment.

St. Louis

May 29—The iron market is, if anything, duller than ever. There seems to be no prospect of any improvement within the next 60 days. A few small orders are being received for immediate shipment. There seems to be no inclination on the part of buyers to take anything for future requirements. The prevailing price is \$11 per ton, Birmingham, or \$14.75, St. Louis, though there is no question but that this price would be shaded at least 25c. to obtain orders.

Sault Ste. Marie Canals

The report for the Sault canals in April shows that 374 vessels passed through, carrying 792,857 tons of freight, of which 370,325 tons were east bound and 422,262 tons west bound. The total is less than in April, 1910, by 1,166,326 tons, or 60 per cent. The mineral freights reported this year included 339,411 tons coal, 136,315 tons iron ore, 19,137 tons pig and manufactured iron, 4844 tons copper and 26,907 bbl. salt.

FOREIGN IRON TRADE

British Iron Ore Imports—Imports of iron ore into Great Britain four months

ended April 30 were 2,441,431 long tons in 1910, and 2,485,363 in 1911; increase, 43,932 tons.

British Foreign Trade—Exports and imports of iron and steel and of machinery in Great Britain, four months ended April 30, are valued by the Board of Trade returns as follows:

	Exports	Imports	Excess
Iron and steel	£14,757,854	£3,744,338	Ex. £11,013,516
Machinery	10,094,804	2,035,061	Ex. 8,059,743
Cutlery and hardware	2,427,241	1,651,289	Ex. 775,952
New ships	1,698,428	.....	Ex. 1,698,428
Total	£28,978,327	£7,430,688	Ex. £21,547,639
Total, 1910	28,081,673	5,591,024	Ex. 22,490,649

Increase in exports, £896,654, or 3.1 per cent.; increase in imports, £1,839,664, or 32.9 per cent. The total quantities of iron and steel included above were in long tons:

	1910	1911	Changes
Exports	1,534,618	1,475,674	D. 58,944
Imports	434,667	599,619	I. 164,952

Imports are largely in the form of pig iron and of half-finished material, such as billets, blooms and bars.

METAL MARKETS

New York, May 31—The metal markets continue rather quiet, and with only small changes in price.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold:			
April 1911	\$1,505,634	\$ 4,524,835	Imp. \$ 3,019,201
" 1910	36,283,625	2,100,918	Exp. 34,182,707
Year 1911	3,359,658	23,990,572	Imp. 20,630,914
" 1910	47,275,749	13,499,276	Exp. 33,776,473
Silver:			
April 1911	7,610,154	4,251,532	Exp. 3,358,622
" 1910	4,696,534	3,840,495	" 856,039
Year 1911	23,611,196	14,998,313	" 8,612,883
" 1910	18,336,083	15,238,634	" 3,097,449

Exports from the port of New York, week ended May 27: Gold, \$5100; silver, \$1,050,857, principally to London. Imports: Gold, \$682,063; silver, \$696,080, from Mexico, Central and South America.

Gold—The price of gold on the open market in London continued at the usual level, 77s. 9d. per oz. for bars and 76s. 4½d. per oz. for American coin. There was no special demand. In New York gold continues to be taken for Canada, \$3,900,000 going to Montreal and Toronto this week.

Platinum—The market continues strong, and there is no sign of lower prices soon. Dealers ask \$43 per oz. for refined platinum and \$45.50 for hard metal.

SILVER AND STERLING EXCHANGE

May	25	26	27	29	30	31
New York	53¼	53¼	53¼	53½	.....	53¼
London	24½	24½	24½	24½	24½	24½
Sterling Ex.	4.8630	4.8625	4.8630	4.8625	.....	4.8630

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

Silver—Supplies for some weeks back have not been so large as usual until the past week, but they have been sufficient to meet requirements. Market continues steady.

Average price of silver for the month of May was 53.308c., New York.

Exports of silver from London to the East, Jan. 1 to May 18, as reported by Messrs. Pixley & Abell:

	1910	1911	Changes
India	£2,632,840	£3,457,600	I. £ 824,760
China	1,113,500	822,800	D. 290,700
Total	£3,746,340	£4,280,400	I. £534,060

Copper, Tin, Lead and Zinc

NEW YORK

May	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.
25	12¼ @12¼	12.05 @12.15	44¼	4.35 @4.37½	4.20 @4.22½	5.32½ @5.35	5.17½ @5.20
26	12¼ @12¼	12.05 @12.15	44¼	4.35 @4.37½	4.20 @4.22½	5.32½ @5.35	5.17½ @5.20
27	12¼ @12¼	12.05 @12.15	44¼	4.35 @4.37½	4.20 @4.22½	5.32½ @5.35	5.17½ @5.20
29	12¼ @12¼	12.05 @12.15	44¼	4.35 @4.37½	4.20 @4.22½	5.32½ @5.35	5.17½ @5.20
30	.....	.....	.....	.....	.....	.....	.....
31	12¼ @12¼	12.05 @12.15	46¼	4.35 @4.37½	4.20 @4.22½	5.32½ @5.35	5.17½ @5.20

The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis New York, cash. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

May	Copper			Tin		Lead, Span-ish	Zinc, Ordinar-ies
	Spot	3 Mos	Best Sel'd	Spot	3 Mos		
25	55	55½	59	203¼	188¼	13½	24½
26	54¾	55¾	58¾	202	187¼	13	24½
27	.....	.....	.....	.....	.....	.....	.....
29	55	55½	59	203	188½	13½	24½
30	55½	55½	59	206½	188½	13½	24½
31	55½	55½	59¼	210	190	13½	24½

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.; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¼c.

Copper—The market has been very quiet through the week, and very little business has been done. Sales made have been chiefly for export. The large selling agencies are holding at 12¾c., delivered, 30 days, with a corresponding level for export. Some inquiries were received, but consumers do not seem

ready to pay the price, and no business resulted. The advance in standard in London in the last three days of the week has not yet had any apparent effect on the market here. Lake has been dull. The largest producer continues to sell at 12 3/8c. for the small quantity taken.

Copper sheets are 18@19c. base, for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 13 3/4c. base, carload lots at mill. Business is very quiet.

European buyers have not been in evidence, but with the firmer London standard market, this may change. The market closes dull but firm at unchanged prices, 12 1/4@12 3/8c. for Lake copper; 12.05@12.15 for electrolytic in cakes, wirebars or ingots, while casting copper is quoted nominally at 11 7/8@12 1/8c. for the week.

The London standard market, which at the end of last week was rather easy—speculative buying having stopped almost entirely—again became more active the beginning of the week, and touched its highest point the morning of May 31, when quotations reached £55 6s. 3d. for spot and £55 18s. 9d. for three months. The close is cabled as sensitive at £55 3s. 9d. for spot and £55 16s. 3d. for three months.

Tin—The Syndicate in London has everything its own way. The spot market is extremely firm, and quotations for this material are now £20 per ton higher than for future deliveries. This situation may ease up somewhat after the May deliveries have been made, for, as it appears at present, it has all the earmarks of a squeeze of the May shorts. Some interest was shown by American consumers in purchases for future delivery, which in comparison with the quotations for prompt tin now look cheap. The market closes strong at £210 for spot and £190 for three months; New York quotations being about 46 1/4c. for May-June deliveries and about 42 3/4c. for July.

Lead—The market does not display any new features and remains very dull. No change is to be reported in the quotations, which are 4.20@4.22 1/2 St. Louis and 4.35@4.37 1/2c. New York.

The London market retains its firmness, a very good demand being reported on the part of consumers, while supplies do not seem to be very large. It closes at £13 3s. 9d. for Spanish lead and £13 8s. 9d. for English.

Spelter—The market is quiet, and as consumers all seem fairly well supplied, at least for the near future, very little buying is reported. The close is unchanged at 5.17 1/2@5.20c. St. Louis, and 5.32 1/2@5.37 1/2c. New York.

In Europe, the excellent demand on the part of consumers continues and prices remain very firm. The London market closes at £24 10s. for good ordinaries and £24 15s. for specials.

Base price of zinc sheets \$7.25 per 100 lb., f.o.b. La Salle-Peru, less 8 per cent. discount.

Other Metals

Aluminum—The market continues dull, with very few sales. In the absence of business prices are nominally unchanged at 20@20 1/2c. per lb. for No. 1 ingots.

Antimony—The market has again become very dull and prices are unchanged. Cookson's is held at 9 1/2c. per lb., but U. S. can be had at 8 7/8@9c., and 7 3/4@8c. is quoted for Chinese and Hungarian.

Quicksilver—Spot supplies are still very scarce; nevertheless the price has again been reduced. At New York sales are now made at \$43, to arrive, per flask of 75 lb. In San Francisco \$42.50 is quoted for domestic orders and \$40 for export. The London price is now £8 5s. per flask, with £8 quoted from second hands.

Cadmium—The price in Germany is now, for metal 99 1/2 per cent. pure, 700@750 marks per 100 kg.—equal to 78.27c. per lb., average.

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@50c. 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 March 31 were, in metric tons:

	Imports.	Exports.	Excess.
Copper.....	46,400	20,016	Imp. 26,384
Copper, 1910....	48,444	11,718	Imp. 36,726
Tin.....	3,496	2,679	Imp. 817
Tin, 1910.....	3,552	2,484	Imp. 1,068
Lead.....	17,467	10,024	Imp. 7,443
Lead, 1910.....	13,320	9,027	Imp. 4,297
Zinc.....	8,763	35,512	Exp. 26,749
Zinc, 1910.....	12,669	24,913	Exp. 12,244
Nickel.....	820	580	Imp. 240
Nickel, 1910.....	1,251	293	Imp. 958
Aluminum.....	1,921	795	Imp. 1,126
Aluminum, '10.	2,132	452	Imp. 1,680
Minor metals....	449	3,482	Exp. 3,043
Minor, 1910....	374	2,967	Exp. 2,593

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

Ores:	Imports.	Exports.	Excess.
Gold ore.....	19	.....	Imp. 19
Gold ore, 1910..	6	.....	Imp. 6
Silver ore.....	737	.....	Imp. 737
Silver ore, '10.	296	.....	Imp. 296
Copper ore.....	4,431	3,748	Imp. 683
Copper ore, '10.	4,540	5,602	Exp. 1,062
Tin ore.....	3,960	39	Imp. 3,921
Tin ore, 1910..	3,892	63	Imp. 3,829
Lead ore.....	30,884	1,146	Imp. 29,738
Lead ore, 1910..	23,751	263	Imp. 23,488
Zinc ore.....	52,134	9,266	Imp. 42,868
Zinc ore, 1910..	45,266	12,263	Imp. 33,003
Nickel ore.....	2,843	.....	Imp. 2,843
Nickel ore, '10.	62	.....	Imp. 62
Miscellaneous... 1,720	223	Imp. 1,497	
Miscellan's, '10	1,260	192	Imp. 1,068
Chrome ore....	1,761	162	Imp. 1,599
Chrome ore, '10	7,135	69	Imp. 7,066
Pyrites.....	144,629	2,483	Imp. 142,146
Pyrites, 1910..	125,255	3,225	Imp. 122,030

Miscellaneous includes ores of tungsten, molybdenum and other rare metals. Imports of slag and slag products were

139,935 tons in 1910, and 148,044 in 1911; exports, 20,075 tons in 1910, and 19,412 this year.

Zinc and Lead Ore Markets

Platteville, Wis., May 27—The base price paid this week for 60 per cent. zinc ore was \$39. The base price paid for 80 per cent. lead was \$53@54 per ton.

SHIPMENTS, WEEK ENDED MAY 27

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Galena.....	751,100	.....	.....
Mineral Point.....	701,110	.....	.....
Platteville.....	491,690	56,000	312,100
Benton.....	253,400	66,900	86,000
Hazel Green.....	246,180	.....	.....
Highland.....	219,400	60,000	.....
Rewey.....	212,000	.....	.....
Montfort.....	148,980	.....	.....
Harker.....	130,760	.....	.....
Cuba City.....	.....	.....	408,320
Livingston.....	.....	60,000	.....
Shullsburg.....	.....	74,300	.....
Total.....	3,154,620	307,200	806,420
Year to date.....	57,082,370	3,497,825	14,081,790

Shipped during the week to separating at ing plants, 2,422,740 lb. zinc ore.

Joplin, Mo., May 27—The highest price paid for zinc sulphide ore was \$43 per ton, the base ranging from \$36 to \$40 per ton of 60 per cent. zinc. Zinc silicate sold at \$25 high, the base \$19@21 per ton of 40 per cent. zinc. The average price, all grades of zinc ore, was \$37.42. Lead prices continue at \$54@56 per ton with no marked change. The average price, all grades of lead, was \$55.14 per ton.

SHIPMENTS, WEEK ENDED MAY 27

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville.....	3,873,410	.....	944,700	\$99,572
Joplin.....	2,021,390	.....	262,740	47,653
Galena.....	1,133,610	.....	119,700	24,829
Alba-Neck.....	710,880	.....	11,360	14,523
Duenweg.....	477,810	.....	65,650	10,878
Oronogo.....	302,830	.....	84,670	7,826
Spring City.....	191,210	132,490	63,370	6,670
Miami.....	350,030	.....	79,280	6,437
Sarcoie.....	334,000	.....	.....	6,346
Jackson.....	259,400	.....	22,470	5,676
Quapaw.....	251,320	.....	.....	4,021
Carl Junction.....	151,710	.....	32,440	3,986
Granby.....	78,670	165,650	23,900	3,805
Cave Springs.....	64,320	.....	.....	1,190
Totals.....	10,200,590	298,140	1,710,280	\$243,410

5 mos.....	207,974,550	13,360,520	35,511,540	\$5,239,681
Blende val., the week, \$193,227;	5 mos.,			\$4,095,642
Calamine, the week,	3,231;	5 mos.,		156,557
Lead value, the week,	46,954;	5 mos.,		987,482

MONTHLY AVERAGE PRICES

Month	ZINC ORE				LEAD ORE	
	Base Price		All Ores		All Ores	
	1910	1911	1910	1911	1910	1911
January.....	\$47.31	\$41.85	\$45.16	\$40.55	\$56.99	\$55.68
February.....	40.69	40.21	39.47	39.16	53.64	54.46
March.....	43.60	39.85	39.71	38.45	51.26	54.77
April.....	41.00	38.88	39.33	37.47	49.72	56.37
May.....	40.19	.....	37.51	.....	48.16	.....
June.....	40.20	.....	37.83	.....	48.80	.....
July.....	39.63	.....	36.80	.....	48.59	.....
August.....	40.13	.....	37.32	.....	49.75	.....
September.....	43.45	.....	39.96	.....	54.73	.....
October.....	43.31	.....	40.50	.....	53.18	.....
November.....	47.20	.....	43.20	.....	54.80	.....
December.....	42.50	.....	40.70	.....	55.70	.....
Year.....	\$42.43	.....	\$39.79	.....	\$52.12	.....

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.

An increase of activity in the purchasing field this week caused prices to strengthen on medium grades of ore. One mine, with a reserve stock of 1000 tons at Miami, has sold the stock and the mine output at a rate of 100 tons per week until cleaned up. The mine has a capacity of 80 to 90 tons per week. The insurrection in Mexico has driven several smelters into this field for an increased supply of ore, and as conditions in that country may continue unsettled for some time, this increased demand may continue until the decreased reserve stock is cleaned up.

Other Ore Markets

Pyrites—Domestic pyrites are quoted at 11½@12c. per unit of sulphur at mines for furnace sizes; fines about 1c. less. Spanish pyrites, furnace size, are 13c. per unit, ex-ship. Arsenical pyrites are from ½@1½c. per unit less.

Tungsten Ore—Ferberite, wolframite and huebnerite ores, \$6.50@7 per unit per ton of 2000 lb. of ore containing 60 per cent. of tungsten trioxide. For scheelite ore, 50c.@\$1.50 per unit less.

Manganese Ore—The base price, as fixed by large buyers, is 25c. per unit for manganese and 5c. per unit for iron content, for a base ore containing 49 per cent., or over in manganese, not over 0.20 phosphorus and 8 per cent. silica. Prices range down to 23c. per unit for 40 per cent. manganese; with deductions for excess phosphorus and silica.

Zinc Ores—For Rocky Mountain blende of good quality, especially as to iron and lead contents, the current price is for the zinc contents, less eight units, at the St. Louis price for spelter; with a deduction of \$16 to \$18 per 2000 lb. of ore; sellers to deliver ore at smeltery. Penalties may be charged for detrimental impurities. Blende is readily obtainable at Joplin on the basis of 87 per cent. of the zinc content at St. Louis quotation, less \$16 for treatment, and less penalties for iron and lime.

CHEMICALS

New York, May 31—The general market remains unchanged from recent reports.

Copper Sulphate—Supplies are better and there is less pressure to hasten shipments. Quotations remain at \$4.50 per 100 lb. for carload lots.

Arsenic—The market remains weak and quotations on white arsenic are a shade lower at \$1.50@1.62½ per 100 lb., sales of 112 tons are reported at the lower figure.

Nitrate of Soda—Business is good and the market is firm. Quotations are 2.12½c. per lb. for both spot and future positions.

Potash Salts—It is reported from Berlin that the Bradley and probably other

American fertilizer interests are throwing over their low-price contracts in their haste to come to terms with the syndicate, and to avoid payment of the excess tax. It is reported that the Aschersleben and perhaps some other mines which hold these contracts will bring suit to enforce them.

Petroleum

Production of petroleum in Rumania in February was 94,532 metric tons; for the two months ended Feb. 28 it was 206,690 tons.

Production of petroleum in the Baku district, Russia, in February was 33,094,837 poods, or 54,186 metric tons.

MINING STOCKS

New York, May 31—The general stock market for most of the week was quiet and dull, with only small changes. The dullness was emphasized by the holiday on Tuesday.

One sale of Homestake was reported at \$87 per share.

The Curb market followed the Exchange and was generally quiet, with trading only on a moderate scale. The copper shares were heavy for the most part.

The first marked exercises of authority by the new Curb Market Association occurred this week. One was the suspension of a broker for three months for non-compliance with the rules; the other was the removal of two stocks—Rawhide Queen and Rawhide Coalition mining—from the stocks permitted to be dealt in on the Curb.

At auction in New York, May 25, 100 shares Mines Securities Corporation, 7500 shares Trappers' Flat Mining and Milling Company and 1000 shares Boston-Mexican Mines Company brought \$7 for the lot; 20,000 shares Orphan Copper Company, \$160 for the lot; \$25,000 bonds and \$29,052 notes Virginia Anthracite Company, \$200 for the lot.

Boston, May 29—Copper shares have maintained a firm tone marketwise and in spots considerable activity has developed. This has been particularly noticeable in the Cole-Ryan stocks. Both Calumet & Arizona and North Butte have been well taken and at steadily advancing prices. The first named has risen \$6.50 during the week and touched \$58.50 today. The directors declared the usual quarterly dividend of \$1 a few days ago.

North Butte is up \$2.75 during the week to \$35.25. Developments at this property are particularly encouraging and are receiving attention by stock-market interests. East Butte has also continued a strong feature with a high at \$13.25. Mayflower and Union Land have recorded good advances among the low-priced issues. American Zinc and Island

Creek stocks have also been active and buoyant—both the result of clever manipulation and pool work. Inspiration and Mason Valley have had active periods and there is talk of an amalgamation

COPPER PRODUCTION REPORTS
Copper contents of blister copper, in pounds

Company	February	March	April
Anaconda	20,900,000	21,900,000	21,500,000
Arizona, Ltd.	2,860,000	3,094,000	2,840,000
Balaklala	676,605	866,670	845,000
Copper Queen	7,114,278	7,333,629	6,933,422
Calumet & Ariz.	1,762,000	1,960,000	3,850,000
Detroit	1,918,365	1,914,710	1,814,740
East Butte	1,065,000	1,120,000	1,085,000
Imperial	.....	.....	.....
Nevada Con.	4,992,553	5,932,259	5,298,632
Old Dominion	1,890,000	2,563,000	2,535,000
Shannon	1,166,000	1,322,000	1,258,000
South Utah	318,410	300,007	300,137
Superior & Pitts.t.	1,808,000	2,540,000	.....
United Verde*	2,800,000	3,000,000	2,500,000
Utah Copper Co.	7,329,326	7,260,267	8,169,248
Lake Superior*	17,750,000	20,000,000	16,000,000
Non-rep. mines*	12,281,590	12,224,993	11,825,000
Total production	86,032,127	93,331,535	86,754,179
Imports, bars, etc.	23,935,222	24,345,814	25,655,122
Total blister	109,967,349	117,677,349	112,409,301
Imp. in ore & matte	5,981,487	6,126,650	5,207,484
Total	115,948,836	123,803,999	117,616,785
Brit. Col. Cos.:			
British Col. Copper	767,470	804,542	.....
Granby	1,633,300	1,988,341	.....
Mexican Cos.:			
Boleo	2,226,560	2,700,880	2,403,520
Cananea	3,906,000	3,542,000	3,644,000
Moctezuma	1,950,475	2,049,150	2,315,292
Exports from:			
Chile	5,488,000	9,408,000	.....
Australia	2,744,000	4,816,000	.....

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.

*Estimated.

†From April the Superior & Pittsburg production is included with Calumet & Arizona.

STATISTICS OF COPPER

Month.	United States Product'n.	Deliveries	
		Domestic.	for Export
IV, 1910	117,477,639	67,985,951	31,332,434
V	123,242,476	59,305,222	45,495,400
VI	127,219,188	53,363,196	65,895,948
VII	118,370,003	56,708,175	59,407,167
VIII	127,803,618	67,731,271	61,831,780
IX	119,519,983	64,501,018	75,106,496
X	126,469,284	67,814,172	68,186,912
XI	119,353,463	60,801,992	67,424,316
XII	123,339,219	43,594,018	88,104,075
Year 1910	1,452,122,120	749,426,542	722,431,494
I, 1911	115,696,591	42,078,567	53,208,739
II	109,828,297	50,518,998	45,111,019
III	130,532,080	66,080,789	59,081,127
IV	118,085,223	52,407,650	62,129,599
VISIBLE STOCKS.			
	United States.	Europe.	Total.
V, 1910	141,984,159	246,870,400	388,854,553
VI	160,425,973	239,142,400	399,568,378
VII	168,386,017	232,892,800	401,278,817
VIII	170,640,678	222,320,000	392,960,678
IX	168,881,245	218,444,800	387,326,046
X	148,793,714	211,276,800	360,070,519
XI	139,261,914	198,060,800	337,322,711
XII	130,389,069	193,200,000	323,589,069
I, 1911	122,030,195	236,629,120	358,659,373
II	142,439,490	236,992,000	379,431,734
III	156,637,770	233,385,600	390,023,009
IV	162,007,934	223,014,400	385,022,434
V	165,555,908	212,284,800	377,840,708

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. From Jan. 1, 1911, stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

of the Inspiration and the Miami properties.

The Curb has maintained a firm tone, while some of the penny stocks have shown sharp advances. Rhode Island Coal has been the most active Curb stock, while New Baltic and South Lake have shown the greatest gains.

Assessments

Company	Delinq	Sale	Amt
Best & Belcher, Nev	May 17	June 6	\$0.10
Carney Copper, Ida.	May 15	June 25	0.004
Clear Grit, Ida.	June 9	July 6	0.002
Copper King, Ida.	May 15	June 15	0.01
Davis-Daly, Mont.	.....	June 7	0.50
Dennemora, Ida.	June 26	July 26	0.002
East Hercules Extens'n, Id.	June 19	July 19	0.001
Ely Consolidated, Nev.	May 2	June 22	0.05
Gold Mt. Champion, Utah	May 20	June 7	0.01
Hypothek, Ida.	May 22	June 16	0.005
Imperial, Ida.	May 17	June 17	0.005
Mass, Mich.	.....	.....	2.00
Missoula Copper, Ida.	June 5	July 19	0.01
Mountain Dell, Utah.	May 31	June 16	0.02
New York-Bonanza, Utah.	June 8	June 29	0.02
Nine Mile, Ida.	June 25	July 30	0.001
North Star, Ida.	May 15	June 15	0.001
Overman, Nev.	May 17	June 7	0.05
Reindeer, Ida.	June 1	July 1	0.005
Rockford, Ida.	June 6	July 6	0.001
Silver Shield, Utah.	May 16	June 3	0.015
Smuggler, Utah.	May 20	June 20	0.005
Swansea Consolidated, Utah	May 15	June 7	0.01
Utah Consolidated, Utah.	May 20	June 10	0.01
Wonderful, Ida.	May 22	July 10	0.001
Yellow Jacket, Nev.	May 8	June 8	0.10

Monthly Average Prices of Metals SILVER

Month.	New York.			London.		
	1909.	1910.	1911.	1909.	1910.	1911.
January	51.750	52.375	53.795	23.843	24.154	24.865
February	51.472	51.534	52.222	23.706	23.794	24.081
March	50.468	51.454	52.745	23.227	23.690	24.324
April	51.428	53.221	53.325	23.708	24.483	24.595
May	52.905	53.870	.....	24.343	24.797	24.583
June	52.538	53.462	.....	24.166	24.651	.....
July	51.043	54.150	.....	23.519	25.034	.....
August	51.125	52.912	.....	23.588	24.428	.....
September	51.440	53.295	.....	23.743	24.567	.....
October	50.923	55.490	.....	23.502	25.596	.....
November	50.703	55.635	.....	23.351	25.680	.....
December	52.226	54.428	.....	24.030	25.160	.....
Total	51.502	53.486	.....	23.706	24.670	.....

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

COPPER

Month.	NEW YORK.				London, Standard.	
	Electrolytic		Lake.		1910.	1911.
	1910.	1911.	1910.	1911.		
January	13.620	12.295	13.870	12.680	60.923	55.604
February	13.332	12.256	13.719	12.611	59.388	54.970
March	13.255	12.139	13.586	12.447	59.214	54.704
April	12.733	12.019	13.091	12.275	57.238	54.035
May	12.550	11.992	12.885	12.214	56.313	.....
June	12.404	.....	12.798	.....	55.310	.....
July	12.215	.....	12.570	.....	54.194	.....
August	12.490	.....	12.715	.....	55.733	.....
September	12.379	.....	12.668	.....	55.207	.....
October	12.559	.....	12.788	.....	56.722	.....
November	12.742	.....	12.914	.....	57.634	.....
December	12.581	.....	12.863	.....	56.769	.....
Year	12.738	.....	13.039	.....	57.054	.....

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

TIN AT NEW YORK

Month.	1910.	1911.	Month.	1910.	1911.
	January	32.700		41.255	July	32.695	.....
February	32.920	41.614	August	33.972	.....
March	32.403	40.157	September	34.982	.....
April	32.976	42.185	October	36.190	.....
May	33.125	.....	November	36.547	.....
June	32.769	.....	December	38.199	.....
			Av. Year	34.123	.....

Prices are in cents per pound.

LEAD

Month.	New York.		St. Louis.		London.	
	1910.	1911.	1910.	1911.	1910.	1911.
January	4.700	4.483	4.582	4.334	13.650	13.009
February	4.613	4.440	4.445	4.266	13.328	13.043
March	4.459	4.394	4.307	4.238	13.063	13.122
April	4.376	4.412	4.225	4.262	12.641	12.889
May	4.315	4.373	4.164	4.223	12.550	.....
June	4.343	.....	4.207	.....	12.688	.....
July	4.404	.....	4.291	.....	12.531	.....
August	4.400	.....	4.290	.....	12.513	.....
September	4.400	.....	4.289	.....	12.582	.....
October	4.400	.....	4.271	.....	13.091	.....
November	4.442	.....	4.314	.....	13.217	.....
December	4.500	.....	4.363	.....	13.197	.....
Year	4.446	.....	4.312	.....	12.920	.....

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

SPELTER

Month.	New York.		St. Louis.		London.	
	1910.	1911.	1910.	1911.	1910.	1911.
January	6.101	5.452	5.951	5.302	23.350	23.887
February	5.569	5.518	5.419	5.368	23.188	23.276
March	5.637	5.563	5.487	5.413	23.031	23.016
April	5.439	5.399	5.289	5.249	22.469	23.743
May	5.191	5.348	5.041	5.198	22.100	.....
June	5.128	.....	4.978	.....	22.094	.....
July	5.152	.....	5.002	.....	22.406	.....
August	5.279	.....	5.129	.....	22.800	.....
September	5.514	.....	5.364	.....	23.165	.....
October	5.628	.....	5.478	.....	23.900	.....
November	5.976	.....	5.826	.....	24.083	.....
December	5.624	.....	5.474	.....	24.019	.....
Year	5.520	.....	5.370	.....	23.050	.....

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

PIG IRON AT PITTSBURG.

Month.	Bessemer		Basic		No. 2 Foundry	
	1910.	1911.	1910.	1911.	1910.	1911.
	January	\$19.90	\$15.90	\$17.08	\$14.40	\$17.94	$14.75
February	18.96	15.90	17.21	14.50	17.38	14.81
March	18.53	15.90	16.93	14.65	17.00	14.96
April	18.28	15.90	16.84	14.65	16.75	15.00
May	17.10	15.90	15.94	14.23	16.18	14.72
June	16.52	.....	15.60	.....	15.53	.....
July	16.40	.....	15.40	.....	15.40	.....
August	16.09	.....	14.89	.....	15.16	.....
September	15.92	.....	14.73	.....	14.93	.....
October	15.90	.....	14.05	.....	14.88	.....
November	15.84	.....	14.26	.....	14.78	.....
December	15.90	.....	14.15	.....	14.65	.....
Year	\$17.10	.....	\$15.65	.....	\$15.83	.....

STOCK QUOTATIONS

COLO. SPRINGS May 23		SALT LAKE May 29	
Name of Comp.	Bid.	Name of Comp.	Bid.
Acacia	.03	Beck Tunnel	.31
Cripple Crk Con.	.01	Black Jack	.16
C. K. & N.	14	Carisa	.15
Doctor Jack Pot.	.04	Cedar Tallman	.07
Elkon Con.	.56	Colorado Mining	.55
El Paso	.56	Columbus Con.	.45
Findlay	.03	Daly Judge	14.50
Gold Dollar	.09	Grand Central	.82
Gold Sovereign	.02	Iron Blossom	1.35
Isabella	.10	Little Bell	.45
Jack Pot.	.05	Lower Mammoth	.13
Jennie Sample	.08	Mason Valley	9.25
Lexington	1	May Day	.17
Moon Anchor	.02	Nevada Hills	3.07
Old Gold	.02	New York	1.08
Mary McKinney	.30	Prince Con	.57
Pharmacist	1	Silver King Coal'n	1.50
Portland	.98	Sioux Con.	.33
Vindicator	.76	Uncle Sam	.73
Work	.02	Yankee	1.15

TORONTO May 29

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	6.75	Dome Exten	.55
Hudson Bay	.85	Pearl Lake	.54
Temiskaming	.70	Dobie	3.10
Wetlaufer-Lor.	1.09	West Dome	2.10
Apex	.15	Standard	.15
Central	.73	Preston E. D.	.33
Hollinger	12.12	Canada	1.12
Porcu. Gold	.60	Rea	5.42
Porcu. Tisdale	.11	Coronation	.34
Imperial	.12	Swastika	.60

SAN FRANCISCO. May 29.

Name of Comp.	Cig.	Name of Comp.	Bid
COMSTOCK STOCKS			
Alta	.06	Belmont	6.20
Belcher	1.80	Jim Butler	1.25
Best & Belcher	.51	MacNamara	.12
Caledonia	.48	Midway	.20
Challenge Con.	.19	Mont-Tonopah	.85
Chollar	.21	North Star	.14
Confidence	1.90	West End Con.	.52
Con. Virginia	1.20	Atlanta	.10
Crown Point	1.75	Booth	1.07
Gould & Curry	1.29	C.O.D. Con.	.08
Hale & Norcross	.23	Comb. Frac.	.07
Mexican	3.70	Jumbo Extension	.27
Occidental	.65	Oro	.04
Ophir	2.05	Silver Pick	.05
Overman	.39	St. Ives	.10
Potosi	.33	Tramps Con	1.02
Savage	.32	Argonaut	1.70
Sierra Nevada	.54	Bunker Hill	17.12
Union Con	1.60	Cent. Eureka	11.20
Yellow Jacket	1.61	So. Eureka	17.00

N. Y. EXCH. May 29

Name of Comp.	Cig.	Name of Comp.	Cig.
Amalgamated	67 3/4	Adventure	6 1/2
Am. Agrl. Chem.	54	Algoma	9 1/2
Am. Sm. & Ref., com	80 3/4	Allouez	31
Am. Sm. & Ref., pf.	106 3/4	Am. Zinc	28 1/4
Anaconda	40	Arcadian	14
Batopilas Min.	1 1/2	Arizona Com.	17 1/2
Bethlehem Steel pf	63 3/4	Atlantic	6
Chino	23 1/2	Bonanza	1 1/2
Comstock Tunnel	29	Boston & Corbin	15
Federal M. & S., pf.	59 3/4	Butte & Balak	4 1/2
Goldfield Con.	6 1/2	Calumet & Ariz	58 1/2
Great Nor., ore ctf.	61 1/2	Calumet & Hecla	465
Homestake	84 1/2	Centennial	12 1/2
Miami Copper	20 1/2	Con. Mercur	.07
Nat'l Lead, com.	55 1/2	Copper Range	62 1/2
National Lead, pf.	108 3/4	Daly-West	5
Nev. Consol.	19	East Butte	12 1/2
Pittsburg Coal, pf.	87	Franklin	10 1/2
Ray Con.	17 1/2	Granby	35 1/2
Republic & S., com	30 1/2	Hancock	24
Republic I & S., pf.	95	Hedley Gold	13 1/2
Sloss Sheffield, com.	49 1/2	Helvetia	1 1/2
Sloss Sheffield, pf.	112	Indiana	14 1/2
Tennessee Copper	38 1/2	Isle Royale	15 1/2
Utah Copper	48 1/2	Keweenaw	2 1/2

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