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Mr. JAMES R. BURNET is no longer connected with the ENGINEERING AND MINING JOURNAL.

COMPOSITE fire-bricks made of coke, or graphite and clay (bonded with tar), have for several years past been used experimentally in France and Germany for lining the hearths (bottoms and sides) of blast furnaces. These bricks cost in Germany about \$12 per 1,000 pounds. Thus far these experiments appear to have given highly satisfactory results—mostly, however, at furnaces where the output of slag, as compared with that of iron, is very large.

AN important point was decided in an electrical case by Judge Taft of the Superior Court at Cincinnati last week, in regard to prior rights. The telephone company asked for and obtained an injunction restraining the Mount Auburn Electric Street Railroad Company from using the single trolley system, on the ground that it interfered with the operation of the telephone wires. Six months were allowed to the Electric Railroad Company in which to make the necessary alterations. This is a good illustration of vested rights.

ONE of the strongest evidences of the great revival in manufacturing industry, which is now taking place in England, is the fact that there is actually a scarcity of labor. It is reported that the application for skilled workmen is such that the unions cannot supply all that are needed. Overtime is very general in most of the large works. The industrial condition all over the world is exceptionally good, and if prices are not pushed to too high a figure, as they were in 1879-80, the year 1890 will be one of the most prosperous that this country has ever seen. Even the voice of the croaker, with his old-time lie of "a million of men out of employment," is no longer heard in the land.

THE latest advices from Nicaragua bring satisfactory information of the progress made with the important preliminary work of the canal. The pier, which is the first essential to enable the dredgers to open the harbor, is making rapid progress, about 250 feet being now completed. This work is proceeding at about the rate of 60 feet per week, and its effect has been even greater than was calculated upon by Mr. A. G. MENCAL, the chief engineer, the action of the waves in piling up sand having so far saved brushing and filling. The health of the staff continues excellent, and their time has been well occupied in working out certain modifications and improvements on the line of the canal, which will reduce the estimates by at least \$2,000,000.

THE latest contribution to our information on the subject of railroads in China is from the pen of Mr. FUNG YEE, late Secretary of the Chinese Legation in London. In a magazine article he explains that the failure to establish railways in China is due to the conservative caution of his countrymen, but that, in his opinion, the difficulties in the way of carrying out the new policy, lately adopted, are on the eve of being overcome, and that even the resignation of CHANG-CHI-TUNG, the great Chinese advocate of railways, will not lead to the abandonment of the Pekin-Hankow scheme. He believes that imported material will be used in constructing the first section, and by the time that is finished, native works for the production of rails and equipment will have been organized.

IN an editorial in our issue of Sept. 22d, 1888, on "Mexico as a field for American Enterprise," we drew attention to the rapid advance in the material progress of the country, that was then taking place as evidenced by the railroad traffic receipts. The railroads we then referred to were the Mexican Central, Mexican Vera Cruz, and Mexican National lines, and in the first half year of 1888 they showed an increase in traffic receipts of over \$1,000,000 as compared with the corresponding period of 1887. We now have to record an equal growth of movement for the whole of the past year as contrasted with 1888, as will be seen from the following table:

	1889.	1888.	Increase.
Mexican Central.....	\$6,287,603	\$5,750,774	\$536,829
Mexican Vera Cruz.....	4,159,668	3,927,962	231,706
Mexican National.....	3,649,780	2,404,936	1,244,844
	\$14,097,051	\$12,083,672	\$2,013,379

This volume of traffic is all the more astonishing when it is remembered that nine years ago the only important part of the railroad system of the country was represented by the Mexican Vera Cruz road, and that the railroad traffic of the country, including its import and export trade over that line, only amounted to about \$5,000,000 annually. The Mexican International Railroad, from Piedras Negras to Torreon, on the Mexican Central Road, is also now a line of importance, as is the Inter-oceanic of Acapulco and Vera Cruz, the latter of which, although only open at present in disjointed sections, shows total receipts for the past year of \$1,002,566.

IT is stated in the *Colliery Guardian* that within the past twenty years the work of blast furnace improvement in Scotland has proceeded in an amazing manner. The furnaces have been increased in size to such an extent that the weekly make has in some cases risen to an average of about 275 tons. The improvements referred to include the raising of the height from 50 to 65 or 70 feet and the closing in of the furnace tops, so that the gases may be drawn off and utilized in the boiler furnaces for raising steam, and in the ovens for raising the temperature of the air used in the blast. This "amazing progress" reads like a piece of ancient history to us Americans. We have become so accustomed to hearing of air blast furnaces making 300 tons per day, that we have almost forgotten the time when they made less than that amount in a week, but it is really less than twenty years since our blast furnaces took those gigantic strides which have led to their present stage of perfection. The Scotch, however, are a step in advance of us in one respect. We are told that at the Langloan, Summerlee and Gartsherrie Works the closing in of the furnace tops has been followed by the chemical treatment of the effluent gases, so as to make them give up their tar products and their ammoniacal gas—the latter to be transformed into sulphate of ammonia, one of the richest fertilizers now at the service of the farmer. Owing to this phase of enterprise on the part of the Scotch ironmasters their establishments are now fast becoming gigantic chemical factories. The furnaces referred to use raw bituminous coal, instead of coke, which accounts for their gases containing the tar products referred to.

## THE MIGRATION OF CAPITAL.

The transference of capital from one part of the world to the other is one of the most notable financial events of our time. For the past year or two we have been hearing of English syndicates buying American manufacturing plants and paying almost incredible prices for them. Solid cash is paid for some of them, and it is one of the puzzles of the day to know where the money received has been re-invested. Other English capital is going into Australia, South Africa, and the Argentine Republic, although not, as far as we are aware, to anything like the extent that it is coming to America.

In the United States there are also seen vast movements of capital from one section of the country to the other. For 40 years there has been a steady investment of Eastern capital in the mines of the Far West, accompanied by an Eastern movement of the gold, silver, copper, lead, etc., from some of these mines—alas! for the investors—not from all of them. So there has been a movement of capital both from England and our Eastern States into the West for the purpose of covering the country with railroads, and, to the extent that these have paid dividends, some of the money has come back again. More recently there has been the great business of Western farm mortgages and investments in town lots in real or hypothetical cities.

Another great movement is that of New England capital into new cotton mills in the South, together with that of Pennsylvania capital into Virginia, Tennessee and Alabama iron works. The crude iron industry of New England seems destined to extinction, since it cannot possibly compete with the cheap fuel of western Pennsylvania and with the cheap ores of the South, and New England capital must either seek other forms of investment within its own borders or go elsewhere.

We cannot share the opinions of many writers that the influx of English capital into this country is an evil, and that there will be a constant drain of profits out of this country as the result. Dividends will undoubtedly be sent out of the country, but much of the money so sent will come back for re-investment, and will bring other money with it. The money invested here in new manufacturing plants, when a market can be found for their product, gives employment to labor, and the more labor there is employment for the greater will be the home market for the farmer, who now produces much more than the country consumes.

The transfer of capital from New England and Pennsylvania to the South is certainly a good thing for the South, and, indirectly at least, a good thing for the whole country. New England's pig iron industry may be destroyed, but New England capitalists will get a better return for the money invested in Virginia and Alabama than for that invested in pig-iron making in New England. If the South is made rich by manufacturing raw iron and coarse cottons, she is more able to buy the finer products of New England, in which New England will, for another century at least, stand supreme.

There may be such a thing as too much transference of capital from New England to other places. The *Manufacturer's Gazette* sounds a wail of distress as follows:

"New England people have millions of dollars invested in Western railroads that have shrunk in value \$100,000,000 in three years. They have \$100,000,000 worth of Western farm mortgages not worth fifty cents on a dollar. They have millions of dollars sunk in Minnesota, Colorado, Arizona and New Mexico, the bare mention of which makes them shudder. They have fortunes invested in cattle and sheep ranches without cattle or sheep, land grants without title or value, and sandy farms without fertile soil or pure water. They have lots of cash invested in sugar trusts, cotton-seed trusts and lead trusts, with no knowledge of assets or actual condition."

This may all be true, but Boston and Hartford have been made wealthy by the mines and farms and railroads of the Far West, and by insuring buildings of the whole country; and if it were not for the Far West as a place for investment, New England would be as badly harassed by her wealth as England, that has to scour the whole world to find a place in which to invest it.

Nevertheless, we agree with the *Gazette* that there is still a profitable business for every enterprising and industrious concern in New England. There may be a few industries of the cruder kind doomed to extinction, but there is abundant room yet for the exercise of the splendid skill of New England mechanics and textile workers, and there is no reason why, with proper education of her rising generation in the finer industries, she should not rank equal to France in artistic productions, in which she has only recently made a beginning.

## THE METRIC SYSTEM AND OUR EXPORT TRADE.

A score of years ago, just after the formation of the American Metrological Society, the advocates of the metric weights and measures seemed to have accomplished a good deal towards the general adoption of the

system in this country. It had been authorized by Federal law, and a coin (the five cent nickel) weighing five grammes and measuring two centimeters in diameter, had been issued from the Mint, with the view of furnishing to the people an object lesson on these units. An active discussion had been inaugurated, in which the advocates of the metric system seemed to have at all points a decided advantage, and the contributions to this discussion, especially those of the late Dr. Barnard, President of the Metrological Society, constitute to this day a most valuable part of the literature of the subject.

But twenty years have effected little progress. The Metrological Society can point to one achievement, due in no small degree to its own intelligent initiative, namely, the adoption of standard time throughout the country. Yet this great reform was outside of the metric system altogether; and the instructive fact deserves notice, that it was accomplished at last, not by professors of science, and not by the legislation, but by the voluntary concerted action of men of affairs. The function of scientific discussion was simply to enlighten the people. When the time came, a convention of railroad agents *did the thing*, so quickly and so easily as to amaze its foremost and most learned advocates.

On the other hand, the metric reform stuck fast, and in some particulars may even be said to have retrograded. Metric standards have been distributed to the various States, but we have never heard of a solitary instance in which any use has been made of them. International metric standards have recently been deposited with the United States Coast and Geodetic Survey, and the seals upon them were opened the other day by the President of the United States, in the presence of a distinguished company of representative scientific and professional witnesses, after which they were solemnly repacked, to be heard of, for the present, no more. The law fixing the metric weight and measure of the "nickel" still exists, I believe; but a director of the mint has found it convenient to change the coin in both particulars, and the present "nickel" is not metric at all. The children in our public schools learn all about the meter, the gramme, the liter and the hectare, and "do sums" in these units with facility, as well they might, because the sums are so easy, but that ends their use of the knowledge they have gained on the subject. Scientific treatises and records of experiments, particularly in chemistry and microscopy, make large use of metric units; and the American Institute of Mining Engineers (as well as many other technical societies, doubtless) has recommended to its members the use of this system in their professional papers. But engineers still describe American plants, machines and localities in feet and inches, pounds and ounces, acres and square miles. The conversion of an integral number of units under the old system into a fractional or mixed number under the new, does not seem to be worth the trouble. The circumstance that for practical reckoning a meter may be taken as 3 feet  $\frac{3}{8}$  of an inch, proves to be interesting, but not inviting.

The friends of the metric system, however, need not be discouraged. They have succeeded in making their generation familiar with the system itself—a great point gained. The metric terms are so commonly encountered in literature that a knowledge of them is indispensable, even to those whose reading is confined to the papers and the magazines. And as fast as they become really more convenient and useful to our people, they will be—they are already—adopted. Our fashionable ladies, buying their imported silks by the meter, because they come folded that way, rejoice to know that a meter exceeds a yard by "a finger." Indeed, many foreign articles are bought and sold by this international standard; and its advocates have another ground for encouragement, if they will take it, in the instruction which this circumstance should convey to them, warning them to avoid, in their future campaigns, the mistakes of the past.

For it has become clear that the theoretical advantages claimed for the meter and its derivative are partly not well founded, partly counterbalanced by disadvantages, and partly, even when conceded, not sufficient to effect a general change. The meter is not an aliquot part of the earth's surface, or of any one meridian quadrant. The earth is not symmetrical, no two of its meridians are exactly of equal length; probably the length of any given meridian is not constant; certainly the progressive improvement of instruments of precise measurement has caused, and will hereafter cause, continual changes in the results of such work; and finally, the French engineers who made the original measurement of a meridian arc, from which the meter was deduced, did not get it right, even according to the standard set by that particular meridian at that particular time and that particular state of geodetic science. The claim of the meter, therefore, to be a physical constant, set in the frame of the universe, and recoverable at any time from its cosmic prototype, has entirely collapsed. That meter of the meridian turns out to have been a delusion, based on the erroneous measurement of an irregular and inconstant base-line.

The episode is, however, not quite as ridiculous as the profound absurdity of the pyramid theory of the British inch, which, notwithstanding repeated refutations (of which Dr. Barnard's is the most thoroughly and beautifully destructive) still springs up anew, with the vitality described

by poets, and poets only, as the exclusive attribute of "Truth, crushed to earth." On this head, therefore, the two parties may well cry quits. The standard for the inch is neither in the polar diameter of the earth nor in the reconstructed diagram of a crumbling pyramid; and the standard of the meter is in no meridian. Each standard is an arbitrary length, represented by a rod of a given form and composition at a given temperature.

But the theoretical argument for the convenience of the metrical system as a whole, because of its uniform decimal relation and its comprehensive unity and simplicity, is also weaker than was supposed. It is partly counterbalanced by the inconvenient length of the meter as a unit—a fact which the relatively small use of yards as compared with feet in our own practice indicates. It is partly counterbalanced, also, by the inconvenience of division into tenths, as compared with halves, quarters and eighths. And the remainder of it is not enough to overcome inertia.

All the disadvantages of the metric system in the matter of division inhere in the decimal notation. Everybody knows that eight or twelve would have been a better base for numerical notation than ten. If prehistoric peoples had only omitted their thumbs when counting on their fingers, how much better off we should now be! But nobody dreams of uprooting the decimal notation on that account; and yet, on the other hand, our non-decimal units and divisions do not give way to it.

The strongest argument in favor of the metrical system is the international one, drawn from its use by so large a portion of the civilized world. And this gains strength in proportion as our intercourse with metric nations is multiplied. In other words, commerce, rather than scientific discussion or legislation, must furnish the impulse to change in our national standards. The present condition of the question, viewed from this standpoint, is as follows:

In the Argentine Republic, Austria, Belgium, Colombia, Costa Rica, Ecuador, France, Germany, Holland, Hungary, Greece, Italy, Mexico, Norway, Peru, Portugal, Roumania, Servia, Spain, Switzerland, French and Dutch Guiana and Venezuela, aggregating about 250,000,000 in population, the metric system is obligatory. In Bolivia, Chili, Great Britain and Ireland, Mexico, Paraguay, Sweden, Turkey, the United States and Uruguay, with a population of about 140,000,000, it is legalized and permissive. In Guatemala it is used in coinage and land measurement. In Hayti and Honduras the coinage is metric. Denmark and Russia are the only important European States rated as non-metric; but the metric system is in partial use in Denmark, and has been introduced by law in Finland.

As I have observed, we buy a good many foreign articles by metric measurement. But we do not make domestic goods of metric dimensions, or pack them in metric quantities. The reason is plain; we have not yet seriously entered into competition for foreign markets with our manufactures. But that event is not far away; and it is safe to predict that the metric system will take its place in our shops, when thus called for by the demands of successful commerce.

American exhibitors of machines and tools which took prizes at the late Paris Exhibition found that their exhibits, though universally admired, could not be sold in Europe, because they would not fit into the metrical conditions prevailing in all European shops. They could be exhibited, but they could not be used. Now the American is willing enough to take prizes in shows; but he expects them to help him dispose of his wares. To brag and not sell will by no means satisfy him.

Perhaps the prospect of a large exportation of machinery to European states may not be good enough to warrant the American manufacturer in setting up a metric plant; but when we turn our attention to Mexico and Central and South America, the case is different. Here is a vast continent, undergoing a rapid development of its natural resources, at the hands of nations passionately republican in spirit and eager to make friendly alliance with the United States, and to end their commercial dependence upon our great rival, England.

Whatever else is done or left undone to favor the development of this trade, in the way of steamship subsidies, reciprocal tariffs, commercial treaties and Pan-American conventions, it is obviously going to be a good thing to offer to these peoples the goods they want in the sizes and shapes they are accustomed to use. In no branch of trade will this consideration weigh more than in the export of American machinery and machine-tools. My friend, Mr. SELLERS, very naturally objects to a change of his whole plant involving the destruction of a vast amount of capital invested in feet and inches. But I do not despair of seeing him, and others like him, turn out metric tools for the South American trade, rather than not get that trade. In short, if we are going to contest with England the commercial control of this hemisphere, why should we not take advantage of her obstinacy, and, by suiting her customers, get them away from her?

This subject will be considered by the Pan-American Congress now sitting in Washington; and I am indebted for some of the statistics above given to an interesting report by Prof. T. C. MENDENHALL, Superintendent of our Coast and Geodetic Survey, issued for the information of the delegates of the United States to that Congress.

The universal adoption of a metric standard for electricity (the C. G. S. unit) shows what men of science can do, to facilitate their own work. They have pointed the way. The next step seems likely to be one, not of science, but of business.

R. W. R.

#### NEW PUBLICATIONS.

TRANSACTIONS OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Vol. X., 1889, and Index to Vols. I. to X. Published by the society.

The progress of this society is well shown by the bulk of its tenth volume, which has over a thousand pages including the index to the papers and discussions of the past ten years. It contains the proceedings of the meetings at Scranton in October, 1888, and at Erie in May, 1889, and a review of the trip of the joint engineering societies to Europe last summer. The society now numbers 985 members, and the number is rapidly increasing. The papers are mostly of a high class, and many of them of permanent importance. The index to the papers and discussions of the society for the ten years since its organization is very complete.

SPON'S ENGINEERS' DIARY AND REFERENCE BOOK FOR ENGINEERS, MACHINISTS, CONTRACTORS AND USERS OF STEAM, FOR 1890. New York and London: E. & F. N. Spon, Publishers. Price \$1.

The diary is a quarto volume chiefly filled with advertising of English engineering houses, with blank pages interleaved four days to a page. It contains a number of useful tables of reference for engineers. The book would be more useful to American engineers if the advertisements and other information were American instead of English.

PRACTICAL BLACKSMITHING. Vol. II. Compiled and edited by M. T. RICHARDSON. Cloth, small 8vo., 262 pp. Illustrated. Published by the compiler. New York, 1889. Price, \$1.

The first volume of this series, already favorably commented on in these columns, gave a brief account of the early history of blacksmithing, and described the tools used and their manufacture, and gave plans of shop arrangement, with many useful wrinkles about furnaces and other fittings. The present volume is also largely devoted to tool making, but also contains a short essay on the early history of iron and steel, and discusses artistic iron work. The compiler draws most of his material from contributions to the *Blacksmith and Wheelwright*, of which he is the editor. The matter is well selected, is generally of the most practical character and is made clearer by the numerous illustrations. It is necessarily of a somewhat rambling nature, owing to its being compiled from detached articles, and the arrangement is therefore not very systematic; but the compiler has exercised good judgment, and has succeeded in bringing together a great deal of information useful to the craft, and compressed into small compass. Vol. III. will be devoted to the consideration of jobs of work. In view of the dearth of literature on the subject, Mr. Richardson's series will doubtless prove very acceptable.

THE DEVELOPMENT AND THE PHILOSOPHY OF THE STEAM ENGINE. An Historical Sketch. By Prof. ROBERT H. THURSTON. Published by John Wiley & Sons, New York, 1889. Cloth, small 8vo., 48 pp. Price 75 cents.

Anything from Professor Thurston's pen will be favorably received by the engineering profession. The present sketch embodies the matter contained in a paper originally prepared in 1884 for the British Association for the Advancement of Science. This has now been revised and added to, and is reprinted for more general circulation.

In his introduction Professor Thurston says that it cannot be said that the theory of the steam engine is yet in its final and complete, its most perfect and most practically available form. Its final shape must probably be given it by some such master of mathematical and physical science as was Rankine, or such as was Clausius; but the main principles and the essential facts of a complete theory are unquestionably now well determined and well recognized by the most advanced thinkers and most intelligent practitioners, and are in various ways presented by the recognized authorities among later writers. It is at least practicable, to-day, whenever a design is to be prepared, to compute from known and well-established data the probable wastes of the engine and its efficiency under prescribed conditions, and with such accuracy that no serious apprehension need be felt by the designing engineer in regard to the ultimate outcome of his venture financially and economically.

Professor Thurston advocates the method of Marks for computing the heat transfer and consequent waste within the engine, and that of Buel for calculating the efficiency of the engine and of fuel and steam consumption.

The essay is a concise summing up of the history of the theory of the steam engine. The author proposes a classification of the successive stages of progress as follows:

1. Primary period.—That of incomplete investigation and of earliest systematic but inaccurate theory.

2. Secondary period.—That of the establishment of a correct thermodynamic theory, the theory of the *ideal* engine.

3. Tertiary period.—That of the production of the complete theory of the engine, of the true theory of the *real* engine. Regarding this, Professor Thurston says: "The work of developing this theory is still incomplete. It remains to be determined, by experiment, precisely what are the laws of transfer of heat between metal and vapor, in the engine cylinder, and to apply these laws in the theory of the machine. . . . A real beginning has, however, been made in the final research. The work of Clark was a qualitative investigation, which the later researches of Hirn and of Isherwood supplemented by their quantitative measures of internal wastes. The first systematic investigation of the methods of variation of these wastes with variation of the principal quantities determining their magnitudes was made in 1884, by Gately and Kletsch, under the direction and supervision of Professor Thurston. . . . The general results of this investigation supply the needed data for a complete provisional theory of the steam engine, including the physical as well as the thermodynamic phenomena, the theory of waste as well as the theory of heat transformations. It has thus been made possible to construct a theory of the heat engine which may serve as a guide in design and in construction, and a check upon the

experimental determinations of efficiency made at test trials. It has now for the first time become possible to predict on theoretical grounds the performance of any well constructed steam engine, and to base upon preliminary computations a very approximate estimate of the probable consumption of steam, heat and fuel of a steam apparatus which it may be proposed to design. It is also now practicable to make intelligent and useful estimates of the relative value of alternative plans of construction of proposed new types of engine, and of probable actual costs of operation and of efficiencies for any given type, size and design of engine.

"The theory of the compound, or the multi-cylinder, engine has now (1889) become well understood and its fundamental principles recognized. These are that the limitations of the efficiency of the single cylinder preclude the adoption of high ratios of expansion, and that the wastes of the multi-cylinder engine are approximately measured by the wastes of that one of its cylinders which is most subject to loss."

#### CORRESPONDENCE.

We invite correspondence upon matters of interest to the industries of mining and metallurgy. Communications should invariably be accompanied with the name and address of the writer. Initials only will be published when so requested. All letters should be addressed to the MANAGING EDITOR. We do not hold ourselves responsible for the opinions expressed by correspondents

#### Florida Phosphates.

EDITOR ENGINEERING AND MINING JOURNAL:

SIR: The late Dr. Geo. W. Hawes was, I believe, the first to point out the existence of large deposits of sandstone rich in phosphate of alumina in the State of Florida. In the "Proceedings of the United States National Museum for 1881," page 46, he described this sandstone with analyses, showing it to contain 46.75 per cent.  $\text{SiO}_2$ , 19.50 per cent.  $\text{Al}_2\text{O}_3$ , 16.07 per cent.  $\text{P}_2\text{O}_5$ , and 14.28 per cent.  $\text{H}_2\text{O}$ .

The specimens came from Hawthorne, in Alachua County, from the Vicksburg beds. Yours very truly,

FRED. P. DEWEY.

WASHINGTON, D. C., Feb. 17, 1890.

#### Black Hills, Dak., Chlorination of Low Grade Gold Ores.

EDITOR ENGINEERING AND MINING JOURNAL:

SIR.—Can you inform me, through the columns of your journal, what progress has been made in the treatment of low grade refractory ores at Black Hills, Dak., by the chlorination process, and is it proven beyond doubt that these ores can be economically treated?

Any information you can give on this subject will, I doubt not, be appreciated by many of your readers and subscribers.

I am led to put these inquiries to you on account of information that these ores cannot be profitably treated by chlorination or leaching process. NEW YORK, February 17, 1890.

"DEADWOOD."

#### Scientific Bibliographies.

EDITOR ENGINEERING AND MINING JOURNAL:

SIR: In your editorial of February 8 on the subject of scientific bibliographies you have very clearly stated an obstacle of great moment to the professional engineer, chemist, and metallurgist especially, and to the balance of mankind in general. Some time ago I had occasion to require the results of the chemical examination of pig iron, with reference to the distribution of carbon, silicon, phosphorus, and sulphur. I remembered that I had seen somewhere some detailed discussion of the subject, but for the life of me I could not at the time remember where. Finally it came to me that it must have been in *Stahl u. Eisen* somewhere, and after a diligent hunt I found it. Now this may be a case where one should have known without having to refresh his memory, but we cannot always remember what we ought to remember, and books are for the purpose of supplying just such deficiencies. The course of training at our colleges should be directed towards the strengthening of the memory as well as towards the strengthening of the reasoning faculties and of the power of correct observation. If our young men were sent out into the world with memories trained to retain certain classes of facts, groups of facts, as one might say, we would hear less of inaccurate statements. The teaching of science has as much to do with the lack of accurate knowledge as the disposition of the pupil. It is too often the case that the pupil is graduated from his college without knowing even the names of the leading authorities in his especial branch of science to say nothing of the cognate branches. It seems to me that an excellent plan for inducing students to read and remember is to cause them to file with the professor at the end of each month titles and abstracts of the more important articles that have appeared in the various papers and journals during the past month. This would, of course, necessitate an extensive subscription list, but no scientific school can be properly conducted without all of the leading journals devoted to scientific matters. At the School of Mines at Freiburg once I counted 68 scientific papers, journals and magazines in the reading room, and the professors there are constantly referring to the great authorities, and where their opinions are set forth, and to the current scientific literature.

If, in addition to his lectures, repertorium, and quizzes the professor would require of the students such titles and abstracts as I have already mentioned, there would result at the end of the year, or of two, or three, years, a very valuable compendium of reference. It should be provided with a table of contents and an elaborate index, both of authors and subjects, and should be kept in the library of the department. It would serve as a constant stimulus to each succeeding class, for each would have a visible proof of the industry of its predecessor. Such a plan may be in use now somewhere. I do not know whether it is or not, but I believe it would be productive of great good not only to the students but to the professor as well.

The great trouble with scientific students, as indeed with all sorts of students, is to induce them to read outside of the text-book. Just at the very period of life when the memory should be stored with leading facts and theories, we find it too often the case that the student regards the text-book and the lectures of his professor as the only things worthy of

close attention. When we couple this with the further fact that it is not often that a text-book can reveal the subject as it is, and that the lectures are often more antediluvian than the books, the wonder is that we get along as well as we do.

But no kind or amount of instruction can do away with the need for biographies and monographs. How often within the last few years I have most earnestly desired a good monograph on "Coke, its history, manufacture and uses," I'm sure I do not know. And then again the treatment of low grade auriferous sulphides demands a book to itself, as well as American methods of coal mining, of iron ore mining, of gold ore mining, of boring with the diamond drill, and of prospecting generally.

When one comes to look over the field, he is amazed at the number of books that have not been written, as well as the number that have. Of the making of books there is no end, and there seems to be no beginning of the making of other books that every professional man needs. It is a curious thing, this pouring out of books that do not exactly supply the want. What we all feel that we need we cannot get. We purchase book after book in the hope that in the multitude of counsellors there may be wisdom, only to find after all that the book is not to be had.

We need more books like Peter's "American Methods of Copper Smelting," or Stetefeldt's "Lixiviation of Silver Ores," or Howe's "Metallurgy of Steel," or Kunz's "Precious Stones," now in press.

Who will furnish them? It seems to me that the really successful book must be written, not from a desire of making money, but from a sincere love for the profession and an earnest desire to leave the scientific world enriched by our labor. It must be dictated by love indeed, not of money, but of science. It must be so attractive that the profession will have it at any price, while cheap enough for general use.

But there are several things to be considered. In the first place, such books can hardly be written outside of the great centres where the great libraries are; in the second place, many of those who could do the work are too much engrossed in their present business; and in the third place, the market is so limited that publishers look askance at a new book on science, unless the opportunities for the sale of it are unusually favorable.

The right book, however, will not fail of friends to publish or friends to buy. Let us have it!

WM. B. PHILLIPS.

BIRMINGHAM, Ala., Feb. 12, 1890.

#### Mining in Sonora, Mexico.

EDITOR ENGINEERING AND MINING JOURNAL:

SIR: Now, nearly four months ago I came to Sonora to examine and search for a Mexican gold mine, sufficiently developed and known to be good, for an American-English company having on hand and ready to erect a 100-stamp mill. Also to examine into the reported or so-called coal properties of Sonora. How I have succeeded in these undertakings in the eight out of ten districts of Sonora, viz: Altar, Magdalena, Ures, Hermosillo, Guaymas, Alamos and Sahuaripa, I propose to tell you in this and succeeding letters.

The other two districts not mentioned above are Arizpe and Moctezuma.

My entrance to Mexico was from San Francisco via Southern Pacific Railway to Benson, and thence by New Mexico & Arizona Railway to Nogales, a border town half American and half Mexican, probably containing in all some 4,000 population. From this place I took horses, and met the first introduction to the Mexican Custom House regulations, of which, practically, everyone except tourists soon gets enough. Nogales lives on some cattle raising, but largely on trading with miners in both countries, and, it is hinted, sometimes on smuggling. Very little of this trade goes to the United States, but there is a market for manufactured goods in the free zone, or Zona Libre, extending on the Mexican territory from the Gulf of Mexico to the Pacific Ocean, a few miles south of San Diego, Cal. My friends told me that on my trip there would be no use to take blankets or anything to eat along as we could stop each night at ranches where everything could be had to sleep and eat. However, I had a pair of heavy blankets which I took along, accompanied by a friend and a mozo, or Mexican servant or guide. We took nothing to eat.

Nogales is 3,800 feet above the level of the ocean, and by the middle of October the nights are cold notwithstanding a latitude of 31 degrees 30 minutes. The road rises following toward southwest for some 15 miles to an altitude of some 4,500 feet, thence down southwest to Las Planchas silver mine, owned and worked by a New Orleans company. The first night our guide lost us in an arroyo, and there we staid with practically no fire, because no wood, till daylight, and with nothing to eat. I might as well give advice here to all Americans, Englishmen, Germans, etc.—Mexicans don't need the advice, because they always carry with them a *sarape*, a blanket three feet wide by six feet long, single thickness, their coat and their bed, and may be buried in it also—that wherever you get off a railroad or tourist line it is absolutely necessary to also carry your bed, and this generally consists of two heavy pairs of woollen blankets and some five yards of four or five-foot wide tent ducking to first lay on the ground, then blankets, and then again cover over. It is also well to carry a small feather pillow. With this, after a hard day's ride, sleep can be successfully courted, although it makes one, from its hardness, have a vivid recollection of a spring bed and mattress. The usual Mexican bed, in this part of the country, is a *petate*, a mat braided of palm leaves 4½ feet by 6 feet, and as many blankets as can be afforded. A few aspire to the dignity of a cot and some a mattress of fine grass three inches thick, not covered, but tied with strings through and through. The number of bedsteads with springs and mattresses, such as would cost even \$15 to \$20 in the United States, are so few in all Sonora that I doubt if there are even 300. The best hotels in Hermosillo and Guaymas have only two or three each. The duties are excessive. A bedstead I saw, which should have cost, say, in Illinois \$10 to \$15, paid a duty of \$36. Saddles pay \$1 per pound. Of this more later. We got breakfast the next morning at 10 o'clock at Arizona Ranch, owned by an American with a Mexican wife.

Las Planchas Mine is silver, has produced very well for several years, has two claims and a fair grade of ore, and is being developed on American plans at present. A 5-stamp mill and amalgamation pan is in opera.

tion. This did not succeed well at first, but is now said to work better. The next mine I saw, the Guadalupe Mine, was near Saric on the Busani River, 45 miles southwest of Nogales and 17 miles south of the Arizona line. This is a gold mine, comprising five claims, three on east side of river and two on west side. There is a 10-stamp mill with pans and settlers, good boiler, but engine too small to drive all at one time. The situation is splendid; plenty of water and fuel. Elevation probably about 3,000 feet above sea level. The main vein on east side of river is 8 feet or more in thickness, where being worked, three claims being on same vein. Besides considerable cooyoting done in the usual Mexican style, to get ore and not to develop, there is an incline shaft starting on west side of vein and in about 100 feet crossing it and passing into country rock or hanging wall. This ore with proper handling should mill \$15 per ton. A mill test which I made of it ran higher than this, and it is really easy to work and handle, and some 4,000 tons, the tailings of which are dammed in a wheat field below the mill, netted over \$40,000. With a pan, gold can readily be washed out of the tailings. They show \$7 to \$9 per ton. Of the two claims on west side of river, one has a vein of 8 feet and shows \$11 on a mill test and has a shaft some 50 feet deep. The other has about the same development, one vein 2½ and another 3 feet, separated by a horse probably of 5 feet. This ore ran on a mill test \$15. This property makes a good showing. The mill is not running at present. Too many high-priced men who knew really nothing about mining, a disregard of all economy in management, and the giving of frequent *bailes* (dances) in Saric used up all the income of a ten-stamp mill. The saving was all done on plates. My impression is that good

reliability and safety are the first requisites that should be considered. Any slighting of these merely to save money in the first cost will prove the more expensive method in the end. Electrical apparatus can be so constructed and installed as to meet every requirement of the miner. To obtain such results the method of installation should be well considered beforehand for each particular case, and only the best material obtainable should be used.

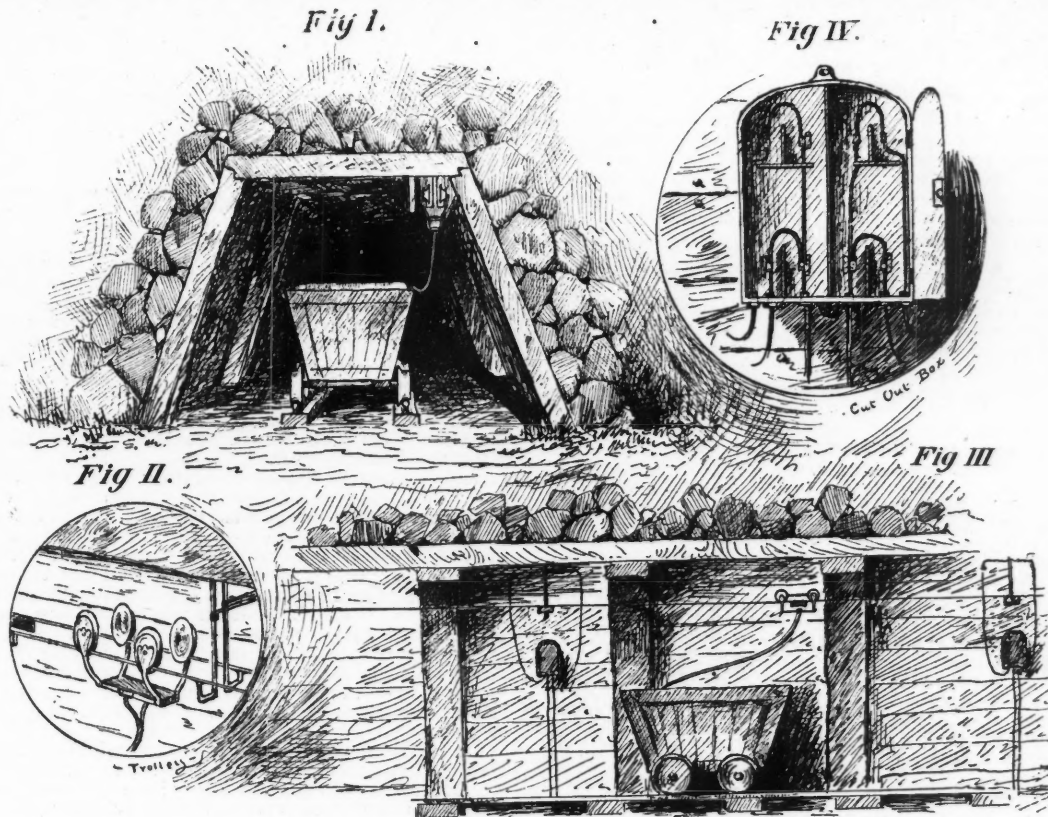
It is my aim here to give a few suggestions as to how a mine may be equipped with electrical machinery, keeping pre-eminently in view safety, reliability and economical operation. Almost the first question that confronts us is that of electrical pressure or voltage. Pressures of 110, 220, 300 and 450 volts are now used by plants in successful operation. At present 450 volts seems to be the limit for working inside the mine. In some cases, by using the three-wire system, twice that pressure, or 900 volts, may be used.

Let us now look at the machinery to be operated in the mine. We find two general classes, which I will designate as fixed and movable.

Under *fixed*, I would place hoists, pumps, fans, air compressors, and drums for operating endless and tail ropes, or any other machinery that does not require constant shifting and handling.

Under *movable*, may be placed tramways, drill, coal cutters, etc. It is very evident that any system that contemplates all the above applications must be exceedingly flexible, and to insure reliability it must be so constructed that an accident, such as a "cave in" in one portion of the mine shall not interfere with the operation of the rest of the system.

Main conducting wires of ample size should be run from the generat-



ELECTRICAL DEVICES IN MINING.

plates carefully attended by competent men would save over 80 per cent. of the gold in this ore, but with an engine of sufficient size it could also at some time be run through pans and settlers. This mine can be reached with wagon from Santa Ana on the railroad, 65 miles south of Nogales, in 30 miles, or in 100 miles from Tucson, Ariz. It is bonded till next fall to Californian parties, and will probably be taken by them. This mine appears like a good proposition for, say, a thirty-stamp mill, and when thoroughly opened up in various places might supply even a forty-stamp mill.

BRAD BARNER, M. and C. E.

HERMOSILLO, SONORA, Mex., Feb. 7, 1890.

PRACTICAL APPLICATION OF ELECTRICITY TO MINING.

Written for the Engineering and Mining Journal by Charles Hewitt, N. Y.

It is not the purpose of this article to give any elaborate treatise on the application of electricity to mining, but rather to remonstrate against repeating the history of the electric light and the electric railway in this the latest field for the application of electrical machinery. I refer now to method of construction. Some excuse can be made for the pioneer work in the two branches named on account of the lack of experience. The knowledge gained by such experience should prevent bad workmanship with its consequent failures in mining installations. Yet we do hear of failures or partial failures in electrical mining machinery. It is not surprising to hear of such failures where old mine ropes or iron rails stuck up on wooden pegs along the side of a gangway are used as conductors, or where dynamos intended to be operated in a clean dry room are placed hundreds of feet beneath the surface of the ground, where the moisture will condense on them like beads on an ice pitcher. Absolute

ing station through the main gangway or shaft to the bottom of the mine. These wires should not only be properly insulated, but also incased in such a manner that they can be easily got at, and yet be thoroughly protected from falling stones, cave ins, and other accidents liable to occur. One method of incasing these wires is shown in the lower right hand corner of Fig. 1. It consists of a wooden box with separate compartments or ducts.

If a tramway is to be operated in the gangway, the trolley wires may be run on one side or the other, according to local conditions, somewhat as shown in Fig. 1, upper right hand corner. Fig. 2 shows a method of suspending the trolley wires. At distances of say 200 feet, feed wires may be run from the main conductors in the box to a cut-out box, as shown in Fig. 3, and from the cut-out box to the trolley wires. Now, in each trolley wire, and midway between these feeding points, insert a piece of non-conducting material, as shown in Fig. 3. In this manner each section has its own feeder, and is entirely distinct from every other section, except in that it derives its current from the mains in the box. An accident, such as a "cave in," would cause the fuses to burn out in the cut-out box for that section where such accident might occur, and thus automatically disconnect that section of 200 feet from the entire system without interfering with the rest of the tramway or any motors that may be in operation in other parts of the mine.

The writer has also devised a means by which the locomotive, as it approaches each section, will operate a switch in the feed wire and turn on the current, and turn the current off again as it leaves each section. In this case all bare and exposed trolley wires will be "dead" except the section where the locomotive happens to be. This may be used merely as an additional safeguard. From the main conductors in the box, branch wires are to be run into each working chamber. At the entrance to the

chamber the branch wires should first run into a cut-out box as shown in Fig. 4, so that any accident occurring in a chamber shall automatically disconnect its branch from the rest of the system. These branch lines may be strung overhead on proper insulators, so as to readily permit of changes being made as the work progresses. From the branch lines individual connections should be made with each motor. If a three-wire system is used all motors that do not require frequent handling should be connected to the outside or positive and negative conductors, while all motors such as those used for drills, cutters, etc., that do require frequent handling by the miners, should be connected to the middle or neutral wire. This will lessen the pressure on these motors by one-half and consequently lessen the liability to shock.

No matter how well constructed the motors may be, if they are improperly set up and connected, trouble is sure to follow. Care and attention to the details of installation will frequently make the difference between success and failure.

#### THE MINERAL RESOURCES OF THE WEST KOOTANIE DISTRICT BRITISH COLUMBIA.

Written for the Engineering and Mining Journal by Geo. E. R. Ellis, M. E. F. C. S.

A study of the literature of the subject would lead one to imagine that but little had been done—other than some placer mining—towards proving and developing the mineral resources of the western Kootanie country. For example, the "Catalogue of the Economic Minerals of Canada," issued by the Geological Corps in connection with the Colonial and Indian Exhibition of 1886, makes the following references to the mineral deposits of this district:

**NATIVE COPPER, British Columbia, Geological Survey, 349.**—Large nuggets (found loose). "Native copper has not yet been discovered *in situ* in British Columbia, but loose nuggets, which are occasionally found, indicate its existence, probably among some of the volcanic rocks of the province. Native copper, supposed to come from one or other of the rivers of the Alaska coast, has been used from time immemorial by the coast Indians, and was accounted by them of great value." [Probably this paragraph makes no reference whatever to the Kootanie District].

**ORES OF COPPER.**—No reference made to the Kootanie country.

**GALENA, Kootanie Lake, B. C., 102.**—Galena (argentiferous). "In 1885 as many as 49 claims had been located in the vicinity of Kootanie Lake,\* chiefly on galena deposits. These deposits have not been examined by the Geological Survey, but assays made in the laboratory have shown as much as 15½ ounces of silver to the ton."

**NATIVE SILVER AND SILVER ORES.**—No reference to the Kootanie Division.

**GOLD AND GOLD ORES, Big Bend, Columbia River, B. C., 266.**—Gold in quartz taken three feet from the surface.

**Homestead Claim, McCulloch Creek, B. C., 267.**—Gold in quartz, taken from surface.

"The extension of the Canadian Pacific Railroad through the southern portion of the 'Big Bend' country has made this district comparatively easy of access, and auriferous veins from which the places worked in former years have been supplied are now beginning to be discovered."

Later publications add but little to the scanty information thus obtained. A visit to the district, however, would convince even an ordinary observer that considerable money and labor have been expended in developing the mining claims and in showing that the country is well worthy of the attention of American and other capitalists.

The West Kootanie mining camps are situated in the hills on all sides of the Kootanie Lake and are wholly located on British ground. Leaving the Northern Pacific Railroad at Kootanie Station, Idaho, on the banks of the Pend d'Oreille Lake—the country surrounding which has lately been proved to be very rich in mineral deposits—we proceed by stage 32 miles through a densely wooded district to Bonner's Ferry, a small settlement on the banks of the Kootanie River. Here connection is made with a small steamer which leaves Bonner's Ferry twice a week, making calls at and shipping ore from the various mining camps situated on the Kootanie Lake.

The largest amount of development has been done in the neighborhood of Nelson, a small but increasing settlement twenty-five miles down the west arm of the lake. Nelson is entirely surrounded by precipitous hills covered with timber and brushwood, and therefore prospecting is somewhat tedious and difficult. Notwithstanding these obstacles, prospectors during the past three years have done excellent work, and at the time of my visit to the district (October, 1889) no less than 150 mining claims had been located in this district alone. Development work was carried on during the winter of 1888 and the whole of 1889, and has given indisputable evidence of the richness of many of the deposits. Nearly all the ore of this camp carries a liberal percentage of copper, and hence the district is known locally as the "Copper Camp." The first mine discovered in the Nelson district was the "Silver King," located in June, 1887, by the Hall Brothers. Since that date the Hall combination have expended upwards of \$40,000 in developing their locations, but by far the larger amount has been appropriated to the Silver King claim. The character of the ore is gray and peacock copper and copper glance (carrying from 50 to upwards of 2,000 ounces of silver per ton). The value of the ore has improved greatly with depth. At the end of 1888 the Silver King ore shipped to the smelter averaged 300 ounces in silver per ton and 28 per cent. in copper; in September, 1889, the shipment "ran" 370 ounces in silver and over 30 per cent. in copper, while a carload lot shipped to Butte City, at the end of last November, assayed as high as 572 ounces in silver and over 43 per cent. in copper. A large quantity of "second-class" ore is also obtained from this mine; this will form a valuable source of revenue as soon as smelting works are established near Nelson. The development on the Silver King consists of two tunnels, the lower one upwards of 200 feet

\* This refers to what is now known as the "Galena Camp," in the neighborhood of Ainsworth (Warm Springs).

long, and a winze in the lower tunnel 54 feet deep. The vein is well defined throughout the whole depth of the winze, and varies from three to five feet in width. Some ore taken from the bottom of the winze (108 feet below the surface of the hill) "ran" as high as 14,892 ounces in silver per ton! Near the eastern boundary of the Silver King the vein seems to bifurcate, and consequently the Hall Brothers have taken up two other claims—the Bonanza and the American Flag—on the two branches of the main vein. (This location of more than one claim on the same vein is likely to afford work for the lawyers before long.) A little work has been done on these claims, but, the owners not being capitalists, only sufficient to show that there is every indication of the existence of a large body of ore, similar in character to that found on the Silver King.

The Dandy claim is the west extension of the Silver King, and has been developed at six different points along the line of outcrop. Ore was found at every point. The claim, however, should have been developed at one point alone, for it is too valuable a property to be worked in a haphazard manner. There are other extensions of the Silver King lode, both east and west, which, with development, would doubtless prove of considerable value.

Two hundred yards south of the Silver King vein, and parallel to it, is another lode upon which several claims have been located. The most promising is the Iroquois, which will in time prove a worthy competitor with the best claims in the camp. A tunnel 75 feet long has been driven, showing ore the whole distance. Samples taken from various parts of the tunnel assayed from 12 to 140 ounces in silver, with 10 to 20 per cent. copper.

Another promising location is that known as the Tough Nut, situated near Forty-Nine Creek, and about two miles from the Silver King. The vein here is undoubtedly a true fissure, and varies from two to four feet in width. The ore is high-grade gray copper, and in places assays upward of 200 ounces for the whole width of the vein. The development has been well done, and consists of a tunnel run into the hill on the course of the vein, and a shaft sunk 400 feet from the mouth of the tunnel.

Over the divide and about two miles from the Tough Nut is the Ike Nail gold mine. The vein is two feet wide and runs high in free-milling gold. Twenty-seven men were employed here during the summer of 1889, while a larger number will be needed in the coming spring for the running of a 25-ton Huntington mill, the erection of which had been completed at the time of my visit. The value of the ore on the dump at this mine is probably nearly \$100,000.

Before taking leave of the Nelson camp, I may remark that the neighborhood of Nelson affords excellent opportunities for the erection and working of smelting and reduction works. There is an abundance of argentiferous copper ore, carrying upwards of 50 ounces of silver per ton, which will not bear the cost of transportation to outside smelters. Timber and water are close at hand and in abundance, while the neighboring hills contain immense quantities of limestone, oxides of iron and manganese and other materials requisite for the reduction of the ore.

Leaving the "Copper Camp," and proceeding up the lake, we reach Warm Springs (also known as Ainsworth), on the west side of the Kootanie Lake, near which is the "Galena Camp." One of the most promising mines in this district is the "Number One," owned by Portland and Victoria parties. The ore consists of Galena and carbonate of lead, and runs as high as 400 ounces in silver per ton. A large quantity of ore was shipped to outside smelters during the past year, and there seems to be every likelihood that the property will prove a good investment for its owners. The mine is developed by a shaft and tunnel—the latter, after being run 300 feet, taps the vein at the 125-foot level.

The Little Donald mine, which was recently purchased by a Portland gentleman, has improved so much on development that it can now be placed on a par with the best mines in the Galena camp. The ore is large cubed galena, and contrary to the somewhat general rule, it runs high in silver. A considerable quantity of ore has been shipped from this mine, assaying from 100 to 200 ounces in silver, and as high as 77 per cent. in lead.

The Gallagher mine is in the same district, and is a chloride proposition. The vein in places is 9 feet wide, and has assayed from wall to wall 82 ounces in silver per ton. Shipments have also been made from this property, and, as might be expected from the above, assay with very satisfactory results.

The Highland, Sweden, Jerusalem, and about twenty-five other claims in the Galena camp would probably make good mines if further developed.

The Blue Bell mine, owned and operated by the Kootanie Mining and Smelting Company, is located on the east side of the Kootanie Lake, nearly opposite the Warm Springs. This is probably the greatest galena mine in the Northwest, it being a vast mountain of ore. A cross-cut run on the 100-foot level showed over 60 feet of solid ore without disclosing the walls. The ore is low grade, but has improved considerably with depth. Thus, near the surface the rock carried 15 ounces in silver, while at the 100-foot level 32-ounce ore was obtained. There is every probability that the Kootanie Mining Company will erect smelting works for the treatment of the Blue Bell ore during the present year.

Want of space has prevented me from mentioning any but the best-developed mines. Want of capital has compelled many locators to let their claims remain undeveloped, for smelting charges and freight to outside smelters come to about \$52 per ton. The establishment of a smelter (or smelters) at Nelson, or at any point on the lake, will change the present state of affairs, for many of the locations will more than pay for working from the grass-roots. Rumor says that the Canadian Pacific Railway Company is going to connect their main line with the Kootanie Lake District via the Crow's Nest Pass, and I am also informed that the Northern Pacific Railway Company will construct a branch line to Bonner's Ferry in the coming spring, and run a line of steamers on the lake in connection therewith. All this, of course, will lessen the cost of shipping the ore, but the desideratum needed for the full development of the country is the establishment of smelters on the edge of the Kootanie Lake.

The short time at my disposal and the large extent of country involved prevented me from attempting a geological study of the district. I hope, however, to be able to afford some information upon this part of the subject before the end of the present year.

BUTTE CITY, MONTANA, February, 1890.

### A COMPARISON OF THE NEEDLE AND BARREL METHODS OF BLASTING IN COAL MINING.

Written for the Engineering and Mining Journal by Leo Gluck, E. M., Assistant, Geological Survey of Missouri.

In the coal mines of Illinois and in other Central States, two methods of blasting are commonly practiced; one known as the "needle method," the other as the "barrel method." The "needle method" is the one prescribed by law in Illinois; but despite this the "barrel method" is largely used, by reason of numerous advantages. While prosecuting certain studies at the Reinecke mine, near Belleville, Ill., the writer had opportunity to become familiar with these two methods, and was able to make a somewhat detailed comparison, which showed that the "barrel method" requires both less time and less skill than the "needle method," and further, that the former seems to have no considerable element of danger above the latter which should prevent it from being recognized by law.

The two methods of loading the holes are plainly illustrated in the accompanying sketches. In both methods the shots are fired by squibs.

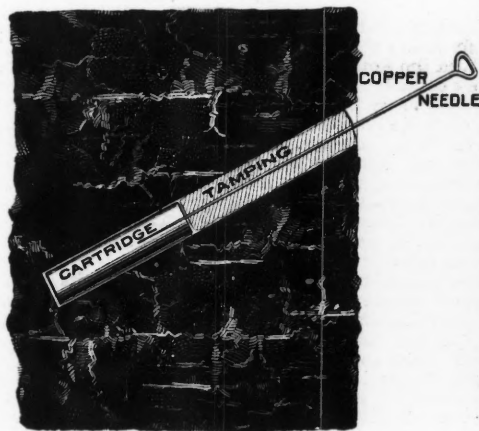
By the "needle method" the cartridge is inserted in the hole at the end of the copper needle, and is tamped in around the latter with a copper-tipped tamping bar. The needle is then withdrawn, and the squib, when fired, shoots down the channel left in the tamping material by the withdrawal of the needle. To obtain good results the tamping material must be very uniform, must extend to the mouth of the hole and the needle must be withdrawn with skill; otherwise the channel will be partially or wholly clogged, resulting in a "hanging fire" or a "misfire" of the charge.

By the "barrel method" the cartridge is inserted in the hole at the end of a copper tube, about five-eighths of an inch in diameter, through which a copper wire runs, as shown in the sketch.

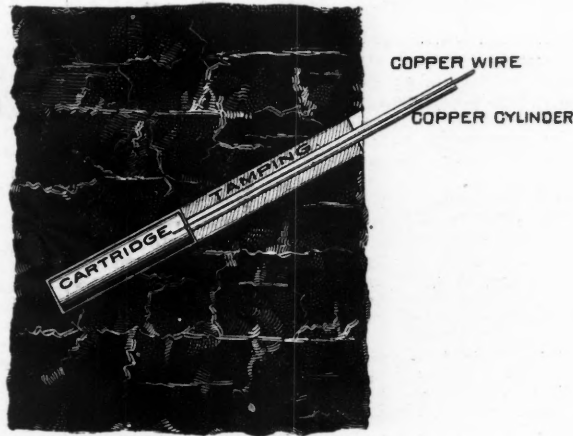
The cartridge is then well tamped in around this tube, and though various kinds of tamping bars are employed for this, a copper-tipped one should always be used, as with the "needle method."

The wire is then withdrawn and the squib shoots to the cartridge down through the copper tube.

By this latter method a smaller amount of tamping has to be done, as



NEEDLE SYSTEM.



BARREL SYSTEM.

a continuous channel has not to be constructed to the mouth of the hole, as with the "needle method." Further, a poorer tamping material can be used, as it is not necessary for a smooth channel to be made, as with the "needle method." The only additional element of danger is that with certain conditions the barrel is apt to be shot out, and might injure any one standing at a short distance in its line of flight.

From the reasons already given it is apparent that there is a considerable saving of time by use of the "barrel method"; but the writer had opportunity to determine the amount of the saving by actual comparison. At intervals during a period of four weeks, time was kept on about thirty holes, loaded by some five different men, without the knowledge of the latter. The results showed that loading by the "barrel method" is just twice as fast as is loading by the "needle method."

The consequent reduction of cost will be readily appreciated; but in addition to this, rapidity of loading permits firing in wet holes in which the cartridge of a hole loaded by the longer needle method is in danger of becoming saturated with moisture.

The first cost of the "barrels" or tubes is small, and the wear is very slight. As they are generally buried under the coal after a blast, however, it is necessary to have several extra ones, to permit continuous blasting.

In view of the advantages cited, and further in view of the fact that the method is at present largely used in the face of the law, it certainly seems that this law should be so modified as to recognize and to recommend it.

**Length of Locomotive Boiler Tubes.**—Some interesting experiments have recently been made by the Paris, Lyons & Mediterranean Railroad on the comparative value of short and long tubes in the locomotive boiler. As a result of these experiments the road has adopted standards for lengths of tubes, varying from 13 feet to 14½ feet. With boilers having tubes of these lengths there was found a total evaporation in a given time about 5 per cent. greater than with boilers having tubes 10½ feet in length, but there was a loss on the water evaporated per pound of coal varying from 2½ to 5 per cent.

\* With the present law, which does not recognize the "barrel method" at all, an iron tube is sometimes substituted for a copper one. This is, of course, to be condemned, and should be provided against in any modification of the law.

### IRON AND STEEL MANUFACTURE IN FRANCE.

A most interesting paper was presented by Professor S. Jordan, of Paris at the recent meeting of the British Iron and Steel Institute in that city, in which he shows the progress made in the manufacture of iron and steel between the years 1877 and 1887, the latter being the last returned in the official statistics.

From a commercial point of view, the statistics of France are not of great interest to us, since we neither import nor export iron and steel in any great quantity to or from that country, nor do we meet French competition seriously in other markets; but we cannot afford to neglect the progress France is making in the technical details of the manufacture. The French seem to devote more attention than either our British friends or ourselves to scientific research in connection with manufacture, and, as the president of the Iron and Steel Institute said in his address at Paris, the French chemists have rendered great service, not only to their own native industry, but to the world at large. From this point of view we propose to note a few extracts from Professor Jordan's paper which show differences between French and American practice.

**Coke.**—Coke is now produced in France almost only in the improved coke ovens, called Belgian, of the Imet, Coppie, or other analogous systems, in which the coal is introduced through hoppers placed in the arched ceiling of long rectangular and horizontal chambers or vaults open at both ends, and the extraction of the coke is effected by means of mechanical pushing rams. The vertical Appolt ovens are not now much in use. The obsolete beehive ovens are used only at one or two collieries, but their products are not used for blast furnaces, and are only used for fundry purposes.

As the beehive oven is in almost universal use in this country, the knowledge that it is obsolete in France is something of a surprise. Is the Frenchman more progressive than the Yankee, or is there such a difference in the coal of the two countries that the beehive oven is best for one, and the Belgian for the other?

The small coals carbonized are seldom of only one origin. The coke makers rather try to make economical mixtures by associating the dearer coking coals with the largest possible proportion of the cheaper non-coking coals, so as to come as near as possible to the limit of the property

of coking. These mixtures are made with great care by means of various apparatus. The coke makers have in that way been able to notably lessen the cost of production of coke, owing to the use of the Coppie and other ovens which produce good coke with coals that would not cake in the beehive ovens.

This is in strong contrast to the American system. We do not think our own coke makers have made any serious attempt to reduce the cost of coke making, unless the importation of cheap Hungarian labor can be called such an attempt.

The application of coke ovens to the production of tar and ammoniacal salts, has found a place in some collieries, but commercial circumstances have not favored the extension of the manufacture of by-products. The quality of the French coal does not suit this special industry of by-products so well as the English or German coals.

**Pig Iron.**—The production of coke pig iron increased in ten years from 1,372,000 to 1,547,000 tons of 1,000 kilos, while the number of furnaces decreased from 133 to 84. The charcoal pig iron production decreased from 80,000 to 12,000 tons of 1,000 kilos, and the number of blast furnaces from 84 to 12, the industry being now quite unimportant. This is a contrast to the condition in the United States, where the production of charcoal pig is still increasing, although slowly in comparison with coke iron.

**The Rollet Process.**—Some of the iron works in the Loire region are using for the production of superior iron and steel with ordinary pig a special refining process (Rollet's process). It consists in melting the pig with an extra-basic slag, obtained by means of fluor spar and limestone. The melting is effected in a basic-lined or water-jacketed cupola furnace blown by hot blast. The pig iron is thus purified by the removal of the greater part of its sulphur, and of a certain part of its phosphorus. The fired metal is sometimes cheaper than the pure pig made with manganese foreign ores.

**Silico-Spiegel, etc.**—The St. Louis Marseilles Iron Works exhibited at the Paris exhibition an interesting set of products, superior spiegeleisen and ferro-manganese (up to 87 per cent. manganese), silico-spiegel (up to 14 per cent. silicon), ferro-silicon (up to 14 per cent. silicon), and ferro-chromium (up to 65 per cent. chromium). The Tamaris and the Beaucaire furnaces also exhibited ferro-chromium.

**Puddled Iron and Steel.**—In the United States, in spite of the enormous increase in the production of steel and the prediction for many years past





kind, and is controlled by a sensitive governor of the high-speed type. The governor sleeve has a cam groove formed in it by means of which an automatic rotary cut-off valve is regulated. By means of a screw valve the supply of steam can be accurately regulated, and the cut-off arranged as desired.

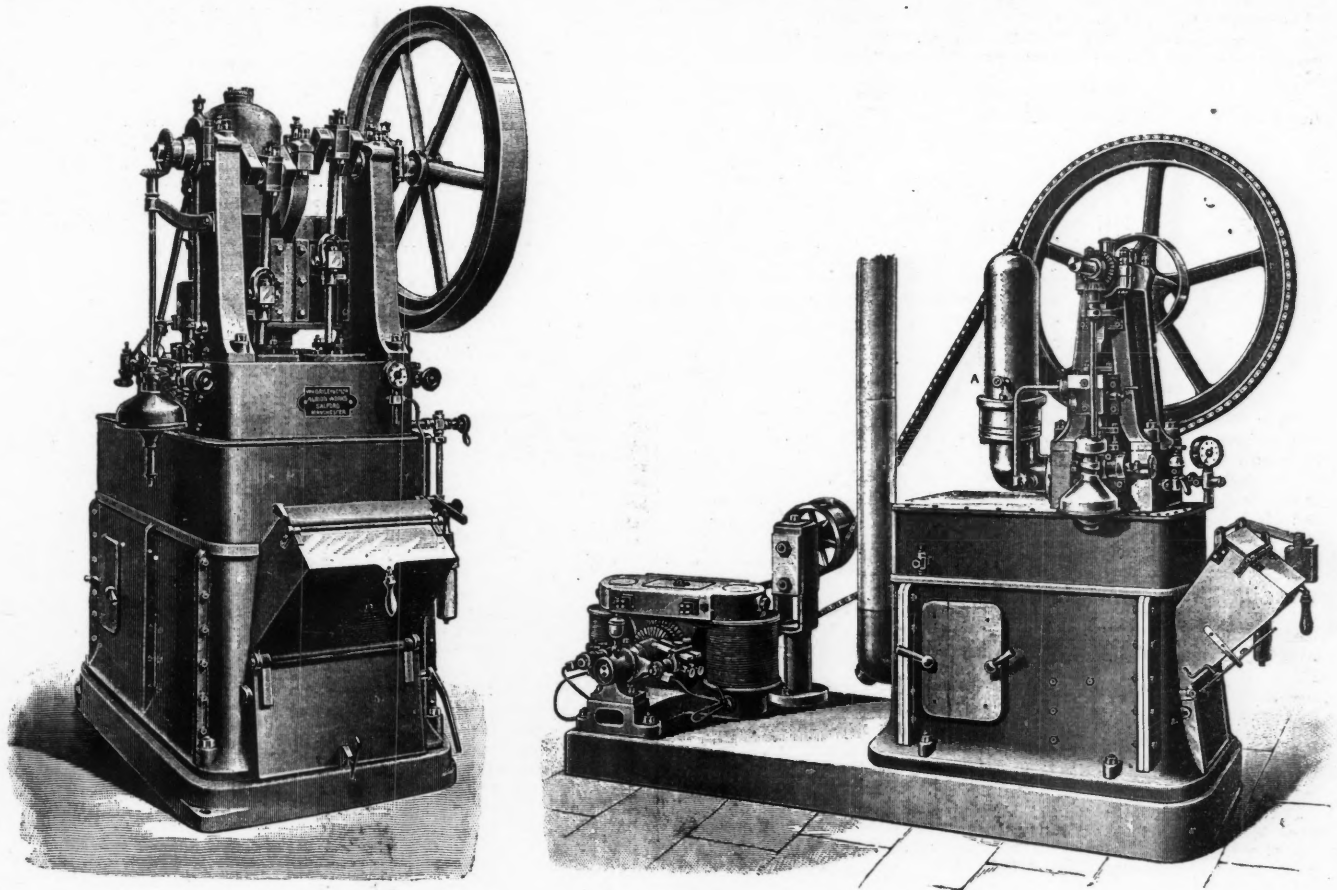
The chief feature of this motor is, however, to be found in the treatment of the exhaust steam. There is a surface condenser fixed in a vertical position, round the tubes of which a continuous current of water is passed. The water supply is obtained from a tank or cistern similar to those used with gas engines for supplying the water jacket, so that the water can be used over again, with occasional replenishments to compensate for the slight loss by evaporation, which, however, is not great. After the engine has been working for some short time, the water becomes of a temperature of 100 to 150 degrees Fahrenheit, and it is found that a considerable mineral deposition takes place where salts exist in the water. The steam being condensed, the water so obtained is pumped back into the boiler, and it is found possible to maintain an unvarying water line in the boiler. The same water is used repeatedly, and if it were not for the slight loss resulting from escapes of steam through the stuffing boxes, etc., there would practically be no fresh water needed. It has been established by experience that about two quarts of water per horse-power per day is all

#### WASHINGTON MEETING OF AMERICAN INSTITUTE OF MINING ENGINEERS.

Washington appears to be an excellent place for the winter meeting of the Institute, for its selection always draws a large attendance. The number of members, and especially the number of ladies, in attendance at the present meeting, is unusually large, and the number of papers announced to be read is also very large, more than 30 papers having been cited by title on the programme of the meeting.

The first session opened on Tuesday, 18th inst., at the Smithsonian Institution, the engineers being welcomed to the city by General Rosecrans, chairman of the local committee, and welcomed to the Smithsonian by Professor Langley in a highly complimentary address, in which great stress was laid upon the fact that Washington possesses more scientific workers, most of them in the government service, than any other city can boast; and no doubt this fact and the great government, private, scientific and artistic collections of the city form a very substantial reason for the favor with which the Institute looks upon Washington as a place for the winter session.

Major Powell, head of the Geological Survey, made a very florid address, in which the service of the engineering profession to the human race and the cause of civilization were fully recognized, and may have been somewhat exaggerated.



THE BAILEY-FRIEDRICH STEAM MOTOR.

that is necessary to supply all loss in the engine or boiler. This quantity is obtained from the condenser by means of a sight drop feed, the rate of the dropping being regulated by a valve. In this way the feed water is kept pure, and incrustation of the tubes prevented. The small consumption of water is remarkable, but is verified by a large number of users in various parts of the world. If necessary the boiler can be arranged to burn petroleum, the consumption being about one quart per horse-power per hour. The makers have made several of these motors in combination with dynamos, including one for the Thomson-Houston Company. The motor has also been applied to pumping. Messrs Bailey have given some results of a number of daily tests made at their works with a motor supplying power for 40 16-candle-power incandescent lamps, the fuel used being gas coke. The fire was lighted at 3 P. M. each day, and the current finally switched off at 9 P. M., during which time the fuel used was 135 pounds, the cost being 6d. per cwt., or equal to 1d. per hour. This is a remarkable result, and one probably the makers would not guarantee, but if it is even approached should be of sufficient importance to justify the adoption of the motor for small powers. The motor is made in three sizes, developing respectively 4, 8, and 12-brake horse-power.

**Warrenite.**—L. G. Eakins has given the name *Warrenite*, after E. R. Warren, of Crested Butte, to a new sulphantimonate of lead found in the Domingo mine, Gunnison County, Colorado, in which locality it is known as "mineral wool." It consists of aggregates of small acicular crystals, forming matted woolly-like masses in the cavities of a highly decomposed gangue rock of silicious material mixed with some calcite. It is dull grayish-black in color, with occasional spots of iridescence, due to superficial oxidation. Analysis gave 39.33 per cent. lead, 36.34 antimony, 21.19 sulphur, 1.77 iron, and traces of silver, copper and manganese.

These preliminary addresses having been completed, Mr. Richard Pearce, President of the Institute, took the chair, and gracefully accepted for the Institute the courtesies so politely offered.

Dr. R. W. Raymond, in the absence of Professor J. P. Lesley, read an obituary notice of the late Charles A. Ashburner. This tribute of the venerable scientist to his favorite pupil was one of the most beautiful compositions we can remember to have read. A biographical notice of Mr. Ashburner was published in the *ENGINEERING AND MINING JOURNAL* December 23th, 1889.

Dr. Raymond then presented, and read in Mr. Coxe's absence, an obituary notice of the late Franklin B. Gowen, by Mr. Eckley B. Coxe. At its close Dr. Raymond made some further remarks upon the great services rendered the mining interests of Pennsylvania, and the cause of civilization everywhere, by Mr. Gowen, in his remarkable campaign against the "Molly Maguires."

The meeting then adjourned, and passed through the Mineralogical Museum of the Smithsonian, which was specially illuminated for the occasion.

#### WEDNESDAY, FEBRUARY 19TH.

The Institute members and their ladies, to the number of about 140, went down the river to Mount Vernon, and inspected the old Washington residence. The weather was charming, and the trip was greatly enjoyed by all who took part in it.

In the evening President Pearce read his address, which was devoted to the subject of the association of gold with other metals in the Colorado ores.

Dr. Pearce's views are very briefly summarized as follows: Gilpin County, Cal., mines furnish a great variety of gold ores, some "free milling," some "base" or "refractory."

When the mines reach a depth below the oxidizing influence of surface

water, the gold is found in a condition in which it cannot be amalgamated. The change in the mineral from pyrite to limonite must have produced some sort of cleansing effect on the gold. Mr. Pearce thinks it not improbable that the gold during the change was dissolved and again precipitated in a pure state.

Mr. R. G. Hills points out that gold in the Little Annie Mine, Colo., has been dissolved or leached out from one point and re-precipitated at another as a result of the alteration of pyrite into limonite. Mr. Pearce thinks this transformation may be explained by the solvent action of certain solutions. Thus alkaline chlorides "and manganese peroxide which always occurs in gossans," with the aid of free sulphuric acid, would bring about this change.

The Gilpin County gold ores all contain bismuth and show arsenic in roasting, though it is not observable in the ore, and Mr. Pearce thinks an association of bismuth and arsenic is accountable for some of the bad features of these ores. He mentions instances of the association of arsenic and gold, and tellurium and gold and silver. Mr. Pearce mentioned some experiments he made in fusing pure gold with non-pyrites. The gold all remains as pure gold distributed through the matte in very small globules. When gold and silver in equal quantity are melted with pyrite the gold disappears, and no alloy of gold and silver can be observed; but on dissolving the finely powdered material in nitric acid, a dark bronze crystalline powder is separated which is composed of 89.06 per cent. gold and 10.94 per cent. silver.

Mr. Pearce thinks this may result from a sulphide of gold and silver decomposed by the nitric acid. Gold and bismuth fused with pyrite gave a matte showing no metallic gold, but the matte heated with nitric acid gave a bronze-colored crystalline sponge containing 89.06 gold and 10.94 bismuth.

Gold, silver and bismuth fused with pyrite gave a matte in which the gold-silver alloy was visible, and dissolved in nitric acid left a sponge containing 82.2 per cent. gold, 17.8 per cent. silver. A compound of gold and bismuth was found. Mr. Pearce concludes that used iron sulphide has no solvent power on pure gold, but in the presence of other metals the gold combines with these and passes into solution.

In regular copper matte smelting he found that the gold formed an alloy with copper, leaving the silver, bismuth and other metals to pass into the matte in a condition to be dissolved, and not as sulphides. The gold and copper alloy forms octahedral crystals.

#### CONCENTRATION BEFORE AMALGAMATION FOR LOW-GRADE, PARTIALLY DECOMPOSED SILVER-ORES.\*

The treatment of silver ores of too low a grade to justify either smelting or preliminary roasting, and yet not "free" enough to permit of raw amalgamation, has ever been a serious problem. As bearing upon it, the operations of the Combination Mining and Milling Company of Black Pine, Deer Lodge County, Montana, during the past year may not be without interest. It is not claimed that the process to be described is not susceptible of great improvement, nor is any claim of originality made for it; but its use is, as yet, not very general, and it seems to offer a means of profitably working the large class of partially decomposed argentiferous ores which, by reason of their low grade, demand some cheap, continuous process for their profitable treatment.

The following analysis, made by Messrs. Von Schulz and Low, of Denver, from a sample of the mill battery for the month of October, 1888, will show the character of the ore:

Qualitative tests gave silica, carbonic acid, sulphur, iron, copper, lead, antimony, arsenic, zinc, manganese, silver, gold, a little chlorine, a little mercury, doubtful traces of cobalt, and very small amounts of calcium, magnesium and soda.

The same sample by quantitative analysis gave:

Silica, 84.09 per cent.; sulphur, 0.19 per cent.; iron, 7.05 per cent.; copper, 1.31 per cent.; lead, 1.01 per cent.; zinc, 0.30 per cent.; manganese, 0.35 per cent.; antimony, 0.66 per cent.; silver, 0.08 per cent.; arsenic, 0.05 per cent.

In gold the ore runs 0.000857 of one per cent., or 50 cents to the ton. In connection with the analysis of the Combination ores we quote the following remarks of President Richard Pearce: "The Combination ore is of a very curious nature. My attention was directed to it some six years ago, and I then discovered hübnerite (tungstate of manganese), and a very rare mineral, pseudomalachite (phosphate of copper), and these finds were noticed in the *Transactions* of the Colorado Scientific Society. The presence of  $P_2O_5$  in the ore is suggestive of the origin of the deposit; it must have come from the adjoining rocks. We know of no phosphides which correspond with the arsenides of copper. Arsenides of copper can always be accounted for by the oxidation and alteration of enargite into arseniates." Our attention having been called to the presence of hübnerite by Mr. Pearce, a determination was made by Messrs. Von Schulz and Low from a sample of concentrates. 20 tons into one, which gave 0.33 per cent. tungsten.

The mill, as originally constructed by Messrs. Fraser and Chalmers for the Black Pine Mining Company, was an ordinary 10-stamp, wet-crushing mill, with room left between the battery and settling tanks for concentrating machinery should it be found necessary to add it. As illustrating the impracticability of working these ores by raw-amalgamation alone a short summary of the operations of the Black Pine Mining Company may be given.

The mill was started on the 16th of July, 1887, and the run lasted until the 14th of September of the same year. During this period there were treated 1,178 dry tons of ore, assaying 17.5 ounces, and containing 20,615 fine ounces silver. Of this amount there was recovered in the form of bullion 9,482.90 fine ounces, or 46 per cent. of the battery assay.

We need only note the points of difference between the Combination Company's plant and the form of mill ordinarily employed for treating silver ores of the class usually termed "free-milling." These, as is well-known, are so-called more because their low grade precludes their profitable treatment by the various other more efficient but vastly more expensive methods, than because they are better adapted to that process.

The ore is stamped, passed over four Frue vanners, the light pulp that

goes over their "tails" being settled in tanks, shovelled into pans, and there amalgamated, discharged into settlers, and the resultant amalgam strained, retorted and melted in the usual manner. An analysis of these concentrates for the month of October, 20 tons into 1, gave the following results:

Silica, 32.50 per cent.; lead, 9.10 per cent.; copper, 8.22 per cent.; sulphur, 1.19 per cent.; zinc, 0.81 per cent.; silver, 0.54 per cent.

Samples of the pulp going to the pans for the same month showed that it contained:

Copper, 1.05 per cent.; lead, 0.48 per cent.; zinc, 0.25 per cent.; sulphur, 0.09 per cent.; silver, 0.05 per cent.

For the year ending May 31, 1889, the details of milling were as follows:

Dry tons crushed	9,061.965
Average assay, ounces of silver per ton	22.67
Gross contents of ore, ounces of silver	205,434.75
Estimated per cent. of reduction	80.70
Estimated product	165,785.84
Dry tons concentrates produced	541,805
Average assay of concentrates, ounces of silver per ton	136.17
Silver in concentrates	73,777.55
Silver in bullion	97,080.60

Total fine ounces	171,438.15
Actual per cent. saved	83.45
Total cost of milling	\$39,537.61
Average cost per ton	\$4.36

Batteries in service, 347 days, 5½ hours.

Average ore crushed per stamp in 24 hours, 2,612 tons.

An analysis of the cost of treating one ton for the year gives the following figures:

Labor and superintendence	\$25,821
Salt and other chemicals	2,965
Fuel, at \$1 per cord	1,944
Castings and iron	3,846
Oils and illumination	1,066
Quicksilver	4,915
Miscellaneous supplies and team in yard	3,084
Total	\$43,641

When the mill was started by the present management, an assay of the escaping slime-water was made, showing the value of the slimes carried by it to be 52 ounces in silver to the ton, or more than double the silver contents of the original ore. A series of carefully conducted experiments were at once inaugurated, and from them it was learned that three tons of these slimes, dry, containing 156 ounces of silver, were passing through the waste-gate from the settling-tanks every 24 hours. These slimes were too light to permit of their being thoroughly settled by even the most extensive system of tanks, and to check this heavy loss, a China pump was placed in the last of the series of slime tanks. This pump discharges into a small tank placed above and immediately in front of the mortars. It is only one foot deep, being made shallow in order to prevent the gradual settling of slimes in it, and the consequent necessity of cleaning it out from time to time. From the side of this tank, and near its bottom, is the 2-inch pipe for supplying the water to the stamps. The only purpose of this tank is to furnish water to the stamps at uniform pressure. By prohibiting the use of any clear water in the battery, the escape of these slimes was very materially reduced, but this of itself was not enough to stop all overflow, as it would be in an ordinary wet-crushing mill, for reasons which will be explained later on.

The immediate effect of turning back into the battery, say two tons every 24 hours of slimes carrying twice as much silver as did the original ore (and this proportion of values has always existed), was to heavily "salt" our battery sample, and as the most rigid economy was essential to the commercial success of the property, the question of securing any accurate check on the mill became momentous. After careful consideration, it was decided to adopt the following system: Night and day samples are taken from the battery launders in the usual manner, and are assayed daily with the other mill samples, but the results are corrected by the salting for the previous month. To determine this percentage, it is simply necessary to obtain the actual battery assay, and this is secured from the data furnished by the balance of the mill work, after the monthly averages are made up, in the following manner: The number of tons crushed, minus the number of tons of concentrates produced, must equal the number of tons amalgamated. The number of tons amalgamated, multiplied by the average assay pan sample, must be equal to total silver contents of the pump amalgamated. This, added to the total silver contents of the concentrates produced, secured in the same manner, gives the grand total of fine ounces of silver in the ore. This divided by the number of tons crushed gives the actual battery assay. In this computation all tons are dry tons. The percentage of salting thus determined varies slightly, but the fluctuation is due more to errors in sampling than to any change in the actual amount of the salting. Usually, this is about five per cent.

But there was still a heavy loss in the escape from the settling-tanks of water carrying rich slimes, owing to the introduction of water at the heads of the vanners. To stop this, a small jet-pump, using steam from the boilers and supplied with 50 feet of steam-hose for a discharge, was placed at the tanks, and slime water used in lieu of clear water for thinning down the pulp in the pans. While this corrected the evil, it also had the effect of increasing the difficulties in the way of concentration, as, in order to stop all overflow from the tanks, only as much water could be used on the heads of the vanners as was pumped into the pans, plus the evaporation.

After much experimenting it has been found that with the limited quantity of water that can be used on the vanners, a speed of 180 revolutions of the crank-shaft per minute, with a belt travel of three and a half feet per minute, and an inclination of three and a half inches in the length of the machine, gives the most satisfactory results on these ores, although intelligent and constant adjustment is rendered necessary by reason of the changes occurring from time to time in the character of the pulp treated.

By reference to the details of milling for the year ending May 31, 1889, it will be noticed that the mill overran its assays 2.49 per cent., or 5144.63 ounces. As the actual battery assay is determined by the assays of average pan and concentrate samples, and as the pan sample is of necessity taken before the rich slime water is pumped into the pans for the pur-

\*Abstract of a paper by C. W. Goodale, Butte, Montana, and William A. Akers Phillipsburg, Montana. *Transactions of the Am. Inst. Mining Engineers.*

pose of thinning down the pulp, the mill is bound to overrun, presuming perfect accuracy of sampling and assaying, exactly the amount of that part of the silver contained in the slime water used in the pans which is amalgamated. As the greatest care is exercised to secure the most accurate sampling possible, and as in the assaying no deduction is made for silver in litharge, except in the tailings sample, the amount that the mill overran may safely be credited to the use of slime water in the pans.

The pan charges have been changed constantly, according to the character of the pulp treated, and the amalgamation tests have been many and varied. The charge now being used, which seems to be the best tested, is 50 pounds of salt, 2 pounds of sulphuric acid, and 1/4 pound of cyanide, with 100 pounds of quicksilver strained in after the pan has been running four hours. The temperature of the pulp is raised by steam to 180 degrees Fahrenheit, and the charge is run at 65 revolutions per minute for eight hours. Settlers are run 14 revolutions per minute, and give good agitation with 3-inch shoes.

In the battery, 40-mesh brass-wire screen-cloth has been used during the past year, with the exception of about two weeks, when 30-mesh was tried by way of an experiment. After a thorough test it was found that the loss occasioned by higher tailings exceeded the profit accruing from increased crushing capacity, and the 40-mesh screens were replaced. The falling off in the savings during the time the 30-mesh screens were in use was largely owing to the fact that the difference between the very finest of the slimes and the coarse particles that would pass through a 30-mesh screen was so great that with the increased quantity of pulp to be treated by the vanners, they could not be made to do close and clean work.

COMMENTS ON THE CHEMICAL REACTIONS IN THE BLAST-FURNACE.

Written for the Engineering and Mining Journal by A. D. Elbers.

After having attempted in previous and somewhat preliminary articles\* to counteract the still prevailing tendency of admitting the possibility that reactions may take place in the furnace between oxygen, carbon and iron that would constitute a sort of a go-as-you-please process in which CO and CO<sub>2</sub> can only be made to do the proper thing when they happen to become intermixed in certain proportions, and in which the iron can do both—dissolve carbon and extract it from gases—I now propose to give an opportunity to scrutinize whether my suggestions on the rules of combination have been worked out in detail, through all of the various oxidizing and carbonizing changes, with any degree of logical sequence.

The composition of the least oxidized but unstable compound of iron and oxygen corresponds—as nearly as can be analytically determined—to the formula: 4Fe + O = Fe<sub>4</sub>O. It is immaterial whether the respective iron molecules are united in blocks or aggregates of four, forty or four hundred, but it is highly important, even in a practical sense, to be able to account for the gradual chemical changes *within* these aggregates, from the lowest to the highest stage of known oxidation. For if we can produce cogent arguments to the effect that metals, metalloids, and their compounds must consist of aggregates having fixed numbers of molecules and being less firmly or closely united among themselves than their molecules are, and that some of these molecules change chemically while others do not, then many still insufficiently explained phenomena, such as the occlusion of gases, the expanded volume of hardened steel, the repetition or second appearance of oxide tints on tempering steel, the pleochromic properties of certain silicates, etc., will also be more fully understood.

It is known that no higher degree of oxidation than that of Fe<sub>3</sub>O<sub>4</sub> can be produced on heated metallic iron, but that magnetic oxide can be partly changed to ferric oxide by intense heating when the oxygen of the air finds no greater affinity, *i. e.*, when there is no metallic iron present. Hence it is logical to assume that those molecules within the same aggregate, which are most exposed to the influx of oxidizing gases, can only reach the higher and stable forms of oxidation after the other molecules, which are farther removed from such contact, have become oxidized to a certain degree, but that the aggregates of all unstable oxides, from Fe<sub>2</sub>O to Fe<sub>3</sub>O<sub>4</sub> (= Fe + FeO + 2Fe<sub>3</sub>O<sub>4</sub>), still contain molecules of metallic iron.

The same theory is applicable to the progress of deoxidation, and also to that of carburization if the latter is assumed to set in at the last stage of deoxidation. This reversed order, *i. e.*, the progress of deoxidation, being the more pertinent one in considering blast furnace reactions, is illustrated in the following table, from which the evolution of Fe<sub>3</sub>O<sub>4</sub> has been left out because its introduction would necessitate the adoption of a greater common multiple than the one heretofore used (Fe<sub>12</sub>):

- A. FeO + CO = Fe + CO<sub>2</sub>
- B. FeO + 2CO = Fe + CO<sub>2</sub> + CO
- C. FeO + 3CO = FeC + 2CO<sub>2</sub>

Fe <sub>12</sub> O <sub>18</sub>	-2O	{ -10O }	+ 6CO	+ 6CO	+ 9CO
	or + 2CO	{ or + 1CO }			
FeO > O	FeO > O	FeO > O	FeO	FeO	FeC
FeO > O	FeO	FeO	FeO	Fe	Fe
FeO > O	FeO	FeO ×	Fe	Fe	Fe
FeO > O	FeO > O	FeO ×	Fe	Fe	Fe
FeO > O	FeO > O	FeO > O	FeO	Fe	Fe
FeO > O	FeO > O	FeO > O	FeO	FeO	FeC
FeO > O	FeO	FeO ×	Fe	Fe	Fe
FeO > O	FeO	FeO	FeO	Fe	Fe
FeO > O	FeO > O	FeO > O	FeO	Fe	Fe
FeO > O	FeO > O	FeO > O	FeO	FeO	FeC
6Fe <sub>2</sub> O <sub>3</sub>	4Fe <sub>3</sub> O <sub>4</sub>	3Fe <sub>3</sub> O <sub>4</sub>	3Fe <sub>4</sub> O <sub>3</sub>	3Fe <sub>4</sub> O	3Fe <sub>4</sub> C
		+ 3FeO (×)			
No. 1.	2.	3.	4.	5.	6.

The above mode of notation appears to be the most suitable one for illustrating the structural relations of the aggregates. Column No. 1 is

fully saturated. In No. 2 two molecules of oxygen have been removed, with the result that four molecules of FeO are set free, which then unite with the adjoining molecules of Fe<sub>2</sub>O<sub>3</sub>, thereby forming four aggregates of Fe<sub>3</sub>O<sub>4</sub> out of the three aggregates of Fe<sub>2</sub>O<sub>3</sub>. In No. 3 only one additional molecule of oxygen has been removed, whereby the three molecules of FeO, marked +, are set free, which have no chance to unite directly with higher oxides; hence their molecular approachment is apt to be again in the direction of re-establishing the original number of aggregates. The further elimination of 3O, in column No. 4, breaks up the remaining stable compounds, and thereafter the deoxidation of FeO molecules begins (see reaction "A"), the initial result probably being, that one molecule of FeO is reduced in each aggregate, the two re-actions requiring, together, the influx of 6CO. The change must be a gradual one, because the CO<sub>2</sub> that is developed by the deoxidation of the first molecule of FeO has to pass before the next molecule of FeO can become reduced. In other words: CO<sub>2</sub> prevents reduction. This gradual deoxidation of each aggregate, as indicated in columns No. 4 and 5, probably starts from the interior and then extends towards the circumference, which is the reverse of the progress of oxidation; and the carburization can only set in in the measure in which the CO<sub>2</sub> has passed out, until, finally, as shown in column No. 6, the last molecules of FeO become carburized, in conformity with reaction "C," always provided that the CO<sub>2</sub> evolved from other aggregates, or also from the combustion of carbon, does not prevent carburization or even deprive some of the carbides (FeC) of their carbon. Here we have then—what I consider to be—a more rational explanation of the possibility of opposite reactions (FeC + CO<sub>2</sub> = Fe + 2CO) than the assumption that CO<sub>2</sub> could reoxidize iron particles that have just evolved it, can afford. Plenty of fuel, and a correspondingly large production of CO have, therefore, the effect of producing Fe<sub>4</sub>C (from which graphite becomes segregated by already bespoken subsidiary reactions); but when the supply of CO runs short (reactions "A and B") then the iron output is apt to consist of compositions varying from Fe<sub>4</sub>C + Fe<sub>3</sub>C to 8 Fe + Fe<sub>4</sub>C = Fe<sub>12</sub>C, *i. e.* of pig iron that is low in carbon.

Whether the suggestions herein contained are plausible, I have to leave to those who have thorough practical as well as theoretical knowledge of the working of blast furnaces. In order to facilitate such investigation I append a pro forma calculation, in which the deviations from customary reckonings are in conformity with my own interpretations. The pro-forma charge and its reactions are estimated on the basis of

1,428<sup>6</sup> lbs. of Fe<sub>2</sub>O<sub>3</sub> = 1,000 lbs. Fe.  
 Total weight of air-blast to " " = 5:1  
 " " carbon " " = 8<sup>62</sup>:10  
 Percentage of carbon absorbed by the iron (Fe<sub>4</sub>C) = 5<sup>36</sup>%

Calculation.

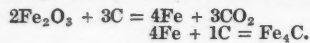
5,000 lbs. of dry air (23% O: 77% N) yield.....	1,150 lbs. O
1,150 lbs. O change to CO <sub>2</sub> by combining with.....	431 lbs. C
	1,581 lbs. CO <sub>2</sub>
1,581 lbs. CO <sub>2</sub> change to CO by taking up.....	431 lbs. C
	2,012 lbs. CO
The change of 1,428 <sup>6</sup> lbs. Fe <sub>12</sub> O <sub>18</sub> to Fe <sub>12</sub> O <sub>3</sub> or Fe <sub>4</sub> O requires.....	$\frac{357^2 \times 28}{16} = 625$ lbs. CO
The change of Fe <sub>4</sub> O to Fe <sub>4</sub> C re- quires.....	$\frac{71^4 \times 3 \times 28}{16} = 375$ lbs. CO
	1,000 lbs. CO
Excess.....	1,012 lbs. CO
357 <sup>2</sup> lbs. O = $\frac{357^2 \times 44}{16}$ change to.....	982 <sup>3</sup> lbs. CO <sub>2</sub>
71 <sup>4</sup> lbs. O = $\frac{71^4 \times 2 \times 44}{16}$ change to.....	392 <sup>7</sup> lbs. CO <sub>2</sub>
	1,375 lbs. CO <sub>2</sub>
428 <sup>6</sup> lbs. O from ore. 808 <sup>4</sup> lbs. C gasified (862 - 53 <sup>6</sup> in the metal).	
5,000 lbs. of air from the blast.	Nitrogen 3,850 lbs.
6,237 lbs.	Total gases escaping: 6,237 lbs.

If 1,000 pounds of carbon and 600 lbs. of CaCO<sub>3</sub> had been used with the same quantity of air (5,000 lbs.), the proportions of Co and CO<sub>2</sub> would be:

	CO <sub>2</sub>	CO
Derived from ore, as before.....	1,375 lbs.	
" " 600 lbs. CaCO <sub>3</sub> .....	264 lbs.	
	1,639 lbs.	
Derived from blast, as before.....		1,012 lbs.
1,000—862=138 lbs. C abstract 44 × 138		506 lbs.
		12
and produce therewith.....		644 lbs.
Composition of } N 58%	Total: 1,133 lbs. 1,656 lbs.	
gases at the } CO 25%		
furnace mouth, } CO <sub>2</sub> 17%		

From the foregoing I draw the following conclusions:  
 1st. The reduction and complete saturation with carbon of Fe<sub>2</sub>O<sub>3</sub> requires theoretically one pound of CO for each pound of Fe, and that of Fe<sub>3</sub>O<sub>4</sub>: one-twelfth less.  
 2d. The proportion of the quantity of CO that is required for actual carburization increases much more rapidly with the degree of saturation than the theoretical proportion.  
 3d. The more completely the reducing ore becomes carburized the less heat is required for its fusion; in other words, 75 pounds of Fe and 30-36 pounds of FeC (= 105-36 pounds of Fe<sub>4</sub>C) require less heat for fusion than 100 pounds of Fe, Fe<sub>3</sub>C, Fe<sub>2</sub>C, etc.  
 It may also be interesting to compare the results of the above pro-forma

calculation with those that are obtained with the same quantities by calculating the re-actions in accordance with the formula :



431 lbs. C combine with 1,150 lbs. O to	1,581 lbs. CO <sub>2</sub> .	
216.7 " " " " " " " " " " " "	795 " " " " " " " " " " " "	to 1,012 lbs. CO.
Which leaves.....	786 " " " " " " " " " " " "	
160.7 lbs. C combine with 428.6 lbs. O from the ore to.....	589 " " " " " " " " " " " "	
808.4 lbs. C.		
428.6 lbs. O from the ore.		
5,000 lbs. blast.		3,850 lbs. N.
6,237 lbs.	Total of gases:	6,237 lbs.
With 1,000 lbs. of carbon and 600 lbs. CaCO <sub>3</sub> .		
431 lbs. C combine, as before, to.....	1,581 lbs. CO <sub>2</sub> .	
354.7 " " " " " " " " " " " "	(216.7 + 133)..... wit 1,301 " " " " " " " " " " " "	to 1,656 lbs. CO.
Which leaves.....	280 " " " " " " " " " " " "	
160.7 lbs. C combine with O from ore, as before, to.....	589 " " " " " " " " " " " "	
Derived from CaCO <sub>3</sub> .....	234 " " " " " " " " " " " "	
53.6 lbs. C in the metal.		= 1,133 lbs. CO <sub>2</sub> .
1,000 lbs.		

It will be readily noticed that the ultimate results remain the same, whether the calculation is based on the re-actions of  $m\text{Fe}_2\text{O}_3$ , with  $n\text{CO}$ , or with  $n\text{C}$ , but that the primary, as well as the intermediate, results differ materially.

The salient features are: In the first case, it has to be assumed that nearly the whole of the fuel carbon changes to CO, that about one-half of the latter becomes utilized, and that all of the escaping CO<sub>2</sub> (barring that of the limestone, which was purposely left out in the first example of each kind) is produced by substitution, or, as it may be called in this case, from "secondary" reactions; in the second case, it has to be assumed that a much smaller quantity of CO is produced, the whole of which escapes unutilized, and that a considerable quantity of CO<sub>2</sub> that has been produced at the tuyeres—*i. e.* by synthetical or "primary" re-action—shall escape from the furnace without having performed any chemical work, and that is an impossibility.

HOBOKEN, February 17, 1890.

#### PALENQUE, THE AMERICAN POMPEII.

Without doubt the buried city of Palenque is the most interesting ruin in America, if not in the world. The very race and language of the people who built it are lost, and no one has yet interpreted the curious hieroglyphics which cover its massive walls. Here are ruins showing a degree of engineering skill which closely resembles that of the ancient Egyptians. Perhaps the strangest thing connected with this extraordinary place is the fact that antiquarians and Egyptologists have never investigated these ruins or sought to interpret these numerous graven records of a great, though long-forgotten, race.

Among the most interesting and extensive ruins of the cities of those mysterious races who antedate the Spanish invasion of Central America, and whose history is carved in the symbols of an unknown tongue on many tablets and monuments of stone, are those of Palenque, which is on the ninety-second meridian west of Greenwich and in about 17 degrees 29 minutes north latitude, in Chiapas, on the border lands of old Mexico and Yucatan.

Palenque was visited by nearly a half-score of travelers before its exploration under competent direction was attempted in 1840 by Stephens and Catherwood. But they reached the site at the beginning of the rainy season, at the end of a journey of extraordinary difficulty, full of hardship and disaster, and conducted their researches under quite as discouraging conditions as did any of their predecessors. Since then there has been no effort whatever to bring to light the archaeological riches of this wonderful ruin.

The work of exploration was done with extraordinary intelligence and thoroughness under the circumstances, and a wise discretion was undoubtedly exercised in the selection of the subjects for description and illustration, but the explorers turned away at last with hearts full of regret over their inability to lay bare more than the most prominent and easiest accessible features of the vast monumental piles that form the ruins of what must once have been the centre of a dense and intelligent, if even a morally hopeless, degenerate population. Stephens says: "We were exceedingly anxious to make excavations, clear out the mass of rubbish, and lay the whole platform bare, but this was impossible. It is probably paved with stones or cement, and from the profusion of ornament in other parts there is reason to believe that many curious and interesting specimens may be brought to light. This agreeable work is left for the future traveler, who may go there better prepared with men and materials and with more knowledge of what he has to encounter."

Palenque was accidentally stumbled upon by a party of Spaniards who were traveling in the interior of Mexico in 1750. They had wandered in search of things new and strange, into the region north of Chiapas, when they all at once found in the midst of a vast solitude ancient stone buildings, the remains of a vast city, still embracing from eighteen to twenty-four miles in extent, and known to the Indians by the name Casas de Piedras. The Indians themselves could give no account of its origin. To this day it is not known by what name it was called, and the name given to it, Palenque, is taken from the village near which the ruins stand. Two exploring parties sent out by Spain, one under Capt. Del Rio in 1787, the other under Capt. Duplax in 1805-6-7, made reports upon the Palenque ruins, which reports were published in 1822 and 1835, respectively, too long after the work of exploration to accomplish any desirable result.

When visited by the American explorers the ruins were overgrown with so dense a forest of gigantic trees and tangled undergrowth that a person ten yards distant in any direction could not be seen. And having no axes or shovels or spades, but only the machete—a short, broad-bladed sword of the Indians—with which to clear away this accumulation of centuries of luxuriant vegetable growth, but little, compared with the entire task, could be accomplished.

Fine buildings, constructed of stone, with a mortar of lime and sand, were found here, the outer walls of which were covered with stucco and painted. The principal of these structures was the so-called palace. It faces the east and measures 228 feet front by 180 feet deep. It stands on an artificial elevation 40 feet high, 310 feet in front and rear, and 260 feet on each side. This elevation was originally faced with stone, but the crowding vegetation has left naught but the foundations standing. The palace is not more than 25 feet high, but it is rendered very imposing by a broad projecting cornice of stone. The front is pierced by 14 arched doorways, about nine feet wide each, and the intervening piers are between six and seven feet wide. The piers which remain standing are ornamented with figures in bas-relief and with intaglio inscriptions in hieroglyphics. In some of these the remains of red, blue, yellow, black, and white pigments were discovered. The figures, usually drawn or engraved in profile, are of persons, male and female, in attitudes of worship generally, but always in posture of worship, clad fantastically and ornamented with indescribable head-dresses, necklaces, and jeweled regalia. Every tablet contains an inscription in symbols of the forgotten tongue, which, if it could be read, would probably tell the history of the picture. The palace was divided and partitioned by interior walls of masonry into a multiplicity of small rooms opening upon interior courts, of which there were four. In one of the rooms was an elaborately carved altar of stone; in another there were sculptured tablets; and on the east and west sides of a court 80 × 70 feet in area, in the northeast quarter of the palace, were large tablets of hieroglyphics, colossal figures in relief, and smaller figures of females, richly robed and ornamented, but crouching in attitudes expressive of fear and terror.

Adjoining the palace on the southeast corner is a structure standing on a pyramid 110 feet high on the slope. It is 76 feet long and 25 feet deep and about 30 feet high. It has five doorways and six piers, all standing, topped by a wide cornice of stone, with a roof that is shaped much like a mansard roof of recent architectural design. The whole front is richly ornamented in stucco, and the corner piers are covered with hieroglyphics, each containing ninety-six squares. On the interior walls are three tables of hieroglyphic inscriptions carved in symmetrical lines out of stone. One was only about half finished when the work was arrested forever by the unknown catastrophe that came "like a thief in the night" and obliterated the race of builders and all knowledge of their literature. The solution of these inscriptions would in all probability shed the light of truth upon the dark mystery of the origin and history of the ruins and their builders, and might reveal things that are more interesting and important from an ethnic point of view than the discoveries at Herculaneum and Pompeii. The hieroglyphics are of a similar character to those found at Copan and Quirigua, indicating that they were engraved by the same race of people.

Remains of an aqueduct by which the city was supplied with water from a stream close by adjoin this ruin, and further on is a broken stone terrace, about 60 feet on the slope, with a level esplanade from which rises another pyramid, now overgrown with trees. It is 134 feet high on the slope, and on its summit is another stone building 50 feet wide and 31 feet deep, having three square doorways in front, but no other openings. The building faces the south, contains three chambers within each other, and sculptured ornaments and hieroglyphics inside and out. In the inner chamber there is an altar, and over the altar on the wall a remarkable sculpture in bas relief. Central in the picture is a richly-carved cross, a very significant figure in this place, surmounted by an apparently defied bird. On either side of the cross are a man and woman standing in the attitude of offering sacrifice to the bird deity. A tablet containing over a hundred hieroglyphic inscriptions occupies a third of the space on the left, and undoubtedly relates to the graven picture. The remaining buildings are similar in character to those which have been described. And in the dense forest that has overgrown the site of the ancient city are hidden deep from the gaze of man as many and as important objects of archaeological interest as any that have yet been disclosed. But one statue was discovered—that of a female figure, 10 feet 6 inches high, and more resembling Egyptian portrait statuary than anything else discovered in this new "Old World." But it is a sufficient promise of other statues and monuments in the depths of the forests round about. Where these great monolithic idols came from, how they were taken from the quarry, how transported and erected, with what instruments they were sculptured, and the thousand collateral and connected questions relating to the designers and builders of the massive structures round about, are questions of the keenest interest that call louder for solution than any other unsolved problem of history, and are yet hidden in the depths of the forest that year by year are deepening the oblivion in which they will be eventually forever lost past all human power of resurrection. Unless the probe of science be soon applied, these treasures of antiquity will slip forever from the grasp of civilization.

**Basic Lining for Bessemer Converters.**—The Pottstown Iron Company, of Pottstown, Pa., have acquired the patent for the United States, for the basic lining for Bessemer converters invented by Ernest Bertrand, of Kladno, Bohemia. The method is somewhat similar to what has been done with acid lining, *viz.*, to grind the material, in this case dolomite or limestone; mix it with water, and with or without an adhesive substance, like molasses, form it into bricks. The latter are burnt at a white heat for about 48 hours in a kiln. These burned bricks are again ground and mixed with 10 to 12 per cent. of tar, the product being used to ram up in the converter. Bertrand claims that the preparatory grinding of the stone into brick, the baking of the latter and grinding the burned brick, yield a product more homogeneous than can ever be obtained from the cupola or kiln-burned dolomite. He claims, too, greater accuracy of material, because there is always a loss of the fine stuff which must be thrown away because it cannot be freed from cinder.

THE ENGINEERING ASSOCIATION OF THE SOUTHWEST.

The Association met in regular monthly session at the Y. M. C. A. Building, Nashville, Tenn., on Thursday evening, Feb. 13th, with about thirty in attendance. In the absence of President John MacLeod, of Louisville, the meeting was called to order by First Vice President W. F. Foster, of Nashville, who called to the chair Maj. E. C. Lewis, of Sycamore, Tenn., who presided during the meeting.

Mr. Berrien L. Blackie, of Nashville, was elected as member, and Messrs. Alfred Hume, J. Price Jackson and Tyler Calhoun, of Nashville, as juniors. The executive committee of the directors unanimously recommended that, in view of the unexpectedly large number of non-resident members, the policy of deferring for the present the furnishing of permanent quarters for the association be adopted, and the amount of money thus saved be added to the fund for printing, in order that a larger number of papers than otherwise might be printed for distribution among the membership. The recommendation received the general support of the resident members, and will, without question, be adopted. In accordance therewith Mr. W. C. Smith, Chairman of Standing Committee on Rooms and Library, reported that he had secured from the proprietor of the previously adopted quarters in Baxter Court, Nashville, the privilege of release from the lease contract. In keeping with the above idea of rendering the work of the association as valuable as possible to the non-resident membership, it was decided to hold about one regular meeting in three at such points outside of Nashville as would accommodate in succession the membership in the several localities. As Kentucky contains nearly as many members as Tennessee, the first outside meeting will probably be held at Louisville.

Applications for membership were received from Messrs. Charles O. Bradford, New Albany, Ind.; James A. Fairleigh, Chattanooga, Tenn.; Bernard A. Wood, Columbia, Tenn.; William Walker, Birmingham, Ala., and Thomas Sharpe, Nashville, Tenn. The executive committee also reported back favorably the resolutions calling for the appointment of a special committee on "Highway Reform," and the resolutions will now go before the membership for letter ballot.

President MacLeod transmitted to the association for Mr. Charles Macdonald of the Union Bridge Company, large photographs of the Hudson River Cantilever Bridge at Poughkeepsie, N. Y., and of the Niagara Cantilever Bridge and the Hawksbury Bridge, near Sydney, Australia.

A paper on "The New Passenger Incline Railway on Cameron Hill, Chattanooga, Tenn." was read by Mr. Linn White of that city. The incline described was designed by and built under the direction of Messrs. Guild & White, civil and mining engineers of Chattanooga, for the Chattanooga Water and Power Company, and was opened for traffic on October 10th, 1889. The incline comprises a double track line of three rails with a fourth rail at the center passing point. The length of incline is 1,495 feet, rise 300 feet, maximum grade 31 per cent, minimum grade 1 per cent., average grade 20 per cent., at which inclination the car floors and seats are built to level. The cars, two in number, are attached by permanent grips to opposite sides of a 1-inch hauling cable that passes through the driving machinery at the top of the incline, which is reversed at the end of every trip. The alignment is straight except for 100 feet of 6 degrees and 40 minutes curve to left (ascending), and 150 feet of 10 degree curve to right. The gauge of the track is four feet; length of ties for double track, 12 feet. The rails are laid directly on stringers seven inches by 12 inches, 16 feet long, bolted to top of ties in order to give room for the cable conduit on those portions of the line which occupy city streets. The cars have a seating capacity of 30 passengers and are stopped at any point of the line by electric signals from the conductor to the engineer at the upper station. The electric signals are transmitted through overhead wires with which connection is maintained with the cars by traveling trolleys projecting from the top of cars. To insure the prompt starting of a descending car that may have been stopped on the nearly level portion of the line, a three quarter inch "tail cable" passes from each car to the foot of the incline, around the tension sheaves and returns to the other cars, the cars being thus attached to an endless cable whose direction of motion is reversed after every trip. The slack of the cable is taken up by the movable tension carriage at the foot of the incline, which works against stiff springs in preference to weights and has a travel of about three feet.

The trips are made in three minutes' time. The provision for holding the cars in the event of a break of the cable comprises a sector brake shoe which falls under the wheels and onto which the wheels roll forcing down a "V" shaped grip onto the rail-head. This brake has repeatedly held the cars motionless on the steepest portion of the incline. To guard against the dangers due to possible "over-winding" the upper extension of each track terminates in a level piece of track, the upper end of which delivers off the ends of the rails onto level ground, from which the cars cannot return to the rails unaided.

Mr. White's paper, with the drawings, will doubtless be printed in full by the association at an early date.

The discussion of this paper occupied so much time that Mr. C. A. Locke requested that his paper on the "Government Survey of the Lower Cumberland River," be postponed until the March meeting.

**Production of Gold in Queensland, Australia.**—The production of gold in Queensland for the past year is estimated to have been 738,000 ounces, against 482,000 ounces in 1888. This increase of more than 53 per cent. is mainly due to the large production of the Mount Morgan mine.

**Electrical Underground Railway in London.**—Experimental trials have been made on Southwark Subway with the electric locomotive, by which this new underground line is to be worked, and highly satisfactory results are said to have been obtained. With a train of three carriages, conveying 100 persons, the maximum load to be carried by any train when the line is open for traffic, a speed of 20 miles an hour was obtained, and the locomotive alone ran at a speed of 30 miles an hour. It is possible before the subway is formally opened for traffic in the spring that further improvements in the electrical plant may be made, by which the speed may be still further increased.

BOOKS RECEIVED.

[In sending books for notice, will publishers, for their own sake and for that of book buyers, give the retail price! These notices do not supersede review in another page of the Journal.]

*A Handbook of Engine and Boiler Trials and of the Indicator and Prony Brake.*—By R. H. Thurston, Dr. Eng. Director of Sibley College, Cornell University. Published by John Wiley & Sons, New York, 1890. Pages 514 and Index. Illustrated. Price, \$5.

DIVIDENDS PAID BY MINING COMPANIES DURING JANUARY AND SINCE JANUARY 1ST, 1890.

NAME OF COMPANY.	Paid in Jan.	Paid since Jan. 1st.	NAME OF COMPANY.	Paid in Jan.	Paid since Jan. 1st.
Badger, Ontario.....	25,000	25,000	Homestake, Dak.....	12,500	12,500
Boston & Mont., Mont..	100,000	190,000	Iron Mountain, Mont.,	25,000	25,000
Calliope, Col.....	10,000	10,000	Kearsarge, Mich.....	100,000	100,000
Calumet & Hecla, Mich.	500,000	500,000	Mammoth, Utah.....	10,000	10,000
Cons. Cal. & Va., Nev..	54,000	54,000	Montana Ltd., Mont....	60,666	60,666
Cumberland, Mont.....	15,000	15,000	Napa, Cal.....	20,000	20,000
Daly, Utah.....	37,500	37,500	Ontario, Utah.....	75,000	75,000
Don Enrique, Mex.....	3,000	3,000	Puzzler, Col.....	2,500	2,500
Franklin, Mich.....	80,000	80,000	Tamarack, Mich.....	120,000	120,000

PATENTS GRANTED BY THE UNITED STATES PATENT OFFICE.

The following is a list of the patents relating to mining, metallurgy, and kindred subjects, issued by the United States Patent Office.

TUESDAY, FEBRUARY 13, 1890.

- 421,378. Rotative Fire-Grate. Henry Born, Cleveland, Ohio.
- 421,382. Lubricating Device. Henry W. Caldwell, Chicago, Ill.
- 421,385. Railway Spike. James Churchyard, Brooklyn, N. Y., Assignor of one-half to Charles F. Quincy, Boston, Mass.
- 421,385. Sight Feed Lubricator. Warren H. Craig, Lawrence, Mass.
- 421,398. Conduit for Electric Railways. Patrick H. Griffin, Buffalo, N. Y.
- 421,404. Car Coupling. James A. Hinson, Des Moines, Iowa.
- 421,418. Means for supplying compressed air to motors. George I. McCarten, Kansas City, Kans., and Frank C. McNally, Kansas City, Mo.
- 421,427. Car Reservoir Relief-Valve for Air Brakes. Har ey S. Park, Chicago, Ill., Assignor to the Westinghouse Air Brake company, Allegheny County, Pa.
- 421,432. Dumping Car. Charles W. Raymond, Dayton, Ohio.
- 421,453. Automatic Cut-off Valve. Charles W. Tremain, Portland, Oregon, Assignor to the Prospective Mining and Machinery Company, of Oregon.
- 421,456. Railway Rail Joint. Robert I. Verplank, Albany, N. Y., Assignor of one-third to William T. Mayer, same place.
- 421,459. Car Coupling. Fred. Wendt and Albert C. Wendt, Marshfield, Wis.
- 421,464. Electric Railway Car. Herbert C. Wirt, Boston, Mass.
- 421,468. Tripod for Rock Drills. Walter H. Adams, Stamford, Conn.
- 421,473. Gas Engine. Harrison J. Baker, Chicago, Ill., Assignor to the Electro-Carbon Motor Company of Illinois.
- 421,474. Gas Engine. John C. Beckfeld and Albert Schmid, Allegheny, Pa.
- 421,476. Driving Mechanism for Motor Cars. John C. Beckfeld and Robert Siegfried, Allegheny, Pa., said Siegfried Assignor to Albert Schmid, same place.
- 421,481. Crushing and Grinding Mill. Thomas C. Cadwgan, Springfield, O.
- 421,483. Artificial Stone Block Pavement. Edward Dart, New York, N. Y.
- 421,485. Journal Box for Car Axles. William O. Dunbar, Altoona, Pa.
- 421,486. Well Boring Apparatus. Lawrence V. Elder, New Orleans, La.
- 421,490. Rock Drill. Joseph C. Githens, New York, N. Y., Assignor to the Rand Drill Company, of New York.
- 421,491. Rock Drilling and Channelling Machine. Joseph C. Githens, New York, N. Y., Assignor to the Rand Drill Company, New York.
- 421,517. Drilling Machine. Francis H. Richards, Hartford, Conn. Assignor to Eckley B. Cox, Drifton, Pa.
- 421,539. Anti-Friction Hnb. Charles J. Applequist, Ellendale, (Dak. Ter.,) N. D.
- 421,545. Key Rail Joint. Robert A. Brogan, Osage Mission, Kans.
- 421,560. Artificial Stone Block Pavement. Edward Dart, New York, N. Y., Assignor to Franklin Haines, same place.
- 421,571. Pulverizing Apparatus. Herman Herz and Bernard Terfloth, Denver, Colo., Assignors of seven-sixteenths to Eugene Croff, same place.
- 421,583. Coke Oven. Isaac N. Knapp, Paterson, N. J., Assignor to the United Gas Improvement Company, Philadelphia, Pa.
- 421,587. Apparatus for Transmission of Power. Ot'o Krell, St. Petersburg, Russia.
- 421,588. Furnace Mouth Lining. Ben. B. Lamprey and Almon C. Bugbee, Lake Village, N. H., Assignors to the Lamprey Manufacturing Company, same place.
- 421,589. Furnace. William Lawrie and John McMillan, Petrolia, Ontario, Canada, Assignor, by mesne assignments, to John McMillan, trustee, same place.
- 421,594. Mining Machine. Moses A. Michales, Allegheny, Assignor to Oliver S. Weddell and Alwilda Michales, Allegheny, Pa.
- 421,605. Hydraulic Motor. William B. McPherson and Wesley Cahoon, Deadwood, Dak. Ter., S. D.
- 421,611. Air Compressor. Addison C. Rand, New York, and Frederic A. Halsey, North Tarrytown, Assignor to the Rand Drill Company, New York, N. Y.
- 421,612. Chuck for Rock Drills. Addison C. Rand, New York, N. Y., Assignor to the Rand Drill Company, same place.
- 421,616. Rock Drill. Addison C. Rand, New York, N. Y., Assignor to the Rand Drill Company, same place.
- 421,625. Roll. William S. Sims, Pittsburg, Pa.
- 421,641. Pressure Indicator for Air Brake Apparatus. Henry H. Westinghouse, Pittsburg, P.
- 421,642. Hydrocarbon Burner. John Wilson, New York, and Allan Mason, Brooklyn, Assignor to Herbert H. Sanderson, trustee, New York, N. Y.
- 421,645. Dumping Car. James W. Alfred, Lewiston, Pa.
- 421,657. Rotary Joint. William F. Bowers, San Francisco, Cal.
- 421,664. Car Brake. William Brunquest, Menominee, Mich.
- 421,677. Support for Trolley Wires. John H. Cunningham, Chelsea, Mass.
- 421,678. Wear Plate for Railroad Rail Ties. Thomas A. Davies, New York, N. Y.
- 421,694. Friction Clutch. Henry J. Gilbert, Saginaw, Mich.
- 421,728. Rotating Steam Engine. Paul Kirchoff, Mittweida, Saxony, Germany.
- 421,753. Explosive Compound. Henry Orth, Washington, D. C., administrator of Bela Brones, deceased.
- 421,769. Railroad Track and Tie. Peter Semonin, Evansville, Ind., Assignor to Peter Semonin, Jr., Memphis, Tenn.
- 421,783. Journal Bearing. Peter Sweeny, New York, Assignor of one-half to Charles H. Boyer, Brooklyn, N. Y.
- 421,786. Spirit Level. Justus A. Traut, New Britain, Conn., Assignor to the Stanley Rule and Level Company, same place.
- 421,790. Electric Motor. Phillip & Walsh, Philadelphia, Pa., Assignor to Charles M. Rhodes, same place.
- 421,811. Pulverizer and Pug Mill. William J. Boland, Chicago, Ill.
- 421,813. Portable Railway. Andrew Bryson, Jr., and Cornelius Tiers, New York, N. Y.
- 421,820. Rail for Elevated Ways. John W. Davy, Pittsburg, Pa.
- 421,821. Rock or Coal Drilling Machine. Charles B. Dawson, Angus, Iowa.
- 421,857. Clay Elevator. Cyrus Chambers, Jr., Philadelphia, Pa., Assignor to the Chambers Brothers Company, same place.
- 421,867. Water Tuyere. Frederick G. Nordmann, Cincinnati, Ohio, Assignor of one-half to John L. Roth, same place. Reissue.
- 421,061. Evaporating Pan. Joseph M. Duncan, Silver Springs, N. Y., Assignor to the Duncan Salt Company, same place.

## PERSONAL.

Mr. A. G. Menocal, U. S. N., Engineer-in-Chief of the Nicaragua Canal Company, has returned to New York from Greytown, Nicaragua.

The bi-centenary of the Hamburg Mathematical Society was celebrated in Hamburg on February 15th. Emperor William sent a message of congratulations. Newton, Herschel, Liebnitz and Gauss were once members of this society.

Dr. E. D. Peters, the well known metallurgist, has completed his contract with the Canadian Copper Company at Sudbury, Ontario, and has returned to his home at Dorchester (Boston), Mass., intending to again take up his consulting business as usual. He is about to leave for Arizona, but only on a temporary trip.

The sum of \$5,000, one-half of the income of which to be paid yearly for the support of some student whose father has worked in or been connected with mining operations in the Upper Peninsula has been donated to the Calumet, Mich., Mining School by Mr. Norrie of this city. The faculty to choose the person who shall be entitled to the scholarship.

Mr. Arnold Jones, manager of the Cassel Gold Extracting Company, of Glasgow, Scotland, and Dr. Henry Liepmann, of London, representing the same company, are in New York, on their return from Denver, where they have arranged for the erection of a small plant for the treatment of refractory gold ores by the Macarthur-Forrest process, which is owned by the Cassel Company.

*El Minero Mexicano*, an old established mining paper of the City of Mexico, has made its appearance in a new cover, the first number under the management of our valued correspondent, Mr. Richard E. Chism, M. E. The matter in *El Minero* is sound and sensible, as might be expected, and altogether in accord with its appearance. We have no doubt the publication of *El Minero* under its new editor will be appreciated in all Mexican mining camps and elsewhere.

The annual assay of the coinage of the various mints of the United States took place last week at the mint in Philadelphia. The Assay Commission comprises Senator John P. Jones, Representative E. H. Conger, Professor Stephen J. Young, Brunswick, Me.; Mr. William A. Sackett, Saratoga Springs, N. Y.; General William Lilly, Mauch Chunk, Pa.; Professor William W. Folwell, University of Minnesota; Professor Henry Mitchell, Roxbury, Mass.; General Francis A. Walker, Boston, Mass.; Professor Daniel W. Fisher, Hanover, Ind.; Mr. Byron Reed, Omaha, Neb.; Professor Thomas Price, San Francisco, Cal.; Mr. John J. Knox, New York; Mr. W. D. Wheeler, Montana; Professor Geo. F. Barker, University of Pennsylvania, Prof. T. C. Mendenhall, Superintendent of Coast and Geodetic Survey; Mr. E. C. Jewett, St. Louis, and the following ex-officio members: E. S. Lacey, Comptroller of the Treasury, Judge William Butler, of the United States District Court, and Prof. H. G. Torrey, of the Assay office, New York.

The members of the Commission assembled at the mint on the 19th inst. in a room set apart for them. In the room were boxes of gold, silver and nickel coins, bearing tags showing the date and place of coinage. There were specimen coins from the mints at Carson City, New Orleans, San Francisco and Philadelphia, all being sent here for examination.

The work of the Commissioners is with the sample coins preserved throughout the year. From every delivery of nickels, quarters, dollars and gold pieces a sample is selected indiscriminately, placed in an envelope and dropped into what is called the pyx, a box kept for the purpose. The specimens thus presented at the various mints are sent to Philadelphia at the end of the year and placed before the Assay Commission in order to see whether or not they come up to the required standard.

Judge Butler was chosen as president of the Commission and committees on Assay, Counting and Weighing were selected. The coinage of the several mints were produced and the committees entered upon the work assigned them.

The National Electric Light Association met in convention on February 11th, in Kansas City. The delegates were welcomed by the Mayor of the city, Mr. J. J. Davenport, and invitations from the Commercial Club, Chicago, Milwaukee & St. Paul Railroad Company, Missouri and Kansas Telephone Company, and the Engineers' Club were accepted.

A report from the Committee on Abolition of Duty on Copper was presented, and from various other committees on the subjects named at the previous meeting. Papers were read by Mr. C. J. H. Woodhury, on Central Station Construction; by Mr. F. E. Sichel, on the History and Theory of the Steam Engine; by Mr. George H. Babcock, on the Economic Generation of Steam; by Mr. C. J. Field, on a Recent Edison Central Station; by Professor Elihu Thomson, on Safety and Safety Devices in Electrical Installations, and many others.

On the 14th, prior to the adjournment of the

convention, the committee on nominations for officers for the ensuing year reported as follows:

For President, M. J. Perry, of Providence, R. I.; First Vice-President, E. A. Maher, Albany, N. Y.; Second Vice-President, C. L. Edgar, Boston; Executive Committee, C. R. Huntly, Buffalo, N. Y., chairman; B. R. Weeks, Kansas City; James E. English, New Haven, Conn.; J. J. Burleigh, Camden, N. J.; M. D. Law, Philadelphia; M. J. Francisco, Rutland, V.; A. F. Mason, Boston; J. A. Seely, New York; H. K. Thurber, New York.

Mr. Mason, of Boston, nominated E. R. Weeks for re-election as president. Mr. DeCamp warmly seconded the nomination. Mr. Weeks, however, gracefully declined, and thanked the convention for the compliment.

Upon motion the secretary was instructed to cast the ballot of the association for the officers as nominated.

## OBITUARY.

Carl Hathergen, director of the great publishing house at Stuttgart, is dead.

Augustus Pettihone, President of the Standard Consolidated mine of Bodie, died in San Francisco February 9th.

Hugh W. Hughes, a prominent quarry owner of red slate, died at his residence, Granville, N. Y., on Saturday, February 8th.

A dispatch from London announces the death of the Right Hon. Sir Louis Mallet, C. B., the well known authority on commercial treaties, and who was one of the bi-metallic members of the Royal Commission on Currency.

William Jarvis McAlpine, past president and honorary member of the American Society of Civil Engineers, one of the most eminent civil engineers of his day, died on Sunday at his home in New Brighton, Staten Island. He was born in New York in 1812, and was educated in the city schools. His first important work was on the Erie Canal. He had charge of the Eastern division of the canal until 1846, when he was appointed chief engineer of the dry docks of the Brooklyn Navy Yard. Six years later he was elected State Engineer of New York. In 1854 he was appointed Railroad Commissioner. He served two years. Later he was the president and chief engineer of the Erie Railroad for two years. In 1870 the Emperor of Austria invited Mr. McAlpine to submit plans for improvements in the rapids of the Danube River. He was in competition with foremost engineers of Europe, but his plans were accepted. He was the President of the American Society of Civil Engineers in 1869-70. He was connected in one capacity or another with almost all the great engineering works on this continent during his active life. The water works of Chicago, Albany, and Toronto were constructed under his direction. He was chief engineer of the new bridge over Harlem River. He laid the foundations, and was for three years the general superintendent of construction at the present Capitol at Albany. He was the first American to be elected to honorary membership in the London Society of Civil Engineers, and the society awarded him a gold medal for the best essay on an engineering subject. During his later life he published several treatises on engineering. He never accumulated wealth. He has been out of active life for only a few years.

## INDUSTRIAL NOTES.

The Rich Hill Iron Works at Rich Hill, Ind., has been refitted and extended. It was formerly known as the Rich Hill Foundry.

Tracklaying on the South Atlantic & Ohio Railroad is being pushed, and Big Stone Gap, Tenn., is expected to be reached in a very short time.

The St. Louis Steel Foundry Company has been incorporated with a capital stock of \$30,000. The incorporators are Henry Fuerhorn, E. R. Fuerborn and William Fuerborn.

Free sites for factories and other liberal inducements to manufacturers are offered by the East Chattanooga Land Company, whose advertisement appears in another column.

The Niles Tool Works, of Hamilton, O., have finished an immense armor-plate bending roll, weighing about 400,000 pounds, which is to be shipped to the Mare Island Navy Yard. Special cars have been built to carry it through to the Pacific.

It is reported that a plant will be established on the land of the Pennsylvania Steel Company at Sparrow's Point for the construction of steel steamships. Two vessels are to be immediately built, of a capacity of 3,000 tons each, to bring ore from Cuba.

The Westphalian Mine Owners' Protective Association unanimously decided, at a meeting at Essen, to found an anti-strike insurance union

with an initial capital of £60,000, the owners contributing in the proportion of a half-penny for each ton of coal produced in 1889. In the event of strikes they are to receive 18 pence compensation for every ton short of the average production.

The Aerated Fuel Company has appointed the Gilbert & Barker Manufacturing Company general agents for the United States. The 25 years' experience of this company in the use of gas, both for lighting and for fuel purposes, qualifies it to install the aerated system of burning oil in the most reliable and perfect manner, and it is so thoroughly equipped that piping, air compressors, oil pumps, tankage and oil can be furnished at the shortest notice and in the best manner.

Mr. Frank M. Gilley read a paper before the Boston Society of Arts on "The Electrical Purification of Sewage." Mr. Gilley described the process used in England, and illustrated the method by experiment. The organic matter in the sewage is decomposed by the nascent oxygen and chlorine, and may be filtered out. The experimenter tells by the appearance of the liquid when to stop the current. The sewage is then filtered and allowed to run into the river.

The following statement has been furnished to us by the Cassel Gold Extracting Company, of Glasgow, Scotland, of the result of treatment of 100 tons (of 2,240 pounds) of auriferous pyrite ore at Ravenswood, Queensland, Australia, by the Macarthur-Forrest process, which is owned by the Cassel Company. Cost of the ore at 16s. per ton, £80; cyanide, labor, fuel and sundries £15s. per ton, £125; total, £205. Product of treatment, 115 ounces of gold and 134 ounces of silver; value, £48; leaving a net profit of £275 to the Cassel Company. The ore on the dump assays, before treatment, 76 pennyweights gold per ton, there was left in the tailings three pennyweights, making an extraction of 23 pennyweights per ton, or 88½ per cent.

The Reading Iron Company, which made an assignment last summer, has increased its capital from \$300,000 to \$1,000,000. The company's works in Reading, Pa., which a few months ago were deserted, are now in active operation, employing over 2,000 men. The capacity of the works has been increased, and two keystone furnaces have been erected. It is estimated that the four furnaces will be able to turn out 2,000 tons per week. The tube works, which are able to produce 4,000 tons weekly, are now being run at almost their full capacity. The present directors of the company are: Austin Corbin, A. A. McLeod, Samuel Seyfert and Geo. F. Baer.

Official statistics give the following figures concerning the coin production of the various mints for the month of January, 1890. The entire output of the Philadelphia Mint was: Double eagles, \$624,800; eagles, \$569,800; standard silver dollars, \$1,350,000; minor coins, consisting of 5-cent pieces and pennies, \$126,680; total, \$2,671,280. The number of pieces coined was as follows: Gold, 88,220; silver, 1,350,000; nickels, 1,500,400; pennies, 5,121,000; total, 8,068,620. The San Francisco Mint coined \$450,000, the New Orleans Mint \$400,000, and the Carson City Mint \$200,000, a total of \$1,050,000, or less than 50 per cent. of the entire monthly output. All the 5-cent pieces and all the pennies are made at Philadelphia, and during the year 1889 nearly 65,000,000 of these minor coins were turned out.

In the foundry department of the new works of the Westinghouse Air-Brake Company, at Wilmerding, 12 miles east of Pittsburg, a new process for molding iron castings will be put in operation. The new foundry will probably be the most complete and most extensive in the United States.

On each side of the cupolas, running the entire length of the foundry building, is a set of continuous tracks, with a turn-table at each end. Trucks attached to a continuous chain run on these tracks carrying the molds past the cupolas, where the molten metal is poured in, and then back to the cleaning room. In the cleaning room the casting, cooled by this time, is removed. The empty box keeps on going until it comes to its starting place, where it is replaced by a new one. On each track 156 trucks will be run, and each one will make a round in about five minutes.

As there are two sets of trucks, one on each side of the cupolas, it will be possible to make 312 castings every five minutes, or 3,744 an hour. The speed of the trucks is regulated only by the length of the time required for the castings to cool sufficiently to be removed.

The right to build and use the continuous-molding process in America was purchased some time ago by the Westinghouse Company from the firm of Alley & McClellan, of Glasgow. A small plant, operated by hand, has been in use at the works of the company in Allegheny City for some time, and has proved very successful.

## CONTRACTING NOTES.

The contract for the metal work for the light-houses at Shark's Fin shoal and Greenbury Point, Md., has been awarded to the Allentown Rolling Mill Company, of Allentown, Pa., at \$24,700.

The Chester Foundry and Machine Company, of Chester, Pa., have contracted to supply the King-essing & Tincum Meadow Company, of Philadelphia, with two sets of centrifugal pumps, complete with engines, boilers, foundations, etc., guaranteed to deliver not less than 24,000,000 U. S. gallons per 24 hours.

This machinery forms part of an extensive plan to reclaim valuable meadow lands adjacent to Philadelphia, which are now flooded at certain seasons, and at some high tides. Embankments are to be erected and a system of canals dug and the water led to a central reservoir, from which it will be pumped into the Delaware.

M. T. Davidson, the well known manufacturer of steam pumping engines, of 77 Liberty street, New York City, has been awarded the contract for section 5 of the Brooklyn Aqueduct extension. His bid of \$76,400 was the lowest, being about ten thousand dollars less than the next bidder. The work calls for the erection of four horizontal engines at Millburn Pumping Station.

Mr. Davidson has previously furnished the city nine of his pumping engines.

The pumping engines proposed by Mr. Davidson are of his triple expansive type, patented in 1888, and one of which type has been running at the Jamaica station for nearly one year, at the unprecedented piston speed in a direct acting pumping engine, of 200 feet per minute.

This triple expansion 5,000,000 gallon M. T. Davidson engine at speed named, works so quietly and smoothly as not to be heard at six a short distance.

**MACHINERY AND SUPPLIES WANTED AT HOME AND ABROAD.**

If any one wanting Machinery or Supplies of any kind will notify the "Engineering and Mining Journal" of what he needs, his "Want" will be published in this column.

Any manufacturer or dealer wishing to communicate with the parties whose wants are given in this column can obtain their addresses from this office.

No charge will be made for these services.

We also offer our services to foreign correspondents who desire to purchase American goods, and shall be pleased to furnish them information concerning American goods of any kind, and forward their catalogues and discounts of manufacturers in each line, thus enabling the purchaser to select the most suitable articles before ordering.

These services are rendered gratuitously in the interest of the subscribers and advertisers; the proprietors of the "Engineering and Mining Journal" are not brokers or exporters, nor have they any pecuniary interest in buying or selling goods of any kind.

**GOODS WANTED AT HOME.**

- 594. Ice machine with a capacity of 10 tons per day. West Virginia.
- 595. Wood-working machinery for making doors, sash and blinds of every description. Tennessee.
- 596. Machinery for manufacturing Portland cement; complete outfit. California.
- 597. Machinery for manufacturing brick. Georgia.
- 598. Boiler and engine about 25 or 30 horse power for brick plant. Georgia.
- 599. Machinery for an oil mill. South Carolina.
- 600. Machinery for roller flour mill with a capacity of 50 bbls. per 24 hours. North Carolina.
- 601. Flour machinery. Complete outfit for mill with a capacity of 75 bbls. per day.  
Also machinery for corn mill with a capacity of 50 bushels per hour. Kentucky.
- 602. Machinery for manufacturing brick. Tennessee.
- 603. Ice plant with a capacity of five tons. Tennessee.
- 604. Coal mining machinery run by electricity. Tennessee.
- 605. Gas coal slack, coarse, at mines, via Philadelphia & Reading Railroad; 1,000 tons bituminous slack, fine and coarse; 1,000 tons Clearfield and Allegheny, and 1,000 tons red ash Buckwheat coal, anthracite. Philadelphia, Pa.
- 606. Flour mill machinery, short roller system. Kentucky.
- 607. Tools for boiler shop. Georgia.
- 608. Steel rails, ten miles 30-lb. steel rails. Texas.
- 609. Boiler, 4 H. P., horizontal. North Carolina.
- 610. Engine, 6 H. P., horizontal. North Carolina.
- 611. Machinery of sufficient capacity to drive a sharpie 20x30 ft., drawing 20 in. of water when loaded. North Carolina.

612. Tire bender, felloe cut-off and boring machine, and tire setter and cooler. North Carolina.

613. Brayton petroleum engine. Texas.

614. Cotton mill machinery. Three 70 spindle gin stands; one steam press; one section blower and distributor; cotton seed conveyor. Texas.

615. Corn mill, with a capacity of 25 or 30 bushels per hour. Texas.

616. Gas pipe for conducting natural gas a distance of seven miles; prices and full particulars. Texas.

**AMERICAN GOODS WANTED ABROAD.**

514. Agency wanted for mining and other machinery. South Africa.

566. Box shooks (Oregon or sugar pine not wanted); sizes of ends, sides, tops and bottoms on application. 1,000 boxes 18x12x9; 500 boxes, 19x13x10; 300 boxes, 21x12x9. Australia.

570. Boxes, 19x11x11; quotations, per 1,000; boxes, 10x5x10, 11x6x11, 12x6x12, 14x6x14; quotations, per 100 gross lots. Australia.

573. Gas machines; catalogues and full particulars; agency if obtainable. Australia.

593. Agency for coal mining machinery. Westphalia, Germany.

**GENERAL MINING NEWS.**

A meteorite of special interest to chemists has been examined by M. Stanislas Meunier. It fell at Migheni, in Russia, on June 9, 1889; and it was evident, from a cursory inspection, that it was of a carbonaceous nature. In external appearance, as stated in *Nature*, it exhibited a deep greenish-black color, relieved by numerous small brilliant white crystals. The surface was considerably wrinkled, and blown out into swellings. The material was very friable, and readily soiled the fingers. A section under the microscope was observed to consist largely of opaque matter interspersed with crystals of a magnesium pyroxene and peridot. Fine particles of metallic iron and nickeliferous iron were readily collected by a magnet from the powdered rock, having all the characteristics of meteoric iron. The density of the meteorite was not very high, 2.495. About 85 per cent. of the rock was found to be attacked by acids, the portion so attacked being shown by analysis to consist mainly of a silicate of magnesium and iron having the composition of peridot. On the remaining 15 per cent. being heated in a current of dry oxygen gas, it readily took fire and burnt brilliantly. The products of combustion, which were allowed to pass through the usual absorption tubes containing pumice and sulphuric acid and potash, showed that the meteorite contained nearly five per cent. of organic matter. In order to obtain some idea as to the nature of the carbonaceous substance present, a quantity of the rock was powdered and then digested with alcohol. On evaporation the alcoholic extract yielded a bright yellow resin which was readily precipitated from the alcoholic solution by water, and much resembled the kabaite of Wehler. The most curious chemical properties of the meteorite, however, are exhibited with a cold aqueous extract of the powdered rock. The filtered liquid is quite colorless, but exhales a faint odor due to organic salt which carbonizes on evaporation to dryness, and may be burnt upon platinum foil. The aqueous extract further contains nearly two per cent. of mineral matter possessing properties of a novel character. Barium chloride solution gives a heavy white precipitate, which, however, is not barium sulphate. Silver nitrate gives a voluminous curdy reddish-violet precipitate, reminding one of silver chromate, but of quite a distinct and peculiar tint, and which blackens in a very few minutes in daylight. The substance which exhibit these reactions is unchanged by evaporation to dryness and ignition to redness, readily dissolving in water again on cooling, and giving the above reactions. The silver-nitrate precipitate, when allowed to stand for some time undisturbed in the liquid, becomes converted into colorless but brilliantly refractive crystals, which polarize brightly between crossed nicols under the microscope, and which are insoluble in boiling water. The properties of this new substance contained in the water extract appear to approximate most closely to those of certain metallic tellurates, but the new compound appears also to differ in certain respects from those terrestrial salts.

The importance of the coal industry in Cape Breton is shown in correspondence of the *Halifax Herald* from Sydney. The writer states that at the present time there are nine coal mines in operation in Cape Breton and two more are opening. In connection with these, directly and indirectly, from 4,000 to 5,000 persons are employed, and a population of about 18,000 has been settled in and about the various mining localities. About 2,550 vessels, with an aggregate tonnage of 450,000 tons, handle the coal shipment this year, with an employment of 24,000 hands. The quantity of coal mined in Cape Breton during the year just closed was 745,000 tons, as com-

pared with 240,000 in 1879. North Sydney and Sydney shipped 460,000 in 1889, as compared with 140,000 tons in 1879. The increase since 1879 has been steady. Comparing the yearly exports since 1878, the result of the present tariff is, in the estimation of the correspondent, "most satisfactory."

**ALASKA.**

SILVER BOW BASIN MINING COMPANY.—The claims of this company comprises about 23 acres, and extend from rim rock to rim rock on either side of the valley. A tunnel is now being driven to tap this ground; this tunnel is now in a distance of 970 feet, and it is expected that the tangent tunnel will be soon commenced. The *Alaska Free Press* says that the Charlotte ground will be reached by March 15th, which will complete the underground work and admit of the opening and commencing of hydraulic mining at the earliest opening of spring; the distance yet to be run to complete the tunnel to the placer ground is only 450 feet. The work for the month of December, in running the tunnel, for 26 days' labor, was 326 feet, or an average of eight and three-fourths feet daily. The water power at the tunnel continues to hold out, in spite of the severely cold weather.

**CALIFORNIA.**

**AMADOR COUNTY.**

(From our Special Correspondent.)

Messrs. Waymouth & Reeves will start their new twenty-stamp March 1st.

AMADOR GOLD LIMITED.—This company is now having its heavy machinery, which has been lying at Cone City all winter on account of the bad state of the roads, conveyed to the mine. The large sixty-stamp mill will start on or about April 1st.

COSMOPOLITAN MINING COMPANY.—This company has started its new thirty-stamp mill. It is currently reported that the plates are showing exceedingly well.

HARDENBURG MINING COMPANY.—This company is erecting an extensive hoisting plant, and will drive its shaft to the 500-foot level before cutting station.

PLYMOUTH CONSOLIDATED MINING COMPANY.—This company is now hoisting ore from No. 3 level running south from Pacific shaft. Rumor says a very important strike has been made, and 40 stamps will resume crushing at an early date.

SOUTH EUREKA MINING COMPANY.—This company, a local incorporation, situated in Sutter Creeks district, has placed enough capital stock with San Francisco capitalists to erect a hoisting plant and drive a shaft to the 1,000-foot level.

THE SUTTER CREEK GOLD MINING COMPANY.—This company is running 10 stamps on surface ore. Specifications are now being submitted for additional 10 stamps and several thousand feet of new pipe. There is a large body of ore above tunnel level.

WILDMAN MINING COMPANY.—This company is contemplating adding 20 additional stamps to its present 20-stamp plant. On the 700-foot level the ore body is 30 feet wide.

**MONO COUNTY.**

(From an Occasional Correspondent.)

The mining interests of Mono County are very dull at present, only 15 stamps running on the Standard Consolidated mine, Bodie, where we used to have over one hundred, the Standard alone running thirty-five. There are several reasons for this. The first one is that in the mines that have been worked for years the richest ore has been extracted, and though there are still large bodies of low grade ore, they will not pay with the present way of working, i. e., steam power with wood at \$10 or more per cord; but I have no doubt that some new and cheaper power will come to the front, that will set new life in the Bodie mines. Capitalists seem unwilling to invest in the undeveloped mines. This is chiefly due to the inaccessibility of the location. However, we expect to soon have the shortest overland railway coming through this county. This will bring us within 200 miles of San Francisco, and it is likely that it will change things materially. During the year 1889 only one group of undeveloped mines was sold. They are situated in Jordan district, and are owned by the Paraclete Mining Company, a Nevada incorporation, which has enough ore in sight to run 100 stamps for a long time to come. It is expected that the company will begin operations in the spring.

**COLORADO.**

The United States Senate has passed the Teller Bill to aid the State of Colorado to support its school of Mines. The bill was amended by the

Public Lands Committee, and as passed by the Senate reads as follows:

"Be it enacted that the State of Colorado shall annually receive 50 per cent. of all moneys paid to the United States for mineral lands within the State of Colorado for the maintenance of the School of Mines established at Golden, in the county of Jefferson, in said State, provided that said sum so paid shall not exceed the sum of \$12,000 per annum, nor shall it exceed the amount annually expended by the State of Colorado for said School of Mines out of its treasury.

"Sec. 2. That before any money shall be paid to the State under the provisions of this act the Secretary of the Interior shall certify to the Secretary of the Treasury that the State of Colorado is maintaining a school of mines at said place, in which students in attendance are given instructions in chemistry, metallurgy, mineralogy, geology, mining, engineering, mathematics, mechanics and drawing, and that the students in attendance from other States than Colorado are received into said school of mines on the same terms and conditions that the students from the State of Colorado are received.

"Sec. 3. That the Board of Trustees of said School of Mines shall make report each year to the Secretary of the Interior of the number of students in attendance at such School of Mines, the States of which they are inhabitants, and the general course of study pursued in said school, and the amount expended in support of said school."

#### BOULDER COUNTY.

WALL STREET.—The management of this mine has run a tunnel on the vein about 400 feet, over 300 feet of it being in barreau rock. From the face of the tunnel they have been making an up-raise, and are now within 17 feet of surface, which is 100 feet above the tunnel.

#### CLEAR CREEK COUNTY.

CENTENNIAL.—It is the intention of the management to continue sinking.

COLORADO CENTRAL CONSOLIDATED MINING COMPANY.—The main shaft on this mine is down 420 feet below the Marshall tunnel, or 800 feet from the surface. A new set of levels will be started when the shaft is 30 feet deeper.

#### CONEJOS COUNTY.

OLD HANSEN.—A report from Platoro tells of a discovery of another bonanza strike in this claim, and there is a large seam of pay mineral exposed.

#### FREMONT COUNTY.

A strike of semi-bituminous coal, says the Denver *Republican*, has just been made on Chandler Creek, seven miles southwest of Cañon City, by the Western Fuel Company, of Pueblo. The vein is five feet six inches, and was struck at a depth of 472 feet.

#### GUNNISON COUNTY.

DOMINGO.—A new sulphantimonate of lead has been found in this mine and is known as mineral wool. It consists of aggregates of small acicular crystals, forming matted woolly-like masses in the cavities of a highly decomposed gangue rock of silicious material mixed with some calcite. It is dull, grayish-black in color, with occasional spots of iridescence, due to superficial oxidation. Analysis gave 39.33 per cent. lead, 36.34 antimony, 21.19 sulphur, 1.77 iron, and traces of silver, copper, and manganese.

#### LAKE COUNTY.

IRON SILVER MINING COMPANY.—Work at the Iron mine proceeds with quiet regularity, says the Leadville *Herald Democrat*. Quite a lot of virgin ground is being opened. The ground in the neighborhood of the Stevens shaft is being developed from the Moyer workings, and the Moyer itself is doing well. The main ore chute of the latter is probably looking the better of the two, and between the second level and the intermediate level, on the lead stope, some ore is being extracted, which is found inclosed in the regular iron ore chute.

In the iron mine proper the connection between the 130-foot level (porphyry winze workings) and the old workings of the 60-foot level has been made, and has exposed several small seams of lead carbonate ore.

#### OURAY COUNTY.

REVENUE TUNNEL COMPANY.—Work in the Virginia mine has been progressing for over a year and is being pushed with Ingersoll drills. The breast is now in the hill 1,345 feet. At this point an air shaft has been started and pushed to the surface, a distance of 750 feet. During the progress of the work several feeders and small veins have been cut, but the management expect nothing of importance until the Sidney vein is reached, which is about 4,000 feet from the mouth of tunnel. The Virginius vein is still further on, and it will require over a mile to reach it.

#### PITKIN COUNTY.

CANOMARA.—Much interest has been manifested, says the Denver *Republican*, in a reported strike in the Canomara. This is a claim lying immediately west of the Aspeu. It was bought up by the Durant people during the time of the Apex litigation. The shaft was sunk to a depth of something more than 600 feet, but the vein was not found. The owners were permitted by the court to drift into the Aspen ground, where the vein was found standing very steep. Last fall the company went to work again in the bottom of the shaft, putting in air drills and making full preparations to go to any depth that might be required. At 930 feet ore has been struck, and there is a streak of it, reported to be about nine inches thick, that is almost pure silver.

EDISON.—This mine is now shipping regularly from 25 to 40 tons. The ore is found deeper than that which was taken out last year, and in two places where it is being opened it is from six to ten feet thick.

ENTERPRISE.—The mine has been closed down to admit of some needed repairs which are being made.

EXPRESS.—A body of copper ore has recently been opened in this mine. The ore is said to run from 60 to 70 per cent. in copper and 10 ounces per ton in silver.

#### SUMMIT COUNTY.

WARE-CARPENTER MINING COMPANY.—This company is operating the claims under 26 leases; 125 men are employed. It has a 90-ton and a 30-ton mill at work.

#### IDAHO.

#### BOISE COUNTY.

ELKHORN.—A succession of strikes has been made in this mine in cutting through a number of parallel and secondary veins while aiming to reach a point on the true Elkhorn lode, where work was suspended many years ago on account of accumulating water, which the facilities then at the command of the miners were inadequate to the task of draining. Quite recently several other strikes have been made, says the Boise City *Statesman*, and a large mill and other improvements are to be added.

#### OWYHEE COUNTY.

DE LAMAR.—This mill is running right along, and is said to be still producing \$1,000 per day.

#### MICHIGAN.

#### COPPER MINES.

The January output in mineral of the Lake Superior copper mines is reported as follows:

	1889.	1889
Calumet and Hecla, tons.....	2,978	2,610
Quincy.....	301	240
Atlantic.....	198	223
Franklin.....	201	180
Huron.....	115	131
Kearsarge.....	.....	.....
Osceola.....	229	207
Tamarack.....	.....	620
Total.....	.....	4,201
Peninsular output for January, 77 tons.		

CENTENNIAL MINING COMPANY.—A letter from Mr. Vivian, the company's agent, says that No. 3 shaft has been recently sunk 15 feet. The ground is very hard and bad for breaking. The lode is showing more copper than has been seen at any time in sinking the last 300 feet, and its general appearance is more like where it is rich in the Calumet than anything had at this point since sinking was started. The lode in the north shaft continues to improve.

OSCEOLA COPPER MINING COMPANY.—The annual report of this company for 1889 shows a total product of 4,534,127 pounds of copper, against 4,134,320 in 1888, the largest output for any year in the company's history. Average price received was 11.94 cents per pound, against 15.03 cents in 1888. Total receipts, \$542,990.74; expenses at mine, \$388,307.59; smelting, transportation, and selling, \$67,476.42; expended for construction, \$32,145.66; dividend of \$1 per share, \$50,000; surplus for year, \$5,061.07; total balance of assets January 1, 1890, \$209,746.22. The superintendent's report says that the year's work leaves the mine in better shape, prospectively, than for a long time. Total assets aggregate \$273,833.06, liabilities \$64,086.84, balance as above. Although the product was greater, the receipts were less than in 1888 by \$79,762.99, owing to smaller price of producing, treating, and laying down in New York was 10.05 cents per pound, against 11.61 cents in 1888. The company paid three dividends \$50,000 each, or \$3 per share in 1888, and but one in 1889, the mining profit having been \$54,870.16 less, but it expects to pay four \$1 dividends this year.

The Opechee shaft is down to the fifteenth level. This level will be opened out ready for drifting. Sinking will be started early next week

for the sixteenth level, where connection will be made with the level running south from No. 4 shaft.

TAMARACK MINING COMPANY.—The levels Nos. 11 and 12 north are looking better. January output of the Tamarack was reduced some thirty tons of mineral by the influenza, and not much over 550 tons were produced. Shaft No. 2, which is 19x7, is divided into three compartments, two of which will be used for hoisting, and the third for lowering the men who work underground, timber, etc.

The shaft, which is at present 2,795 feet deep, or 44 feet below the eleventh level, struck the Calumet lode at a depth of 2,575 feet, and found it rich. A cross-cut 720 feet long from the second level of No. 1 had been previously holed into this shaft at a depth of 2,215 feet, which was found very valuable in ventilating the other parts of the mine. This shaft now has a downcast, while No. 1 has an upcast.

About 125 feet northeast of this shaft-house is an engine-house, 45x65, the basement or foundation walls being of stone, the upper part framed. The hoisting machinery was designed by Mr. Reynolds, of the firm of E. P. Allis & Company, of Milwaukee, who accompanied Superintendent Daniell when he visited the coal fields of England, for the purpose of obtaining pointers on the hoisting engines there in use.

The hoisting machinery is very powerful, and consists of a pair 42x84 Corliss engines. The drum is 30½ feet in diameter. The present machinery is calculated to hoist from a depth of 3,500 feet, and to hoist four tons of rock at the rate of 2,500 feet per minute.

The boiler-house at present contains three of Reynolds' patent upright boilers. These are an innovation in the copper country. They were first introduced at Tamarack Junior No. 2, and were found to be not only much less costly than the ordinary boilers, but were also inexpensive to run. There is room for a fourth or spare boiler, which will soon be added. The fuel (wood) is brought from the bush on cars, and is unloaded direct from them into the boiler-house, the floor of which is nine feet below the track.

The shaft house, with which is combined the rock house, is an immense pile, and looms up as if it were the father of the surrounding territory. From the ground to the top of the roof is 110 feet, above which is a flag pole 40 feet high, from which the glorious stars and stripes will, no doubt, be thrown to the winds on our next national holiday. The ground floor of the shaft-house is large enough for bull teams to enter on one side and go out on the other, still leaving plenty of room to prepare the timbers for underground, and which will be ready for the night shift, during which all the mine timbers will be lowered.

The landing floor is 44 feet above the basement. At No. 1 shaft the cars, when landed, are pushed to the dumps by landers, and when emptied, pushed back by the same means. At this shaft it is proposed to do away with manual labor as much as possible. As soon as the cage arrives at the landing floor, a chain belt conveyer will be attached to the car, which will then be hauled across the floor to a truck, the top of which will be on a level with the landing floor. The truck, by means of another chain belt, will then be hauled to one of the dumping-screens in the rock-house, of which there are three. After the cars are emptied, the truck will be run back and the car pushed across the floor on to another truck on the opposite side of the shaft, to which it landed, which truck will then be pushed opposite to the compartment in which the cage is ready for its reception.

There will at first be three rock breakers—18x24, 13x20 and 8x14—and a steam hammer in the rock-house. The hammer will stand in the center. The rock as it passes through the breakers will fall into bins beneath, and will be loaded from thence into the railroad cars, the truck running below the bins, and the cars will then be sent to the stamp-mill on Torch Lake, a distance of five miles. When inspecting this rock house, the idea occurred to us that it must be much more convenient to handle rock in this manner, instead of running it over a trestle-road to a rock house some distance, perhaps, from the shaft-house. Our guide at once stated that at the Osceola mine there was only one shaft-house, from which the rock had to be carried over a trestle-road to the rock house, and that the extra expense of so handling the rock raised in that shaft amounted to no less than \$3,500 per annum, and so he was, on the score of economy, decidedly in favor of having the rock house combined.

In order to give our readers an idea of the immense quantity of timbers (they are 14-inch, square) in a building of this description, we above give a view of the shaft and rock house before it was closed in. The view is copied from a photograph taken by Joshua Daniell (who is attending the mining school), the eldest son of the superintendent of the mine.

The engine, which has heretofore been used for hoisting in this shaft, will now be used for the third compartment only.

Captain Joseph Roberts, who has had charge of the sinking of this shaft from the roots until the time it reached the vein, is deservng of much



credit, not only for his masterly supervision, but for the care he had of his men; for while the work was in progress, viz., from March 10th, 1885, to August 26th, 1889, there was only one accident of any moment, when a man had one of his legs broken by being struck with the bucket. Capt. Roberts has now charge of the sinking of Nos. 3 and 4 shafts at Section 11, or, as it is known, North Tamarack.

The sinking of this shaft was not pushed until December, 1887, as the hoisting engine up to that time was inadequate. In the year ending June, 1888, the shaft was sunk 771.4 feet; in the year ending June, 1889, it was sunk 1,000.4 feet. The most the shaft was sunk in any month was 97.3 feet.—*Red Jacket News.*

## COAL MINES.

Active operations for the development of the Huron and Tuscola Counties coal fields have been commenced in Sebewaing. The test hole put down in the Sebewaing Fair Grounds last August has been enlarged and is now "Shaft No. 1." At present a crude hoisting apparatus is in use, and a team of horses does the work that will soon be carried on by the aid of steam and more improved machinery. At a depth of 60 feet the casings give place to one prepared by nature, which is of solid slate and sandstone. For the next 20 feet the solid rock forms a roof over the vein of coal. In the bottom of the shaft there is a vein of bituminous coal, four feet five inches in thickness, under which lies a one foot four-inch vein of black-smith's coal. To the south the miners have commenced driving a narrow entry into the solid face of the coal, and have taken out a space about ten feet in length, eight feet in width and to the depth of the vein. In blasting and timbering up the entry the coal secured was in small pieces, but one of the miners, with a pick, broke from the wall a chunk of coal weighing fully 30 pounds, which is said to be superior to any soft coal ever found in Michigan. The coal belt, so far as has been tested, extends, it is said, over about 2,100 acres of territory. Seventeen test holes have been put down by the two companies on the above territory, and coal has invariably been struck at depths ranging from 85 to 118 feet, the veins being from 3 feet 3 inches to 4 feet 9 inches thick. No fixed bed of coal was found north of the Sebewaing River, but it is believed that the vein extends, to a greater or less extent, through the western portion of Tuscola County. The timbering used in the mine will be very light, and it will be perfectly safe to work it in 40-foot rooms. It is estimated that the vein will produce at least 80,000 tons per acre of surface.

## GRAPHITE MINES.

GRAPHITE.—Twenty-four tons of ore are being raised daily and delivered to the railroad, ready for shipment. Work is progressing at the mine, and preparations are being made for more active work in the spring. A recent analysis made from specimens of the ore taken from the bottom of the mine, says the *L'Anse Sentinel*, give better results than any before made.

## MINNESOTA.

## ST. LOUIS COUNTY.

THE LONGYEAR MESABA LAND AND IRON COMPANY.—This company has been incorporated for the purpose of mining smelting, reducing, refining and working ores and metals, marketing the materials, manufacturing brick, stone, iron, steel, copper and other metals, and buying, working, selling and dealing in mineral and other lands in Minnesota.

## MISSOURI.

## JASPER COUNTY.

HANOVER MINING COMPANY.—Articles of incorporation for this company, of Joplin, Mo., capital stock \$10,000, have been filed. The stockholders are Ernest Sontag, Geo. Knerr, Adolphus Dose and G. A. L. Doe. The company is operating a mining lease on the Inter-State Company's land.

## ST. FRANCOIS COUNTY.

MINE-A-JOE.—There is said to be a prospect that this mine will be reopened shortly. Mr. Desloge has organized the Desloge Consolidated Lead Company, which is said to have command of ample capital. It is the universal belief that as soon as the Bonne Terre and Mississippi River Railroad is completed, work will be begun looking to its extension from Bonne Terre to Doe Run mines, 14 miles south of Bonne Terre. The Doe Run mine is owned almost wholly by members of the St. Joseph Lead Company, which company also owns the railroad named, and having already determined on the removal of their smelting works to Herculaneum, to avoid the cost of transporting fuel to the mines, it will be to their interest for the same reason to extend their road to Doe Run, in which event it is probable that the dressed ore from both points, as well as from Mine-a-Joe, which is directly on the line between Bonne Terre and Doe Run, will be shipped over this line to be smelted at Herculaneum, where it will meet cheap coal transported by river barges.

## MONTANA.

## GALLATIN COUNTY.

At Timberline an important strike has been recently made in the property of Messrs. Qually & Hoffman by which a vein of clean coal had been found. For some time past Timberline coal has borne a cloudy name, says the *Helena Journal*, but the result of the past year's working has been so satisfactory that the district may be said to be in its infancy at present.

## LEWIS AND CLARKE COUNTY.

BIG OX.—At this mine work is being pushed with great energy, says the *Helena Journal*, and a rich lead struck. The company will put in a mill and concentrators in the spring.

NORTH STAR.—The work on this claim is being pushed, and double the force now employed will soon be put on.

## MEAGHER COUNTY.

YELLOWSTONE.—A contract for sinking 100 feet on this mine has been let by the company, and work has begun.

## SILVER BOW COUNTY.

The Moulton Mill is now idle, it having closed down to allow the water that it would use if in operation to go to the Anaconda and St. Lawrence mines to help extinguish the fire supposed to be burning in them.

ALICE MINING COMPANY.—The shaft on the Alice mine has reached a depth of 1,217 feet. Before continuing deeper a station will be cut at the 1,200 mark, after which, says the *Butte Daily Miner*, sinking will be resumed and continued until a depth of 1,300 feet is reached. At present ore is being taken from the 1,000-foot level, the ore body at that point having been encountered several weeks ago. The large mill of the Alice is crushing ore from the company's mines and also from leases in the neighborhood.

In addition to other improvements recently made about the mine, a new tramway has been built south from the hoisting works, from the end of which all waste taken from the mine is dumped.

ANACONDA COPPER COMPANY.—The Anaconda mine is flooded to the 900-foot level. A fourteen-inch stream is constantly at work, and the mine will be filled and the fire extinguished in about a month. It will take a month to empty the mine. In the meantime the smelter is supplied with ore from the Syndicate mines.

GLENGARY.—The shaft on this mine is 250 feet deep. From the bottom a drift has been run on the ore body. The ore averages 250 ounces per ton in silver, says the *Butte Miner*.

MINNEAPOLIS MINING COMPANY.—The holdings of this company consist of three full claims recorded as the Elk, Moonlight and Robbin. The property now being worked is developed by a shaft 4x8, which is about 70 feet deep. They have a ledge on which seven feet of quartz have been exposed. C. F. Barbeau, president of the company, has gone to Minneapolis in the interest of the company.

RED LION MINING AND REDUCTION COMPANY.—The property belonging to this company consists of the Red Lion claim and a five-acre millsite, the Utopia, which is only about one-fourth of the full size, and several others comprising thirty or forty acres. The company has also on its millsite a new ten-stamp gold quartz mill with ample copper amalgamating plate surface, and both steam and water power. The Red Lion mine is situated about four and a half miles from the Cable mine, on the same belt. The same character of quartz distinguishes this mine as that found in the Cable previous to the contact. The vein pitches at an angle of about 65 degrees to the north. About 60 or 70 feet north of the vein on the surface is the point of contact between lime and shale, which is about 10 feet thick. The main range is quartzite.

The development of the mine consists of three shafts, one of which, No. 3, is now 110 feet deep and still going down. This shaft is in mineral all the way, says the *Butte Miner*, and the vein, wherever cut, has shown from 3 to 14 feet of ore.

The officers and directors of the company are J. R. Boyce, Jr., president; J. C. Bedlin, secretary, and John H. Curtis, treasurer.

## NEVADA.

## STOREY COUNTY—COMSTOCK LODE.

GOULD & CURRY MINING COMPANY.—Theodore Fox has entered suit in the Superior Court at San Francisco against the Virginia & Gold Hill Water Company, the Gould & Curry Mining Company, James G. Fair, John W. Mackay, the estate of J. Flood et al, to recover the sum of \$1,032,349.50, which the complaint alleges was the profits derived from bullion valued at \$3,000,000, the alleged bullion product of ore extracted from the Gould & Curry mine above the lower tunnel

level under a lease granted to the Virginia and Gold Hill Water Company, in which the above-named defendants were heavily interested and derived the benefit of the bulk of the above net profit, which should have been divided with Gould & Curry shareholders.

OPHIR.—On the 1,300 level from the end of the east crosscut of this mine, 316 feet from the shaft station a south drift is advanced 333 feet from the shaft station, continuing in porphyry and quartz.

## NEW JERSEY.

The discovery of copper and silver ores in the mountains back of North Plainfield is reported. Engineers, it is said, have for some time been at work making borings in the earth in various parts of the suburbs in search of the best locality for the supply of Plainfield's coming water works, and prospectors in rambling about in "The Notch," a gap in First Mountain, are said to have unearthed traces of metals. It is also reported that sufficient investigation has been made to warrant the assertion that, underlying the outer layers of trap-rock and red sandstone in the mountain, are mines which it will pay to develop. The most extended and promising opening hitherto made upon the copper-bearing rocks of Watchung Mountain has been at the Bridgewater mine near Somerville. Prominent local capitalists are said to be negotiating for the control of the mines.

## MORRIS COUNTY.

FORD.—This mine, which has been in almost continuous operation the past twenty years, is abandoned as far as the underground part is concerned. The last of the pumps and other materials have been hoisted out and the shaft planked over.

## WARREN COUNTY.

A company of New York and Pennsylvania capitalists is being organized to work the cement deposits in this county.

## NEW MEXICO.

## GRANT COUNTY.

CARLISLE GOLD COMPANY.—This company, says the *Carlisle correspondent* of the *St. Louis Republic*, will put the main shaft down at the mine 1,000 feet. Last year it determined to put the shaft down 700, but work was stopped a short distance below the 600-foot level. The Carlisle mine has produced more gold than any other mine in New Mexico. The vein is nearly 40 feet wide at the 600-foot level, but the ore is of so low a grade that the profit in mining and milling is very small. With deeper workings the grade of ore may improve.

## PENNSYLVANIA.

## OIL.

J. M. Guffy & Co. have commenced action against E. M. Hukill for the recovery of two tracts of oil-producing territory in the Mt. Morris field, valued at over \$100,000. It is the old story of the expired lease. Hukill had the land leased originally, but lessor some time ago believing that Hukill had forfeited his lease, leased to Guffy & Co. Hukill then got the lessor to throw up Guffy's lease. Hukill then commenced drilling, and the property proved to be valuable.

## UTAH.

The ore and bullion receipts at Salt Lake City banks for the week ending February 1st were \$159,913.72, as compared with \$47,400.84 the week previous.

## FOREIGN MINING NEWS.

## CANADA.

## ONTARIO—PORT ARTHUR DISTRICT.

(From our Special Correspondent.)

Two large deposits of bituminous coal have been discovered along the course of the Albany River, one at Lake Eahmet and the other at Lake Sturgeon. These deposits are about 150 miles, in an almost direct line, north of Port Arthur, and in the wake of the recent iron discoveries of the Sturgeon River district, the galena and silver-head deposits of Dorion township and mica deposits around the north shore of Lake Neepon. Excellent samples of marble are also found along the same line, some of which were sent to the Cincinnati exposition by the Ontario Government, and are now on exhibition in the museum at Niagara Falls.

Indians arriving from Dog Lake, 40 miles north of Port Arthur, report gold discoveries in that vicinity, and show some very fine nuggets.

The Port Arthur Board of Trade have petitioned the Dominion government to remove the duty from all articles of mining and milling machinery

not manufactured in Canada. The matter has also been taken up by the Boards of Trade and members of parliament from British Columbia, and it is hoped that their united efforts will be successful in removing what is at present a serious tax on the mining industry of this country.

Dr. Lehnen, Ph. D., St. Paul, and R. Scott, London, Eng., were in the district last week examining the Silver Falls silver location in the interests of English capitalists.

The Canadian Pacific Railway Company has sent a corps of engineers out to survey a line of railway from Fire Steel River, on their main line, to the iron deposits on Aticokan River and Magnet Lake. The line will be easy of construction, with the exception of the last three miles. If the companies controlling these iron deposits will give a guarantee of a certain output annually there is no doubt that the railway will be constructed, and from the nature of the deposits, the immense surface showing and uniform quality of high-grade ore, a strong company would have no difficulty in shipping 500,000 tons the first year. The following assays of surface specimens may be taken as a fair average of the ore: By Minnesota Iron Company's assayer, Tower, Minn.—Metallic iron, 68.50; silica, 2.90; phosphorus, 0.015; sulphur, 0.052; titanic acid, 0.000.

By F. Hille, M. E. Ch., Minneapolis, Minn.—Metallic iron, 65.90; silica, 5.80; phosphorus, 0.00117; sulphur, 0.16; titanic acid, 0.00.

By H. M. Currie, for Carnegie Bros., Pittsburg, Pa.—Metallic iron, 65.702; silica, 4.200; phosphorus, 0.003. Sulphur and titanic acid not specified, but said to be not appreciable.

**BADGER MINING COMPANY.**—This company is now top stopping along the second level, 900 feet west from the main shaft, which is 360 feet deep, and the company propose putting a compressed air plant and sinking to a depth of 1,000 feet. On the fourth level west the vein is 4 feet wide, and will average about \$325 per ton.

**BEAVER MINING Co.**—Very flattering reports are circulating about the developments made by the diamond drill at this mine. They are based on the sworn testimony of the owners given at the trial of Kirkland vs. Peters, formerly owners of this property.

**KAKABEKA FALLS Co.**—This company has the plans and specifications out for a 20 stamp quartz mill, the erection of which will be proceeded with early in the spring. The company has the assurance of a plentiful supply of ore from the surrounding mines, and it is intended to increase the capacity of the mill towards the end of the year.

**SHUNIAH WEACHU MINING COMPANY.**—This company has driven a drift through an ore body 125 feet long west from No. 3 shaft. It is all shipping ore, averaging 450 ounces to the ton. A block of ore has been opened up in No. 4 shaft east and west, between the first and second levels, 60 feet deep by 90 feet long. Stopping on both of these ore bodies will be commenced in a few days. The stock of this company is steadily going up in the English market, and the developments at the mine appear to warrant it. The work has been most economically carried on under Capt. Thomas H. Trethewey.

**STAR.**—This property is situated in the township of Strange, 40 miles south west of Port Arthur, on the line of the Port Arthur, Duluth & Western Railway. It is owned by Messrs. Butslingame, Twomney and Roberts, of Duluth. The operations are carried on under the supervision of Captain Roberts. The vein showed a width of eighteen inches at the surface, carrying zinc blende and argentite, and assaying from \$60 to \$150 per ton, silver. The shaft is now down 40 feet. The vein for the last eight feet has a width of ten feet and assays for the last four feet \$650 to \$700 per ton, principally native silver.

#### CENTRAL AMERICA.

##### NICARAGUA.

**NICARAGUA COMPANY, LIMITED**—This company has been registered in London, by Ashurst, Morris, Crisp & Co., 6 Old Jewry, E. C., with a capital of £200,000 in £1 shares. Object, to acquire all or any of the following properties: (1) The capital stock, or the property, rights and undertaking of the Managua Lake Navigation Company; (2) the capital stock, or the property, rights and undertaking of the Managua Waterworks Company; (3) a concession of the Municipality of Masaya for the construction of a market in Masaya; (4) a concession by the same municipality for the construction and working of a tramway from the railway station in Masaya, by the route described in the concession to the Plaza de la Magdalena; (5) a concession by the same municipality for the supply of water to Masaya; (6) concessions by the municipalities of Jinotepe, Masatepe, San Marcos and Diriamba, for the supply of water to these towns; (7) the gold mines situated in Nicaragua, known respectively as El Calvario and La Republica. The first directors are Chas. A. Cater, F. W. Honisher, H. P. Powell, Colonel R. Thynne, C. B., and Captain P. Guisto.

#### FRANCE.

An explosion occurred in a colliery near Liecize, Department of Nièvre, on the 18th. It is not known how many lives were lost, but already 34 bodies have been recovered.

#### GERMANY.

**HESSE.**—The copper mines situated on the Hölenthal, some two hours' distance from Eschwege, and which have not been worked for forty years, are again to be worked. They have been purchased by a Hamburg company. It is said that silver and nickel may also be extracted there. In interested circles in the district great expectations have been formed of the project of the Hamburg Company.

#### IRELAND.

**THE MINING COMPANY OF IRELAND.**—This company, founded 65 years ago, is to be wound up, after an existence during which much was done to develop the mineral resources of the country—that being the ostensible object for which the company was formed. The nominal capital was £500,000, but of this only £140,000 was called up, and on this sum various dividends were paid, the highest touching 25 per cent. Prospecting was carried on vigorously in the early days of the enterprise, and quarries, mines and surface properties were leased or purchased in many counties. In County Waterford, the Knockmahon copper mines, in Tipperary, the Slievardagh collieries, and in Wicklow County, the Laganure lead mines returned considerable profits for many years. The first fourteen years, however, passed without benefit to the shareholders, and in 1838 the first dividend warrants were issued. None of the undertakings paid so well as the Knockmahon copper ore mine, from which a net profit of about £280,000, or double the paid-up capital, was realized. Fluctuations, however, in the value of copper set in and the yield showed a decrease, but the directors struggled on until 1876, hoping for a change for the better, which did not come. From the lead mines, too, was once realized a large profit, but circumstances operated against all the ventures of the company during the last two decades, and the collieries no longer showed a profit. The amount of sales at the pit's mouth decreased as the local population diminished, and a still further blow was given by the introduction of chemical manures, as the burning of lime was abandoned in a large measure, and this outlet for the produce of the mines shut off. At Laganure lead was next with difficulty obtained, and prices sank. Sir Robert Kane was for some time chairman, but in 1883 the old board retired, and a new directorate was formed. Large reductions were made in the establishments, and dividends to the amount of £8,000 were paid, but the earning powers of the company since showed no signs of increase, and the directors concluded that it was useless to endeavor to carry on the company. Arrangements are being made to realize the assets.

#### MEXICO.

##### LOWER CALIFORNIA.

We are in receipt of official information that the product of the Boleo Copper Mines for the month of December was 320 tons of 2,240 pounds of fine copper. The output for the current year is expected to exceed that for 1889, the complete figures for which we shall shortly publish.

##### SONORA.

The Rosario mine, near the Arizona line, owned by George W. Chase, of New York and P. T. Downing, of Tucson, is now ready to start crushing. They have a large quantity of good ore on the dump, and all the necessary supplies for a long run have been forwarded to the mine. This is an old Mexican mine, and has produced a large quantity of bullion, but the workings became too deep for the primitive way of working.

#### NORWAY.

##### SILVER MINING.

The Kongsberg Silver Works, which are the only ones of any importance in Norway, have not done particularly well last year. The production of fine silver was only about 5,800 kilograms, and, in addition to the smaller output, prices ruled very low; the quotation has ranged between 110½kr. and 116½kr. per kilogram. The surplus for the last financial year of the Kongsberg Silver Works only amounted to about 170,000kr., whereas it has averaged 450,000kr. annually for the three previous years. The present prospects are considered satisfactory. The Armeu mine, which yielded well all last year, continues to give plenty of good ore; the Kongen's mine, which has now been worked to a depth of 620 meters, is also tolerably good in certain portions; and the third of the Kongsberg old principal mines, the "Gottes Hilfe in der Noth" mine,

has also yielded well, and continues to promise well. Several of the other less important mines have also been worked with more or less satisfactory results.

#### SOUTH AFRICA.

It is difficult, in the absence of precise figures, to realize the enormous expense which miners in South Africa have to bear for the transport of machinery from the coast to the Rand district. The transport rates are simply ruinous, and nothing but a line of railway will save much of the capital invested in that country from absolute waste. The Sheba company had to get a battery of stamps sent up from the coast to the mines. The total weight was between 600 and 700 tons, and as the cost of transport from Biggarsberg—the nearest railway terminus—to Barberton was 15s. per 100 pounds, the wagon transport alone cost the company between £9,000 and £10,000; but as railway freight, landing and forwarding charges have to be added, it is calculated that the total cost in this case will be nearer £12,000 than £10,000. Had there been a railway up the valley of the Kaap River, the freightage for this machinery would not have exceeded £1 per ton. The latest reports from the goldfields state that wagons are plentiful and transport rates on the decline, but these rates still stand at such a figure as seriously to handicap the mining industry there.

Intelligence has been received in Berlin reporting that the building of the Delagoa Bay Railway has been resumed, and is being zealously pushed forward. The part from Moruni to the Transvaal frontier is almost finished, and that to the Komati River is to be completed before the rainy season. The earthwork has been contracted for as far as Barberton, which place the line is to reach within a year. The part from Barberton to Pretoria is being marked out, and many engineers are still being engaged.

#### MEETINGS.

Amy and Silversmith Consolidated Mining Company, at 29 West Broadway, Butte, Mont., on March 15th, at 4 P. M.

Commonwealth Consolidated Mining Company, at room 44, Nevada Block, No. 309 Montgomery street, San Francisco, Cal., on February 26th, at 11 A. M.

Del Monte Mining Company, at No. 309 Montgomery street, San Francisco, Cal., on February 25th, at 12 o'clock, noon.

Empire City Electric Company, at No. 15 Dey street, New York, March 6th, at 4 P. M.

Nevada Queen Mining Company, at room 44, Nevada Block, No. 309 Montgomery street, San Francisco, Cal., on February 26th, at 11:30 A. M.

Rich Hill Coal Mining Company, at Rich Hill, Bates county, Mo., on March 11th, at 9 A. M.

Robinson Consolidated Mining Company, at No. 45 Broadway, New York, March 4th, at 12 o'clock, noon.

#### ASSESSMENTS.

COMPANY.	No.	When levied.	DT'nt'q' in office.	Day of Sale.	Amn't per share.
Adelaide, Nev.....	1	Dec. 31	Jan. 3	Feb. 28	.10
Baltimore.....	6	Jan. 10	Feb. 21	Mar. 12	.20
Best & Belcher, Nev.....	3	Jan. 2	Feb. 13	Mar. 6	.25
Cambrian, S. Dak.....	3	Jan. 2	Feb. 5	Feb. 24	.001½
Col. Quartz, Cal.....	2	Jan. 9	Feb. 11	Feb. 28	.01
Co. St. Gothard, Cal.....	1	Jan. 14	Feb. 17	Mar. 10	.05
Crocker.....	8	Jan. 20	Mar. 5	Mar. 28	.10
Elk M'tain, S. Dak.....	6	Jan. 25	Feb. 25	Mar. 12	.004
Gate City, Dak.....	1	.....	Mar. 15	Apr. 2	.00½
Golden Reward, Dak.....	5	Jan. 10	Feb. 12	Mch. 1	.02
Grand Prize.....	24	Jan. 27	Mar. 5	Mar. 25	.30
Locomotive.....	6	Jan. 31	Mar. 3	Mar. 21	.05
May Flower, Cal.....	45	Dec. 27	Feb. 3	Feb. 25	.50
Mineral Hill.....	.....	Jan. 15	Feb. 19	Mar. 10	.003
Morning Star, Nev.....	6	Jan. 4	Feb. 10	Feb. 28	.01½
Occidental Con.....	5	Jan. 20	Feb. 23	Mar. 24	.25
Overman, Nev.....	61	Dec. 31	Feb. 5	Feb. 26	.25
Queen Bee, S. Dak.....	5	Jan. 10	Feb. 15	Mar. 5	.01
Seg. Belcher & Mides, Nev.....	5	Jan. 4	Feb. 6	Feb. 26	.25
Silver King.....	4	Jan. 15	Feb. 26	Mar. 27	.30
Spanish R., S. Dak.....	2	Jan. 9	Feb. 10	Feb. 27	.02
W. Y. O. D., Cal.....	5	Jan. 6	Feb. 8	Feb. 25	.15

#### DIVIDENDS.

American Coal Company, dividend of 3 per cent. on the capital stock, payable March 10 at No. 1 Broadway, New York.

Daly Mining Company, dividend No. 36 of 25c. per share, aggregating \$37,500, payable February 28th at the office of Lounsbury & Co., Mills Building, New York. Transfer books close February 22d and reopen March 1st.

Homestake Mining Company, dividend of 10c. per share, aggregating \$12,500, payable February 25th at the office of the company, San Francisco, Cal., or at the office of Lounsbury & Co., Mills Building, New York.

Kansas City Smelting and Refining Company, semi-annual dividend of 5 per cent. on the capital stock, payable February 21st at No. 20 Nassau street, New York.

Oakland Gas Company paid a dividend of 20c. per share on February 15th.

Ontario Silver Mining Company, dividend No. 165 of 50c. per share, aggregating \$75,000, payable February 28th at the office of Lounsbury & Co., Mills Building, New York. Transfer books close February 24th.

Oregon Coal and Navigation Company paid a dividend of 50c. per share on February 12th.

Silver Mining Company of Lake Valley, dividend of 5 per cent. on capital stock, aggregating \$25,000.

MINING STOCKS.

For complete quotations of shares listed in New York, Boston, San Francisco, Baltimore, Denver, Kansas City, St. Louis, Pittsburg, Birmingham, Ala.; London and Paris, see pages 239 and 240.

New York.

THURSDAY EVENING, Feb. 20.

The market has been slightly better than last week, and is steady but dull. No large sales are reported. Ten thousand shares of Brunswick were sold at one cent. Phoenix sold at 85c. and Caledonia at \$1.75. Prices are generally firmer in the better mines and all the dividend-paying mines are doing as well as could be reasonably expected.

In the Comstock shares there has been a decrease in the dullness, but they still continue quiet. For Comstock Tunnel scrip \$32 is asked. In other Comstock shares the prices remain practically unchanged.

In the California stocks, the "Bodies" have given little sign of activity. To-day 60c. was asked, with no bids.

In Tuscarora stocks, Navajo is at 25c. In North Commonwealth and Nevada there has been little doing.

Astoria has been heavily dealt in, 10,000 shares selling at 8@7c. On purchases of 6,000 shares, Freeland sold at 60 cts.

In a report from the superintendent of the Horn Silver Mining Company, the following figures are given: 1,920 tons of ore extracted from January 1st to January 31st; ore extracted February 1st to February 8th, 610 tons; sales of ore amounted to \$28,793; total cash receipts for January, \$30,864; total cash payments, \$11,760; ore shipped during January, 1,118 tons.

There have been a few sales of miscellaneous shares, but no noteworthy transactions have occurred, and no appreciable increase in prices.

Boston.

Feb. 19.

(From our Special Correspondent.)

The market for mining stocks continues to rule dull and inactive, with prices fairly steady. There is very little doing in the way of speculation outside of the board room, and investment orders come in very slow. We think, however, that prices have nearly reached the lowest level, and that, with the firm position of ingot copper, an improvement in the copper stocks may be reasonably looked for in the not distant future. The money market continues to be more or less a factor in checking speculative movements, but a change for the better in this respect is confidently looked for within a short time.

All the sales of Calumet and Hecla the past week have been at \$255, and less than 25 shares at that.

Tamarack sold at \$163, but declined on a small lot to \$161.

Boston & Montana touched \$46 1/2 at one time during the week, but sold off to-day to \$45 1/2.

Quincy advanced on a few shares from \$70 to \$71.

Osceola quiet but steady at \$27 to \$27 1/2. Franklin has been in good demand at \$13 1/2, with only 50 shares sold at that price.

Atlantic dull but steady at \$13. Kearsarg sold at \$10, but declined to-day to \$9 1/2.

Butte and Boston continues to be forced for sale, and has declined from \$13.25 to \$11.50.

Allouez touched \$1.75, but rallied and sold at \$1.90.

Centennial declined from \$25 to \$24, making a drop of \$4 per share since the stock was first quoted at the board.

A small lot of Pewabic sold at \$9. Huron sold at \$3.50, same as last week.

Bonanza declined to 85c. Santa Fe has been the most active stock on the list, sales aggregating over 9,500 shares, declining from \$1.12 1/2 c. to 97 1/2 c., with later sales at \$1.

Silver stocks quiet. Sales of Dunkin at 65c. Catalpa at 16@15c. Breece has been active outside the Stock Exchange, selling up to 75c., but reacted to 60c., at which it was offered to-day.

3 p. m.—Tamarack advanced to \$163 this afternoon, and Franklin to \$13.50. Balance of the list unchanged.

Lake Superior Gold and Iron Stocks.

(Special Report by David M. Ford, Houghton, Mich.)

Gold Stocks.—There has been no change in the prices of these stocks during the past week, except the Peninsula Gold and Silver Company, which

has declined from 80c. to 75c., and the Grayling Gold and Silver Company, which has advanced from \$1 to \$1.25.

At the Michigan mine the new mill is running, and on February 10th a double shift was put at work. There are now two boilers at the mill, but the one first bought does not make steam properly on soft coal. Wood will be used as fuel in this boiler, and better results are then expected. The Huntington mill in use is giving good satisfaction, but has failed, as yet, to treat as many tons daily as it is guaranteed to.

For the first three days, ending February 12th over 13 pounds of amalgam was taken from the plates, that being the yield of 27 tons of quartz. This amalgam averages 55 per cent. in bullion, worth from \$250 to \$275 per pound avoirdupois. The quartz milled this week was all taken from the dump, and has yielded over \$70 per ton in gold.

The shaft of this mine is now 80 feet in depth. At a depth of between 65 and 70 feet the vein splits, one part running almost vertically, and the other making off at a short angle to the south. The portion that descends almost vertically has been followed, and this part of the vein, which is about 5 feet in width, shows good results, assays of the quartz averaging over \$300 per ton.

At a depth of 70 feet the first level has been begun, and a drift has been run east 15 feet, and about as far west of the shaft. This rock also shows good results.

Iron Stocks.—These stocks have shown activity and an upward tendency during the past week as is shown by the following quotations:

GOLD MINING STOCKS.

Table with 4 columns: Name of Company, Par value, Lowest, High. Includes Grayling Gold & Silver Co., Michigan Gold Co., Peninsula Gold & Silver Co., Ropes Gold & Silver Co.

IRON MINING STOCKS.

Table with 4 columns: Name of company, Par value, Bid, Asked. Includes Ashland Iron Co., Aurora Iron Co., Champion Iron Co., Chandler Iron Co., Chapin Iron Mining Co., Chicago & Minn. Ore Co., Cleveland Iron Co., Germania, Jackson Iron Co., Lake Superior Iron Co., Milwaukee Iron Co., Minnesota Iron Co., Montreal Iron Co., Norrie (Metropolitan), Odenah Iron Co., Pittsburg Lake Angeline Co., Republic Iron Co.

PIPE LINE CERTIFICATES.

(Specially Reported by Messrs. WATSON & GIBSON.)

The petroleum market continues in the same old rut and speculation is a missing quantity. There has been some increase in development work and production, and a good many bulls are beginning to waver in their confidence in the outlook for the petroleum market, because they fear that the bearish speculative feeling which exists in all markets will at least prevent purchases of oil; while the Standard, being the principal consumer of it, can have no possible interest in putting up its price.

NEW YORK STOCK EXCHANGE.

Table with 5 columns: Opening, Highest, Lowest, Closing, Sales. Lists Feb. 15 to 20.

Total sales in barrels..... 449,000

CONSOLIDATED STOCK AND PETROLEUM EXCHANGE.

Table with 5 columns: Opening, Highest, Lowest, Closing, Sales. Lists Feb. 15 to 20.

Total sales in barrels..... 428,000

Electric Stocks.

Prices during three days ending February 12th:

Table with 5 columns: Company, O, H, L, C. Lists Alleghany, Amity, Bangkok-C-B, Brownlow, Calliope, Clay County, Hard Money, Matchless, May-Mazzeppa, Mollie Gibson, Oro, Pay Rock, Puzzler, Silver Cord, Whale.

PROSPECTS.

Table with 5 columns: Company, O, H, L, C. Lists Aspen Mutual, Big Indian, Big Six, Claudia J., Golden Treasure, Legal Tender, Morning Gum.

COAL TRADE REVIEW.

NEW YORK, Thursday Evening, Feb. 20.

PRODUCTION OF BITUMINOUS COAL for week ended February 15th and year from January 1st:

EASTERN AND NORTHERN SHIPMENTS.

Table with 4 columns: Tons of 2,240 lbs., Week, Year, 1889, Year, 1890. Lists Phila. & Erie R.R., Cumberland, Md., Barclay, Pa., Broad Top, Pa., Clearfield, Pa., Allegheny, Pa., Beach Creek, Pa., Pocahontas Flat Top, Kanawha, W. Va., Total.

WESTERN SHIPMENTS.

Table with 4 columns: Tons of 2,240 lbs., Week, Year, 1889, Year, 1890. Lists Pittsburg, Pa., Westmoreland, Pa., Monongahela, Pa., Total.

Grand total..... 381,228 2,498,230 1,948,520

PRODUCTION OF COKE on line of Pennsylvania R. R. for the week ending February 15th, and year from January 1st, in tons of 2,000 lbs.: Week, 107,641 tons; year, 761,927 tons; to corresponding date in 1889, 611,083.

Anthracite.

The market in hard coal is dull and uninteresting. "Exceeding but not unusual dullness for this time of the year" is the universal statement of dealers. There is no particular schedule of prices being maintained. The prices are lower than those current at the corresponding period last year, and there are rumors of sales of 2d grade chestnut at \$3.15 afloat, and of a better quality, \$3.35.

The output, however, will not be as great this month as in January, owing to the restriction in the supply ordered for February and March.

Bituminous.

The demand and the supply in this are fairly good, and the market is steady. Cars are rather more plentiful, the urgent requirements for them from all quarters having somewhat abated, and altogether the feeling among the dealers in bituminous coal is in marked contrast to the complaints of the anthracite men. Prices are good, and in consequence of labor troubles in Europe, inquiries have been received by producers here as to prices for large orders from the other side. The dearthness of fuel in Europe might well influence the market here, as coke is reported by cable from England to have risen to 35s. Contracts are being filled, and orders are coming in from the retail trade of the smaller ports. These have experienced great difficulty in getting vessels for the transportation of coal, as shipmasters declined to go to harbors where they might be frozen in. With the approach of spring this objection disappears, and coal in fair quantities is now being shipped to these ports.

In regard to the proposed "Seaboard Coal Agency Company," it is stated that at the solicitation of the company, producers have agreed to put off making any contracts until after March 1st. Most members of the trade express doubts as to the combination going through. In all probability producers will have the same agreement as to prices that was maintained last year, with the penalty clause omitted.

The annual report of the Lehigh Coal & Navigation Company shows total revenue \$2,153,233, decrease \$100,401; disbursements \$1,161,045, decrease \$21,655; net \$992,168, decrease \$78,747. After setting aside \$118,241 for sinking fund and allowing \$105,911 for depreciation on coal improvements, surplus is \$768,014. Balance, after paying five per cent. dividends, is \$126,833, against \$119,946 the previous year. Decrease in gross earnings was due to a falling off of \$154,435 in receipts for coal. The general and legal expenses increased from \$58,993 to \$71,965. The amount allowed for depreciation of property is about \$23,000 less than 1888. The gross receipts of the company's railroads were \$5,320,853, a decrease of \$20,661. Coal tonnage was 6,075,400 tons, against 5,957,206 in 1888.

Boston.

Feb. 19.

(From our Special Correspondent.)

The events of the week which are of especial note are in the bituminous rather than anthracite branch of the Boston coal market. The game of bluffing is over. Soft coal agents have placed, and are placing, their yearly contracts with our leading railroad and manufacturing corporations. Nominally no business is being done where contracts call for delivery after March 1; actually, this is all nonsense. I, myself, saw a letter to-day from a leading corporation stating officially that it had closed its contract this week.

It is said that the Norfolk & Western and Chesapeake & Ohio agencies here have already contracted for a large tonnage. This may be an exaggeration; or it may be that technically and literally no large number of contracts have been made, but actually a good share of New England business has now been secured, and not merely two or three agents, but all the "hustlers" are out for contracts. So far as can be learned prices are fully as

low as those of last year. Pool talk is dealt out only to the uninitiated, and the chances of any effective combine this year look very slim from this end of the line. I should quote \$2.50 f. o. b. as an outside price. Contracts are being made on a delivered basis when such a course is demanded.

Anthracite coal is flat. A buyer would do well not to offer \$3.75 f. o. b. at New York for stove coal unless he wanted his offer snapped up. As nothing was said or done about prices at the last meeting of the companies, the agents are apparently given pretty wide discretion. If anything further was needed to rattle the market, the thunder shower of last night would answer. Actual thunder and lightning in February is something of a novelty, and our cold spell has proved of short duration. Buyers are justified in offering almost any price for any size save broken, and while broken is plenty enough, there is no glut of it, as there is of stove and egg.

Freights are easier at New York, quoting 70 to 75 cents; Philadelphia steady at \$1.35@1.40; Baltimore unchanged at \$1.60.

Retail trade is still very quiet for the season. Receipts at this port for the week have been as follows:

	For the week		Since Jan. 1st	
	1890.	1889.	1890.	1889.
Anthracite.....	19,570	11,181	99,708	93,192
Bituminous.....	31,971	15,856	86,430	109,866
Total.....	51,541	27,037	186,138	202,358

Buffalo. Feb. 19.

(From our Special Correspondent.)

Contracts for a portion of the Grand Trunk Railway, Canada's bituminous coal supply has been awarded without much competition. It is understood that the price was on the basis of 1.80 at the International and 1.90 at Suspension Bridge per net ton on cars. Buffalo firms secured 230,000 tons, namely: Messrs. Bell, Lewis & Yates, 150,000; Messrs. Bright, Dowdell & Co., 50,000; and Messrs. Thomas, Loomis & Co., 30,000. Messrs. Thomas, Mitchell & Sons, of Brady's Bend, got 40,000 tons, and the Erie folks quite a good slice.

Coal matters here generally without change. There are two vacancies in the Board of Regents of the New York State University. Mr. T. Guilford Smith, the well-known coal and iron merchant of our city, has been named as a candidate for one vacancy. An excellent nomination. Mr. Smith is unquestionably well qualified for the position in the general opinion of our citizens, and if their voice has any weight, he will surely be appointed to the honorable and responsible office. As was well expressed by one of our citizens: "He is a man of the highest character, public spirited, and would take a special interest in educational affairs."

Mr. Joseph C. Batchelor, of the Delaware & Hudson Canal Company, has been elected a member of the Buffalo Merchants' Exchange.

Many of our citizens are putting down wells for natural gas. The great success attending previous ventures has stimulated others to "go and do likewise."

The electric light companies have been quietly talked to by our new Mayor Bishop, and the result is that they will take off 2½ cents per light per night after March 1st. Similar action taken with the gas light companies will reduce the cost of that commodity on and after same date 5 cents per 1,000 cubic feet, making the price \$1.20 per 1,000 cubic feet.

The Car Service Association is still in trouble; many of our coal shippers have refused to pay the car service demurrage charges imposed, and practically defy the Association to collect them. Manager Van Erten says, "that he will have no official notice of the trouble until the 1st of next month; but all car service associations have passed through similar experiences." A coal shipper says, "I have been soaked on demurrage charges, but I don't intend to pay them. What can the railroad do? They can't hold any other cars for my failure to pay charges on that car, and I'd like to see them sue me for the amount. They can't collect it."

By-the-by, the report of the Cleveland Car Service Association shows that during January the average detention of coal cars was two days and 18 hours, and of other cars, one day and three hours. The average detention during January, 1889, was over four days.

A steam barge arrived in Chicago, a few days ago, with about 700 tons of coal on board which had been pumped out of the wrecked schooner "David Dows."

About 100,000 tons of ore have been contracted for to be brought from the mines to Cleveland next season by lake at \$1.10 from Escanaba, \$1.25 from Marquette and \$1.35 from Ashland and Five Harbors.

Pittsburg. Feb. 20.

(From our Special Correspondent.)

Coal.—The market continues very dull, prices are weak but unchanged. The stage of water being good we can report liberal shipments to the lower markets which contain an abundant supply.

The nominal assets are:

Per 100 bushels.		Per 100 bushels.	
1st pool.....	\$1.75	3d pool.....	\$3.99
2d pool.....	4.51	4th pool.....	3.25
Railroad coal, \$5.20@5.50.			

Connellsville Coke.—The demand has fallen off, many consumers have a good supply on hand

and are disposed to use what they have before contracting for more.

The current rates on Furnace f. o. b. cars at works, \$2.15; Foundries \$2.45; Crushed, \$2.65. Freights.—Shipments, 70c.; Mahoning and Shesango valleys, \$1.35; St. Louis, \$3.65; Chicago, \$2.75; Cleveland, \$1.70.

METAL MARKET.

NEW YORK, Thursday Evening, Feb. 20.  
Prices of silver per ounce troy.

Feb.	Sterling Exch'ge.	London Pence.	N. Y. Cts.	Feb.	Sterling Exch'ge.	London Pence.	N. Y. Cts.
15	4.86½	*	95½	19	4.85½	42¾	95¼
17	4.86	43¾	95½	20	4.85½	43¾	95¼
18	4.86	44	95½				

\* 43 11-16

Silver market has proved very erratic this week, opening with strong upward tendency, but suffering a sharp decline on Wednesday after the allotment of council bills, at 1s. 5d., and increased offering for next week were known. Weakness in Sterling Exchange also depressed prices.

United States Assay Office at New York reports total receipts of silver for the week, 140,000 ounces.

Coinage executed at the mint of the United States during January: Double Eagles, 135,240 pieces; value, \$2,704,800. Eagles, 56,980 pieces; value, \$569,800. Total gold, 192,220 pieces; value, \$3,274,600. Standard dollars, 3,000,000 pieces; value, \$3,000,000. Total silver, 3,000,000 pieces; value, \$3,000,000. Five cents, 1,509,400 pieces; value, \$75,470. One cent, 5,121,000 pieces; value, \$51,210. Total minor, 6,630,400 pieces; value, \$126,680. Total coinage, 9,822,620 pieces; value, \$6,401,280.

Domestic and Foreign Coin.

The following are the latest market quotations for American and other coin:

	Bid.	Asked
Trade dollars.....	.76	.78
Mexican dollars.....	.75	.76
Peruvian soles and Chilean pesos.....	Nominal	Nominal
English silver.....	4.83	4.88
Five francs.....	.94	.95
Victoria sovereigns.....	4.86	4.88
Twenty francs.....	3.85	3.90
Twenty marks.....	4.74	4.78
Spanish doubloons.....	15.55	15.70
Spanish 25 pesetas.....	4.82	4.88
Mexican doubloons.....	15.55	15.70
Mexican 20 pesos.....	19.50	19.60
Ten guilders.....	3.96	4.00

Copper.—The tone of the copper market continues firm, with the demand for trade purposes satisfactory. This remark applies both to Lake copper and also to the casting brands, the latter now being held for stiffer prices, with consumers' orders more numerous. We have still to quote Lake at 14¼@14½c., and casting kinds, 12½@13c., according to brand.

At the beginning of the present week the London market for G. M. B. copper and Chili bars gave indications of returning strength, and an advance of about 10s. a ton was gained, but subsequently this improvement was lost again, and the latest cable quotations are £47 5s. to £47 7s. 6d. spot and £47 17s. 6d. to £48, showing a decline of about 2s. from those of a week ago.

Cable advices report the statistics of visible supplies, as made up for the first half of February, to show a decrease of 500 tons, and all communications lately received from Europe agree that the markets on the other side are in a sound and healthy condition, the latest London quotations for refined manufactured sorts being as follows: English tough, £54 to £55; best selected, £56 to £56 10s.; strong sheets, £65 to £66; India sheets, £60 to £62; yellow metal, 6d.

Tin.—The tin market has been subject to a considerable amount of fluctuation since our last report, but while such tendency as has been apparent has been in the direction of contracted values, the actual change for the week has been quite insignificant and at the slight concession in prices a large amount of business has been transacted. The total quantity changing hands being 400 to 500 tons or more. Spot tin is scarce, and comparatively high prices are obtainable for immediate and early deliveries, and for these positions the market closes rather higher, while for futures the quotations are lower. We quote spot at 21c., February at 21c., March at 20½c., April at 20½c., May at 20½c., June at 20½c.

In London the market has also run rather an erratic course during the week, fluctuating between £91 and £91 10s. for spot, and £91 10s. and £92 for futures, and the latest quotations in that market, as per cable advices, are spot, £90 7s. 6d. @ £90 10s., and futures, £91 @ £91 5s.

It is expected that the total shipments from the East during the present month will again be very heavy.

Lead.—The market continues in a dull and unsatisfactory state, and that although the long discussed Mexican ore question is again understood to be the subject of attention by the Legislature, and it is reported that the Ways and Means Com-

mittee is prepared to propose an alteration of the schedule of duties, the effect of which will be the practical exclusion of Mexican silver lead ores by bringing all lead ores containing gold and silver within the description of ores chargeable with a duty of 1½c. per pound for all the lead contents. In spite of this we have still to quote the present value at 3'80@3'85. The European markets have been steady and the latest cable quotations show a rise of about 5s. per ton, with the present London quotations at £13 for Spanish and £13 5s. for English lead.

Spelter continues irregular and comparatively neglected, the present quotations for pure Western being 5'25@5'30.

The European markets are reported firm, and the London market has quickly recovered its recent relapse to £21 10s. The latest quotations from that market received by cable are: Ordinaries, £22 5s.; specials, £23 10s.

Antimony is in better demand, with Cookson's quoted 28@29 and Hallett's 19½@19¾.

IRON MARKET REVIEW.

NEW YORK, Thursday Evening, Feb. 20.

Pig Iron.—There has been but little change in the market the past week. Moderate sales are reported, among others, one of Allentown iron at slightly lower figures than ruling prices. It is not probable, however, that the sale was made at much less than \$20. Fifteen hundred tons of No. 1 soft Southern iron have been offered at \$16 at the furnaces, with no takers, inasmuch as this grade of iron is a highly carbonized one, and Northern consumers profess ignorance as to its use. A scarcity of pig is complained of by prominent dealers, and rumor has it that the Thomas Iron Works has not more than enough iron on hand to keep them four days. This state of affairs is said to have existed from January 1st.

Prices remain as reported last week. No. 1 X Foundry iron, \$20; No. 2, \$19, and Gray Forge, \$18.

A fact of interest to Eastern men is that the Sheffield, Ala., furnaces have begun to ship pig iron to Pittsburg, via the Tennessee and Ohio rivers. A shipment of 5,000 tons is contracted for. The rate of freight is \$2.50 per ton, and this is so much less than the rate by rail that it may have some effect upon the Eastern market.

Scotch Pig.—The imports of Scotch Pig Iron have been so light that there is very little of this article on the market. Two hundred tons were received last week, but this had been sold prior to delivery, and was not put on the market. The prices remain nominally the same.

Spiegeleisen and Ferromanganese.—There is nothing new to record in the first mentioned product. Prices continue to be \$36@36.50. In ferromanganese, sales have been reported to Pittsburg men. For early delivery quotations are \$88@89.

Steel Rails.—No large sales have been made in this article, and business may be said to be dull. There are rumors of a few steel rails having been sold at \$35. Quotations are nominally \$35.50@36.

The American Iron and Steel Association has ascertained that the total quantity of Bessemer steel rails made in the United States in 1889 by works producing their own ingots was 1,644,234 net tons, or 1,468,066 gross tons, a gain of only 102,045 gross tons over the production of 1,365,921 gross tons in 1888.

Merchant Steel.—The condition in this is not as promising as it was two or three months ago. The mills are all working at present, but orders for future delivery are not plentiful. Prices are as follows: Best English tool steel, 15c. net; American tool steel, 8@10c.; special grades, 13@20c.; crucible machinery steel, 5c.; crucible spring, 3¾c.; open-hearth machinery, 2¾c.; open-hearth spring, 2¾c.; tire steel, 2¾c.

Old Rails.—There is a sale of 1,015 tons of old tees reported at Buffalo. The price given could not be ascertained.

Philadelphia. Feb. 20.

(From our Special Correspondent.)

Pig Iron.—The large shipment of Alabama pig iron to Pittsburg, has started inquiry as to the possibility of getting Alabama iron east of the mountains. The difference in freight and water rates to Pittsburg is \$2.60 per ton in favor of the latter; but the rail rates eastward at present forbid iron reaching Eastern markets that way. The present freight rates by way of Savannah are high enough to place a practical embargo upon Alabama iron in Philadelphia markets, although there are some inquiries in hand for Southern iron, and a few furnace men in the South are figuring for business here; but as yet they have not met with any success. The amount of spot iron offered in this market is light, and it is mostly of inferior make. A few brands of gray forge have been offered at \$17.50, and to-day that figure was slightly shaded, without finding buyers. No. 2 iron is under more active inquiry, and from all that can be gathered, a good deal will be sold within the next 30 days. No. 1 is not actively inquired for, but more is selling; the average price is \$20, but some brands can be had at 25 to 50 cents less. There is no business doing at present in Bessemer pig; the furnaces are all pretty well sold up.

Foreign Material.—Several inquiries have just been received by brokers for foreign material, and the best possible prices have been named; but the terms are strictly private. Buyers would like to obtain spiegeleisen at about \$34.50. Ferromanganese is quoted all the way from \$85 to \$100.

Muck Bars.—Muck bars are quoted to-day at \$33 delivered, and one lot of good make has sold at that price. The lowest mill quotation received to-day was \$31.50; this is the very bottom price.

Merchant Bars.—Merchant iron has been sold in this city at 1'90, but the regular price is 2c., with common quoted at 1'70 to 1'80, and medium 1'80 to 1'90. Several interior mills have been booking a good deal of business for car iron during the week, but the city and near by mills report business rather dull.

Skeip Iron.—Skeip iron is under good inquiry, and the mills are assured of considerable business between this and March 1st. Grooved is quoted at 1'95, and sheared, 2'10.

Wrought Iron Pipe.—Discounts are very firmly adhered to, and business is good.

Nails.—Business is dull, but prices are firm. The factories are busy and prospects good. Quotations are \$2 10 for car lots, but it is asserted that \$2 would be accepted.

Merchant Steel.—The demand for merchant steel is good, but in small lots. Prices would not be shaded excepting for very large orders.

Sheet Iron.—The mills are all running along steadily and receiving fair orders for spring and early summer. There is very little departure from card rates.

Plate and Tank Iron.—The demand for plate and tank is moderate and prices are firm. Quotations: 2'35 for tank, 2'65 for shell, 3'75 for fire box, all iron.

Structural Iron.—Several large orders were promised for this week, but as yet have not been placed. The buyers of structural iron seem to be still undecided as to whether it would be best to place their orders now or wait. Bridge plate is 2'35; angles, 2'30; tees, 2'80; beams and channels, 3'10.

Steel Rails.—Steel rail quotations are strong at \$35 to \$36, without much activity. One mill in the interior is reported to have just closed a contract for 10,000 tons at \$35.

Old Rails.—Old rails are asked for in considerable quantities. Prices range from \$27.50, for tees, to \$28.50. There are a few lots here, and more are promised by March 1st.

Scrap.—The scrap market is quiet. No. 1 has fallen a little, and \$23.50 was the selling price yesterday for two or three fair lots. Machinery scrap is quoted at \$16 to \$16.50; wrought turnings, \$17; cast borings, \$11.

Pittsburg. Feb 19.

(From our Special Correspondent.)

Raw Iron.—The iron market continues in a very unsettled condition, dealers wide apart in their views. As usual city furnace made iron is most fancied and commands the highest prices, and is ranked as better iron, besides in most cases they refuse to sell at prices offered for outside lots. A sale of 5,000 tons Bessemer was made. The parties, however, refuse to furnish figures, which is generally understood to mean below current rates. A dispatch from Sheffield, Alabama, says: "We are celebrating the first shipment of pig iron from Alabama to Pittsburg, Pa., by barges via the Tennessee and Ohio rivers, the present shipment being 5,000 tons grey forge, the rate being \$2.50 per ton, which is so much less than the rate by rail that it affects the iron trade of the entire country. A contract for the shipment of 12,000 tons additional has been made. A big banquet was held at the Cleveland House, attended by a

large number of invited guests from the South and from Cincinnati, Pittsburg, Indianapolis, St. Louis and Kansas City."

The rates from that point to Pittsburg by rail is \$4.50 per ton, difference in favor of water \$2 per ton. One thing is very certain, it will be a big advertisement for the Southern iron trade, and no doubt that was what was intended. Prices have been slowly but gradually tending towards a lower range. Leading dealers seem to think the bottom has been reached. The high cost of raw material and the certainty of its being maintained at least for some time to come compel producers to adjust selling prices in proportion so that the chances of a decline are becoming smaller.

Coal and Coke Smelted Lake Ore.

Table listing various iron and steel products with prices, including items like 2,000 Tons Bessemer, March, 1,000 Tons Gray Forge, etc.

Coke, Native Ore.

Table listing coke and native ore products with prices, including items like 100 Tons Silvery, 50 Tons Silvery, extra, etc.

Muck Bar.

Table listing muck bar products with prices, including items like 500 Tons Neutral, 500 Tons Neutral—March, etc.

Steel Slabs and Billets.

Table listing steel slabs and billets products with prices, including items like 750 Tons Billets, 500 Tons Billets, etc.

Steel Wire Rods.

Table listing steel wire rods products with prices, including items like 350 Tons American Fives, Bloom Ends, etc.

Bloom Ends.

Table listing bloom ends products with prices, including items like 1,200 Tons Bloom Ends, Skeip Iron, etc.

Skeip Iron.

Table listing skeip iron products with prices, including items like 300 Tons Sheared Iron, 200 Tons Narrow Grooved, etc.

Ferro-Manganese.

Table listing ferro-manganese products with prices, including items like 200 Tons 80 per cent. ex. Ship, Baltimore, etc.

Spiegel.

Table listing spiegel products with prices, including items like 50 Tons 20 per cent., 20 Tons 10 and 12 per cent., etc.

Prices.

Large table listing various prices for pig, foundry, white, mottled, silvery, Bessemer, low phos., charcoal pig, coke or bituminous pig, and wire nails.

CHEMICALS AND MINERALS.

NEW YORK, Thursday Evening, Feb. 20.

Heavy Chemicals.—There has been a decided advance in high test carbonated soda ash, and dealers complain that they cannot supply the demand. For 48 per cent., \$1.50@1.55 is asked, and for 58 per cent., the ruling quotations are \$1.50 in a large way, and in small lots \$1.75@2.

Caustic Soda.—Dealers report an increased firmness in this article at the prices given in our last issue. Sales of 3,000 tons, 70@74 per cent. for future delivery, are rumored at current prices. There is a fair demand for 60 per cent.

Caustic Soda Ash.—There is not much demand in this and prices remain unchanged. It is possible that the higher figures in caustic soda and alkali may advance the prices.

Bleaching powder is easier; \$1.45 on spot and \$1.40 to arrive is asked.

Business of a jobbing nature only is reported, and the advance expected on account of the higher Liverpool prices has not developed.

There is a good demand for American brands of sal soda, the English product not being much sought after, and last week's prices are maintained.

Acids.—The outlook in this branch of the chemical market is improving, and the expectation is that before another month goes by the acid manufacturers will be very busy. The stock of the consumers who bought last year when low prices prevailed is becoming exhausted, and by March they will begin to send in their orders. Business is better than last week and prices remain the same. There has been a fair jobbing trade.

Oxalic acid continues dull and weak in prices.

Fertilizing Chemicals.—The market in fertilizers is dull, with a slight increase in business over last week. Sales of high grade dried blood are reported at \$1.95@2, and 200 tons of sulphate of ammonia at \$3.12@3.15.

Ruling prices are as follows: Azotine, \$1.90@2; dried blood, low grade, \$1.85@1.92; high grade, \$1.92@2. Tankage, high grade, 9 to 10 per cent. ammonia and 15 to 20 per cent. phosphate, \$20@21 per ton, and low grade, 7 to 8 per cent. ammonia and 25 to 30 per cent. phosphate, \$18.50. Fish scrap, \$21.50@22 per ton, f.o.b. factory. Sulphate of ammonia at \$3.12@3.15 per cwt. Concentrated tankage, \$1.90@2. Refuse bone-black, guaranteed 70 per cent. phosphate, \$20 per ton. Dissolved bone-black is 95c. per unit for available phosphoric acid, and acid phosphate 80c. per unit for available phosphoric acid. Steamed bones, unground, \$20@23; ground, \$25@26.

Charleston rock, undried, \$5.75 per ton; kiln-dried, \$6.75@7 per ton, both f. o. b. vessels at the mines. Freight by rail from Charleston to New York, \$3@3.25 per ton. Charleston rock, ground, \$11.50@12, ex-vessel at New York.

Double manure salts, 48 to 51 per cent. sulphate of potash, \$1.12@1.15 per 100 pounds for shipments after April 1; high grade manure salts, basis 90 per cent. sulphate of potash, \$2.37@2.40 per 100 pounds. For lots on the spot, an advance over the above-named figures of 2 1/2 c. per 100 pounds is quoted.

Kainit.—The demand in this article is good, but there is no supply. A certain quantity contracted for has been shipped, and that is about all the movement that has taken place. It is reported that \$11 has been offered for some in second hands.

BUILDING MATERIAL MARKET.

NEW YORK, Thursday Evening, Feb. 20.

Bricks.—As before stated no bricks above Haverstraw are being shipped, and the daily receipts are not more than 1,000,000. Sales are reported numerous, and the market is firm but not active. Local dealers state that they will not sell under \$8 per M. for best Haverstraws. Jerseys continue at last week's prices, \$5.50@6, and pales have gone up to \$4 per M.

Lime.—There is very little lime on the way, the result of the restriction ordered by the combination. The demand is quite good, and the price remains about the same.

Cement.—There is nothing new to record in the imported article. It is expected that prices will go up shortly, and that the quotations ruling during the last few months of the year will prevail. The increase in wages on the "other side" was offset by a decrease of trans-atlantic freights, and no appreciable difference in prices has resulted.

IMPORTS AND EXPORTS OF METALS AT NEW YORK FEBRUARY 8 TO FEBRUARY 15 AND FROM JANUARY 1.

Large table with multiple columns showing imports and exports of metals (Spelter, Pig Lead, Tin, Steel Blooms, Bar Iron, Scrap Iron, Steel and Iron Rods, Old Rails, Spiegeleisen) with sub-columns for tons and values.

DIVIDEND-PAYING MINES.

NON-DIVIDEND PAYING MINES

Main table with columns: NAME AND LOCAT COMPART., CAPITAL STOCK, SHARES, ASSESSMENTS, DIVIDENDS, NAME AND LOCATION O COMPANY, CAPITAL STOCK, SHARES, ASSESSMENTS. Lists various mining companies and their financial details.

G. Gold, S. Silver, L. Lead, C. Copper. \* Non-assessable. † This company, as the Western, up to Dec. 10th, 1881, paid \$1,400,000. ‡ Non-assessable for three years. § The Deadwood reviously paid \$275,000 in eleven dividends, and the Terra \$75,000. ¶ Previous to the consolidation in Aug., 1884, the California had paid \$31,320,000 in dividends, and the Con. Virginia, \$240,000. \*\* Previous to the consolidation of the Copper Queen with the Atlanta, Ariz., 1885, the Copper Queen had paid \$1,350,000 in dividends. †† 1,000,000.

NEW YORK MINING STOCKS QUOTATIONS.

DIVIDEND-PAYING MINES

NON-DIVIDEND-PAYING MINES.

Main table of New York Mining Stocks Quotations, divided into Dividend-paying and Non-dividend-paying mines. Columns include Name and Location of Company, dates from Feb. 15 to Feb. 21, and Sales figures.

\*Ex. dividend, †Dealt in at the New York Stock Ex. Unlisted securities ‡Assessment unpaid. Dividend shares sold, 20,115 Non-dividend shares sold 14,549 Total, New York, 161,964.

BOSTON MINING STOCK QUOTATIONS.

Table of Boston Mining Stock Quotations, listing company names, dates from Feb. 14 to Feb. 20, and sales figures.

Boston: Dividend shares sold, 5,094. Non-dividend shares sold, 17,229. Total Boston, 22,323.

COAL STOCKS.

Table of Coal Stocks, listing company names, par values, and prices from Feb. 15 to Feb. 20.

\*Sales in New York, 43,440; in Philadelphia, 21,171. Total sales 151,522.

San Francisco Mining Stock Quotations.

Table of San Francisco Mining Stock Quotations, listing company names and closing quotations from Feb. 14 to Feb. 20.

STOCK MARKET QUOTATIONS.

Baltimore, Md. COMPANY. Bid. Asked. Atlantic Coal 1.00 1.05

Birmingham, Ala. COMPANY. Bid. Asked. Ala. R. Mill Co. \$100 \$60

Kansas City, Mo. Feb. 17. COMPANY. Par value. Bid. Asked. Ben Harrison \$25.00 \$35.00

Pittsburg, Pa. COMPANY. H. L. Closing. Allegheny Gas Co. \$41.00 \$41.00

Sales during the week ending Feb. 19, 1890. Chartiers Gas 50 shs. @ \$39.25

St. Louis, Feb. 19. CLOSING PRICES. COMPANY. Bid. Asked. Adams, Colo. \$ .55 \$ .60

Trust Stocks. Feb. 20. The following closing quotations are reported to-day by C. I. Hudson & Co.

Foreign Quotations. London, Feb. 8. COMPANY. Highest. Lowest. Almada, Mex. 1s 6d. 1s.

Paris, Feb. 8. Belmez, Spain. 550.00 550.00

CURRENT PRICES. These quotations are for wholesale lots in New York.

CHEMICALS AND MINERALS. Acid—Acetic, 100 lbs. \$1.75 @ \$1.00

Salt Cake—100 lb. 60 @ 62 1/2

THE RARER METALS.

Aluminum—(Metallic), 100 lb. \$2 @ \$2.50

BUILDING MATERIAL.

Bricks—Pale, 1,000 3 25 @ 3.50

THE ENGINEERING AND MINING JOURNAL will thank

any one who will indicate any other articles which might with advantage be quoted in these tables or who will correct any errors which may be found in these quotations.