THE ENGINEERING AND MINING JOURNAL

AND

COAL

Entered at the Post-Office of New York, N. Y., as Second-Class Matter.

VOL. XXXVIII. NOVEMBER 8. No. 19.

RICHARD P. ROTHWELL, C.E., M.E., ROSSITER W. RAYMOND, Ph.D., CHARLES KIRCHHOFF, Jr., M.E., } Editors.

☞ **Articles, communications, reports, documents, books—all things whatsoever belonging to the Editorial Department, should be thus addressed: MANAGING EDITOR ENGINEERING AND MINING JOURNAL, P.O. BOX 1833, New York City.**

Communications for Mr. RAYMOND should be addressed to ROSSITER W. RAYMOND, P.O. Box 1465, New York. Articles written by Mr. RAYMOND will be signed thus *; and only for articles so signed is he responsible.

SUBSCRIPTION PRICE, including postage, for the United States and Canada, $4 per annum; $2.25 for six months; all other countries, including postage, $5.50 = 22s. = 28 francs = 22 marks. All payments must be made in advance.

FILE COVERS will be sent by mail for $1.25 or delivered at office for $1 each.

Advertising Rates.—See page vii.

Mr. C. A. Green is our accredited representative for New York.

Mr. A. R. Brown, Jr., is our accredited representative for Boston and the Eastern States. Office, Room 1, Simmons Building, 38 Water street, Boston.

Mr. J. Viennot, 150 South Fourth street, Philadelphia, is our accredited representative for Pennsylvania, Maryland, and Delaware.

Mr. O. D. Cotton, Columbus, O., is our accredited representative for Ohio, Illinois, Missouri, Iowa, Michigan, Indiana, and the Southern States.

Mr. O. J. Frost, care Boston & Colorado Smelting Company, Argo, Colo., is our accredited representative for Denver and vicinity.

REMITTANCES should always be made by Post-Office Orders or Bank Drafts on New York, made payable to THE SCIENTIFIC PUBLISHING COMPANY.

THE SCIENTIFIC PUBLISHING CO., Publishers.

R. P. ROTHWELL, Pres. HENRY M. GEER, Sec. and General Manager,

P.O. Box 1833. 27 Park Place, New York.

CONTENTS.

THE American Society of Mechanical Engineers has held a very successful meeting in this city this week. We print elsewhere the proceedings of the first two sessions, which are particularly interesting as giving some additional data on the early history of the Bessemer process in this country. One feature of the meetings conducive to animated discussion is, that the papers are available to the members in printed form, permitting easy reference and making it possible for those who wish to present objections, add their own testimony, or call for further information. This is an aim that the managers have steadily pursued, and Professor HUTTON, the secretary, informs us that this time they have been so far successful that all the papers but one were available in printed form at the meeting.

The following officers were elected for the ensuing year: President, J. F. HOLLOWAY, of Cleveland; Vice-Presidents, C. W. COPELAND, of New York; COLEMAN SELLERS, of Philadelphia; H. R. TOWNE, of Stamford, Conn. Managers, W. L. CHURCH, of Pittsburg, Pa.; WILLIAM HEWITT, of Trenton, N. J.; CHARLES H. MORGAN, of Worcester, Mass. Treasurer, WILLIAM H. WILEY, of New York; Secretary, F. R. HUTTON, of New York.

FROM France come reports of an encouraging character concerning an invention made by WICKERSHEIMER and PECH, the former a mining engineer and the latter a captain in the French corps of engineers. They give in the *Annales des Mines* the details of a number of experiments that promise well. They have tried to solve in a new way the old problem of enlarging the lower part of a drill-hole with the object of permitting a heavier charge of the explosive to be made. Messrs. WICKERSHEIMER and PECH drill two holes, parallel with and close to one another. They give one of them a light charge, tamping and firing it in the usual way, while the other remains open. The result is, that the wall between the lower part of the two holes is blown away, the *débris* remaining in the holes. This *débris* is removed by forcing a current of water into one hole and out of the other, reversing the current whenever signs of clogging of the hand-pump used appear. In this manner, the chamber is cleared and is now ready for a very heavy charge. It will be readily understood that this method is particularly useful in breaking in or making the first cut into the face. The results, as we have stated, are decidedly encouraging; and while it is of course probable that it will fail in many instances, owing to local circumstances, notably the tendency of some rocks to shatter at the first charge in such a manner that the *débris* can not be got out of the hole easily, there can be no doubt that the new system will prove highly advantageous in many cases. As a new means of reducing the cost of underground excavations, it will be welcomed by many.

THE proposed consolidation of the majority of the gas companies in this city has been carried out, though not quite in accordance with the programme outlined in the meeting of the representatives of the companies a month ago. Five companies, the New York, the Manhattan, the Municipal, and its ally, the Knickerbocker, and the Harlem, had stockholders' meetings this week, at which the articles of agreement were accepted. The Metropolitan Company is to have its meeting on Saturday, but it is not quite certain as yet whether a majority of those interested will indorse the action of the directors, which has been favorable to the consolidation. The stock of the new company is divided as follows:

New York Gas-Light Company	$7,821,000
Manhattan Gas-Light Company	12,352,000
Municipal Gas-Light Company	5,276,000
Knickerbocker Gas-Light Company	3,104,000
Harlem Gas-Light Company	3,103,000
	$31,656,000
Metropolitan Gas-Light Company	7,422,000
Total capital	$39,078,000

The original plan contemplated the addition of the New York Mutual Gas Company to the number of those entering the consolidation; but as yet, no action has been taken by those controlling it. It is asserted by some that a provision in its charter prevents it from consolidating, but that a conditional agreement has been made for the evasion of this obstruction, by which the works will be leased. Others affirm that the company may possibly join hands with the new concern, against which the whole movement is directed—the Equitable Gas-Light Company.

The Consolidated Company, it is true, claims that the sudden community of interest displayed among its members is due to the discovery that the cost to the consumers can be cheapened by uniting their management. There is little doubt, however, that its real object is to make matters uncomfortable for the new-comer, the Equitable Company, which is bound by its charter to furnish gas at $1.75 per thousand cubic feet. With a capacity of from 600 to 700 millions of cubic feet per annum, the Equitable Company has laid fifty miles of pipe in the most populous and profitable district in the city, and its officials claim that with a capital of $2,000,000 they can earn dividends at lower rates than the consolidated companies with only from 6 to 7 times the capacity and twenty-two times the capital. The fight promises to be a bitter one while it lasts.

AN interesting statement concerning the work in the Clapp & Griffith stationary Bessemer converter at the works of OLIVER BROTHERS & PHILLIPS, of Pittsburg, was made on Thursday in the course of a discussion at a meeting of the American Society of Mechanical Engineers, by Mr. ROBERT W. HUNT, of Troy, New York. The metal made in it is remarkably low in carbon, and possesses the important quality of welding very well. boiler tubes of very good quality having been made of it. In order to test the question to what extent the employment of a cinder tap made it possible to use inferior pig, Mr. HUNT blew a mixture of 50 per cent of a pig-iron containing 0·9 per cent of phosphorus and 50 per cent of average Western Bessemer pig. The steel made contained 0·54 per cent of phosphorus, 0·0065 per cent of silicon, 0·08 per cent of sulphur, and 0·12 per cent of carbon. It worked well, and bent cold double. Cast into a 7-inch ingot, rolled into a billet, and then into a half-inch rod, a test showed a tensile strength of 74,000 pounds, an elastic limit of 62,000, an elongation of 25·25 per cent, and a reduction of area of 48 per cent. Five more tests were made, the results of which have not yet come to hand. One test, however, was made from a sprue from the bottom of an ingot rolled to a half-inch rod, and yielded a tensile strength of 78,000

pounds, and an elongation of 28 per cent, results that are justly regarded as astonishing.

These results confirm the good accounts that come from Europe in regard to the use of small converters for special work. It is, of course, well known that for decades fixed converters have been in use in Sweden to make a high quality of metal; but they labored under the drawback that blowing had to be continued until the steel was ready for tapping. The Clapp & Griffith converter is so arranged that the tuyeres can be practically closed by plugs at the end of the blow. The blowing-engine required is comparatively small, one English works using only from 4 to 4·5 pounds pressure of blast. In South Wales and in Leeds, Clapp & Griffith converters have been running for upward of a year without interruption, the product being used for sheets and for screws. Very soft steel running from 0·03 to 0·04 per cent of carbon is aimed at, the recarbonizing being accomplished with from 5 to 6 per cent of 70 per cent ferro-manganese. The capacity of the converter is comparatively great, from 1 to 1·5 ton charges requiring from 28 to 29 minutes, so that on an average from 12 to 15 blows can be made in an eight-hour shift. The repairs of the bottom, which consist of square tuyere blocks, appear to be light, the bottom being changed once a week.

The building in this country of a number of four and five-ton converters during the past few years, for the manufacture of steel for special purposes, such as nails, plates, etc., is sufficient evidence of the drift of opinion among metallurgists. At one time, the claim was made in behalf of those who favored the open-hearth furnace that it was impossible to make in the converter a sufficiently uniform product, that is, to turn out in successive blows a metal that is substantially equally low in carbon, silicon, and manganese. The accumulated evidence of the past year not only concerning the work of small but also that of large converters, has disposed of this objection.

The introduction of the Clapp & Griffith converter marks a further step in the same direction. The cheapness of the plant and its smaller capacity places the Bessemer process within the reach of even smaller works. It is, of course, especially adapted to the requirements of the tin-plate works in Wales, where it has had its first successes; but in this country it will find a wide field for a variety of other purposes for which the puddling-furnace has thus far held hardly disputed sway.

CORRESPONDENCE.

[Communications will be noticed only when accompanied with the full name and address of the writer. Unless specially desired, only initials will be printed. We invite criticism and comment by the readers of the ENGINEERING AND MINING JOURNAL. Replies not intended for publication should be addressed to the Editor of the ENGINEERING AND MINING JOURNAL in blank, stamped, and sealed envelopes. We do not hold ourselves responsible for the opinions of our correspondents.]

"Fallacies."

EDITOR ENGINEERING AND MINING JOURNAL:

SIR: I notice in the JOURNAL of November 1st a two-and-a-half column "criticism," by Mr. C. M. Rolker, of a little paper of mine entitled *Popular Fallacies Regarding Precious Metal Ore-Deposits*. While I confess my inability to comprehend the drift of most of Mr. Rolker's comments, I gather from them an indistinct impression that Mr. Rolker believes that he has knocked me down, jumped on me, and mopped the floor with my gory remains. I wish merely to say to those of your readers who have received a similar impression, that the paper in question appeared in the JOURNAL of June 21st and 28th, and that if any one to whom a file of the JOURNAL is inaccessible takes sufficient interest in the matter to apply for a copy of *Fallacies*, I shall be most happy to furnish it.

This reminds me to call attention to an error—the natural result of taking things on hearsay—that would not escape those familiar with the ground. I made a statement as to the system of underground prospecting practiced at Eureka, which I am now informed was incorrect. There is no such marked difference between the methods of the Eureka Consolidated and the Richmond companies as stated. This slip, however, has no bearing on the argument. ALBERT WILLIAMS, JR.

WASHINGTON, Nov. 4.

The Concentration of Leadville Argentiferous Carbonate of Lead and Blende.

EDITOR ENGINEERING AND MINING JOURNAL:

SIR: Having been connected in 1874 with the Denver Concentrating and Smelting Company, which operated, before the Leadville mines were discovered, on auriferous and argentiferous Colorado ores carrying both lead and zinc, I beg leave to state a portion of my experience with them.

The works above named were constructed by a few men with small and insufficient capital, at a time when ore concentration was still more than it is to-day the pariah among all metallurgical processes, and for which, although it be old and well tested, capital could not be had, while money was always ready then, as it is to-day, for almost any of those new patent processes that appear and disappear like soap-bubbles. Hence, the arrangement was not as good as it might have been made with a reasonable investment of capital. The plan of the company was, to purchase ores carrying lead, to concentrate them, and to smelt the concentrates. In all of this, the works were technically and economically successful. But after buying all the available accumulation of such ores, the company soon found that it was unable to procure lead ores sufficient to keep its comparatively small establishment going. In addition to this, a sharp competition for the purchase of all ores high in lead was created by the simultaneous appearance in the market of the St. Louis and Pennsylvania lead smelting and refining companies. The company then found that the object for which it had built could not be carried out, and it then tried to take up another. The only kind of ore that could be purchased in quantity consisted of the third-class ore (dump) from the Pelican mine, at Georgetown, having as matrix a partly decayed petrosilex, and carrying argentiferous blende and a very small percentage of argentiferous galena.

With its imperfect arrangement, it experienced no difficulty whatever in obtaining the following results:

The crude ore carried about 12 ounces of silver. From this ore were obtained the following classes of concentrates and tailings:

I. Containing exclusively argentiferous galena and producing 86·5 per cent of the lead contained in the ore treated, and 56 per cent of lead in their weight, with 224 ounces of silver to the ton. This first class was smelted at the establishment in a reverberatory furnace, and the base bullion obtained, carrying 495·82 ounces to the ton, was sold to the St. Louis Smelting and Refining Works, the purchaser characterizing the lead as the softest produced in Colorado. The dross from the reverberatory was smelted in a low blast-furnace, producing base bullion with 393·15 ounces to the ton.

II. Containing from 6 to 8 per cent of lead, and the bulk of all the blende, with some 12 per cent of matrix, and averaging very nearly the same assay in silver as the first class, different under-grades being higher and lower. This second class of concentrates was sold to the Boston & Colorado Smelting-Works, at Black Hawk.

III. Coarse tailings showing traces of lead, zinc, and silver, of the latter not above 1·5 ounces to the ton. They were used to level the ground on the premises and on surrounding land.

IV. Fine sands (slimes), for the treatment of which there was no apparatus in the company's works, owing to lack of capital. They contained a trace of lead only, but a comparatively large amount of blende assaying twice the value in silver, as compared with the crude ore. They were carefully accumulated, and may possibly be there yet, it being the intention of the company to subject them to direct chemical treatment at a later date.

The financial result to the company would have been satisfactory in continued operation; but having purchased the premises on credit, and having borrowed money for completing the construction, the money-lender, for reasons of his own, took advantage of the company's neglect to pay interest on the day it was due, to foreclose its real estate, and thus it went the way of so many other industrial establishments. The owners, in whose hands it might have become a solid lasting enterprise, lost it, and those who obtained it did not know what to do with it.

As the nature of the matrix makes but little difference (unless it be baryta), and as between carbonate (6·4) and sulphide of lead (7·4) there is only 1 as difference in density, and as the difference between carbonate of lead (6·4) and blende (4·2) is large enough to allow almost identical results, and yet a play of sizes as between 1 and 1·6, I judge, by my experience, that there is no reasonable cause to doubt that the Leadville ores carrying carbonate of lead and blende can be successfully concentrated at a cost of from 50 cents to 80 cents per crude ton, and yield almost clean carbonates and blende separately, with what silver each may retain, but the two recovering within 90 per cent of the silver, the remainder being left in fine slimes or sands.

My experience would make it appear advisable not to carry the concentration of blende slimes beyond what well-appointed fine sand-jigs can accomplish, but rather to consider them as a reserve for direct chemical treatment. With the proper kind of jigs and work, they can be caused not to retain so high an assay as to make it an economical necessity to immediately realize from them. The carbonate on the one hand and the blende on the other will, in all probability, naturally retain most of the silver contained in the ore. This would not prevent rational attempts at dressing the blende slimes also, but as a matter of secondary consideration only; the first consideration being to keep their quantity and quality as low as possible. F. M. F. CAZIN, M.E.

ELY, VT.

[Mr. Cazin appears to have misunderstood us. The ore to which we refer as known to exist in large bodies in several prominent Leadville mines is a mixture of blende, galena, and iron pyrites, with a little silica. The ore does not, so far as we are aware, contain carbonate of lead in any appreciable quantity.—EDITOR ENGINEERING AND MINING JOURNAL.]

While recurring to this subject, we make room for the following letter addressed to us by Messrs. Taylor & Brunton:

EDITOR ENGINEERING AND MINING JOURNAL:

SIR: The record of work done in 1878 on a lot of ore from the property of the Burleigh Tunnel Mining Company, near Silver Plume, Colorado, may suggest a proper method of treatment for the mixed sulphuret ores of Leadville referred to in the JOURNAL of October 25th.

Over 1000 tons of the ore, consisting of galena, pyrites, and blende, with less than 10 per cent of gangue, were satisfactorily treated.

The first operation, mechanical separation or dressing, was accomplished by means of Krom's air-jigs, the products being—1st. Headings averaging 70 per cent of lead; 2d. Middlings, chiefly pyrites and blende; 3d. A small amount of tailings carrying a little blende; 4th. The unavoidable dust from crushing, which was done by Krom's rolls. Of these products, the third and fourth were wasted, being too low in silver to justify further treatment, and the first was sold to lead smelters. The second product, middlings containing 90 per cent of pyrites and blende, with from 15 to 25 ounces of silver per ton, was worked by battery crushing, chloridizing-roasting, and chloride-leaching; a process differing from the Augustin method only in that chlorides of base metals, preferably of zinc, largely replace salt in the leaching solution. In ores containing much zinc, this process may be relied on to extract all the chloridized silver delivered from the furnaces; and when the ore is at all cupriferous, the returns from the precipitating-room will be 2 or 3 per cent. greater than the amount of silver shown as chloridized by the ordinary hyposulphite test. Undoubtedly in such cases the copper produces results similar to those obtained by Russell's extra-solution in hyposulphite leaching.

The Burleigh Tunnel and Leadville ores of the class under consideration are so much alike that we have no hesitation in predicting the same results from the same treatment of each. Possibly, some of the Leadville ore may require finer crushing preparatory to dressing; or when ore of a finer grain is encountered, there may result a slightly increased quantity of middlings and a corresponding decrease of headings.

In the following estimates of the money results of the treatment advocated, the prices given are those quoted this day by Messrs. Mathews &

Webb, ore brokers of Denver, and the ore selected for illustration is an average product from one of the most prominent of its class of Leadville mines. A partial analysis of the ore is as follows:

Silver, 40 ounces	per ton.		
Silica	8 per cent.		
Iron	17 "		Per cent.
Zinc	22 "	Or approximately, Pyrites	35
Lead	16 "	Blende	33
Sulphur	31 "	Galena	18
Undetermined	6 "		

Its market value per ton is:

40 ounces of silver, at $1.10 an ounce	$44.00
16 per cent of lead, at 25c. a unit	4.00
	$48.00

Subject to the following deductions:

10 per cent of silver contents	$4.40	
*For 22 per cent of zinc	8.50	
Smelting charges	15.00	
Freight from Leadville to Denver	5.00	—32.90
Net value per ton		$15.10

* Deduction of 50c. per unit above 5.

The galena carries from 55 to 60 ounces of silver per ton, while the pyrites and blende assay nearly 40 ounces of silver. Considering the small quantity of gangue in the ore and the silver contents of the blende, it would be advisable to make only three products of dressing instead of four as in the Burleigh ore; that is, headings, middlings, and unavoidable dust. The assay of the last product would not vary much from that of the original ore; the lead headings would yield about 55 ounces of silver, 70 per cent of lead, 5 per cent of iron, and 5 per cent of zinc; the middlings, 36¼ ounces of silver, 20 per cent of iron, and 26 per cent of zinc. The market value of the headings, per ton, is:

55 ounces of silver at $1.10		$60.50
70 per cent of lead at 40c. a unit		28.00
		88.50

Less the following deductions:

50 per cent of silver contents	$2.03	
Smelting charges	7.00	
Freight from Leadville to Denver	5.00	15.03
Net value per ton		$73.47

The milling of the middlings would result as follows:

36¼ ounces of silver at $1.10 an ounce		$39.87
Less milling loss, 10 per cent	$3.99	
Less cost of milling	15.00	18.99
Net value per ton		$20.88

From these values, and allowing 5 tons of ore for crushing loss in dust or slimes, the financial result of treating 105 tons by this method may be deduced as follows:

20 tons lead headings sold at $73.47 a ton	$1,469.40
80 tons iron and zinc middlings milled at $20.88 a ton	1,670.40
	$3,139 80
Less cost of dressing 105 tons at $1.50 a ton	157.50
	$2,982.30
Value of 105 tons of ore, if sold as mined at $15.10 a ton	1,585.50
Net gain by treatment	$1,396.80
	or $13.30 a ton.

In the estimates for working, allowance has been made for repairs, maintenance, salaries, and all office expenses. Yours truly,

DENVER, COLO., Nov. 1, 1884. TAYLOR & BRUNTON.

The weak spot in the above opinion is the very one that all who approach this problem will be forced to face. Messrs. Taylor & Brunton intimate that they consider it possible to mill a material carrying 2½ per cent of lead, 20 per cent of iron, 26 per cent of zinc, and 36¼ ounces of silver at a cost, at Leadville, we presume, of $15 per ton, and with a loss of 10 per cent on the silver. The details would certainly be very interesting; but it would not in reality solve the whole problem. There are known to exist in Leadville large bodies of ore that carry only from 12 to 16 ounces of silver, the precious metal being about equally distributed in the galena and in the blende, so far as preliminary tests have been made. Milling the blende concentrates from such an ore would be manifestly out of the question.

NEW PUBLICATIONS.

THE ART OF ORE-DRESSING IN EUROPE. By WHEATON B. KUNHARDT, Mining Engineer. School of Mines Quarterly, Series 2. New York: John Wiley & Sons. 8vo, 110 pages.

What Church's *Metallurgical Journey in Europe* accomplished in that branch of mining engineering years ago, Mr. Kunhardt's review of recent progress in ore-dressing has done for those interested in the concentration of ores. It is a matter of some surprise that, although not a single year passes in which well-informed engineers and trained observers do not spend months abroad visiting European works, it is only once or twice in a decade that American professional literature is enriched by critical reviews of European practice. Mr. Kunhardt's work in this direction will, we are convinced, prove interesting and valuable to his fellow-engineers for more than one reason. At no time in the history of mining in this country has the necessity for a close study of ore-dressing been so apparent, even to superficial observers, and many have been driven to look up their Rittinger or their Gætschmann, quietly resting on their shelves for years, in order to freshen up their memory, a task which we have no doubt has proved exceedingly irksome. We do not possess in the English language a text-book on ore-dressing worthy of notice, always excepting that curious but interminable series in a contemporary by a gentleman whom a Butte paper, with Western rudeness, calls a "concentrator crank." With works of reference ten years old or older, there is nothing in convenient form to which the searcher after information can turn. In Germany, the achievements of a small but exceedingly well-trained numbers of specialists are on record in such a scattered form that only those who have access to one or two libraries in this country, and who have weeks to spare, can think of following the development of the past decade. In England, ore-dressing as a specialty, as a profession, can hardly be said to exist. In our own country, much remains to be done. No one will deny that the losses in concentration on Lake Superior are exceedingly heavy; that, in spite of good practice at Butte, there is room for a great deal of improvement; and that our engineers have serious and difficult problems to solve in many camps in Colorado. Therefore, the results of their more experienced fellow-engineers abroad deserve their careful attention and study. They will be grateful to Mr. Kunhardt for the brilliant manner in which he has put before them a thoughtful and critical *résumé* of those results. Those, and we believe they are few, who are in a position to study foreign technical journals, will find comparatively few facts with which they are not familiar through their reading. But even they will see them in a different light. Judiciously and systematically arranged, they take on a new significance, and that we take it is the chief merit of Mr. Kunhardt's work. Many will regret that it was impossible under the circumstances to equip the work more liberally with illustrations of the machinery described. Possibly this may be remedied in a later edition, which we trust the success of the book will warrant.

THE NEW YORK MEETING OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

The first session of this young society was opened on Wednesday night in the Hall of the Academy of Medicine in this city, with a full attendance of members and guests.

In accordance with a resolution passed by the society some time ago, making it one of the duties of the president to deliver an address during his incumbency, Prof. John E. Sweet, of Syracuse, New York, spoke for about half an hour. His vivid flights of imagination in attempting to illustrate the great influence of mechanical achievements upon civilization were somewhat bewildering. The address did not in reality contain many thoughts worthy of being put on record, and in some of its parts painfully resembled an average college thesis in its attempts at fine writing. It is to be regretted that Professor Sweet, with his wide and valuable experience, should have thought it more appropriate to deliver a "popular" address, when his audience would have been delighted to hear his opinion on any of the numerous topics of general professional interest on which he is so well qualified to speak.

Prof. T. Egleston, of the School of Mines, Columbia College, was then given the floor for "an important announcement." It appears that Professor Egleston was a passenger in the Aurania when that vessel narrowly escaped wreck. The sudden reversing of the engine caused the packing to break into small pieces, and the piston-rod could not be moved. With great presence of mind, Professor Egleston discovered that this breaking of the packing furnished another illustration of that phenomenon that he has been so diligently and successfully pursuing during the past few years—the fatigue of metals. Metals, it appears, when they reach a "critical temperature," crumble to pieces upon slight provocation, and this is what had happened to the piston-packing of the Aurania. Professor Egleston informed the society also that a very striking illustration of the same general law had come under his observations when, during his travels, he was called upon by an English steel-works to help them out of their trouble. He found that certain samples of steel, when exposed to shock at a certain temperature, promptly collapsed. Users and makers of structural materials will await with breathless anxiety the time when Professor Egleston will submit the details of the facts he has accumulated. Meanwhile the glory is all his own.

THE SECOND SESSION.

The first hour was devoted to routine business, none of which is of general interest save the acceptance of a resolution calling on the president to appoint a committee to devise some means to bring about a better dispatch at the Patent-Office, generally from nine to twelve months behind.

Mr. William Kent, of New York, as chairman of the committee on a Code of Rules for Conducting Boiler Tests, briefly summarized the leading points and the contents of the very elaborate report of that committee. It was decided, in view of the length of the report, that it would be more advisable to delay its discussion to the next meeting of the society, after the members have had an opportunity to study it.

Mr. W. F. Durfee, of Bridgeport, Conn., read a profusely illustrated paper, entitled,

AN ACCOUNT OF THE EXPERIMENTAL STEEL-WORKS AT WYANDOTTE, MICHIGAN.

from which we take the following amusing notes on the early history of the manufacture of Bessemer steel in this country:

In the month of June, 1862, the writer of this paper was invited by the late Captain E. B. Ward, of Detroit, to design and superintend the construction and working of the machinery and apparatus necessary to test, by an experiment on a large scale, the merits of a process for the production of steel, invented by William Kelley, of Eddyville, Kentucky.

At the time of which I speak, the late Z. S. Durfee, who was associated with Captain Ward in the new enterprise, had been for some months in England endeavoring to purchase certain United States patents that had been secured by Mr. (now Sir) Henry Bessemer for a process essentially the same as that of Mr. Kelley, and for a time it was believed that he would be successful in so doing. I mention this at the outset of my paper, as it explains the adoption of certain forms of apparatus, invented by Bessemer, in the Wyandotte experimental works. In discussing with Captain Ward the general scheme for the proposed experiment, it was determined to build an engine of sufficient power and blowing capacity for use in an establishment for producing steel on a commercial scale, should the results in the experimental works justify such an enterprise, and a similar conclusion was arrived at with respect to the size and general character of the converting vessel. As to the rest of the apparatus, it was decided to design it without reference to any possibility of its use in another work, but as cheaply and as simply as it could be made for the purposes of the experiment only; and it was further determined to erect the experimental plant adjacent to, and partly in, the buildings of the Eureka furnace at Wyandotte, some ten miles below Detroit, on the Detroit River, where Captain Ward had extensive rolling-mills. It was also determined that the metal for the experiment should be taken

directly from the blast-furnace, and that the spiegeleisen should be melted in crucibles.

As soon as this general scheme of procedure was fixed upon, I entered upon the work of preparing plans for carrying it into execution, and just here difficulties began to be encountered. I had never seen any apparatus for the manufacture of steel by the method proposed, and the description of that used by Mr. Kelley at his abandoned works in Kentucky satisfied me that it was not suited for an experiment on so large a scale as was contemplated at Wyandotte. I had no plans furnished me from abroad, and very little had been published of the details of the new process as conducted in Europe, and I very much doubt if, at the date of which I speak (June to July, 1862), any citizen of the United States, save the late Z. S. Durfee (then in England), had ever seen the inside of a works where steel was made by the apparatus invented by Bessemer. However, I possessed myself of all the information obtainable, and as it was confidently expected that Mr. Z. S. Durfee would be successful in his efforts to purchase the American patents issued to Bessemer for various forms of apparatus for the production of steel by the pneumatic method, it was thought only to be anticipating the acquisition of property rights in the premises to use such of his inventions as seemed suited to the purposes in view.

I accordingly procured copies of Bessemer's patents relating to the matter in hand, which, together with the descriptive account contained in the first edition of Fairbairn's *History of the Manufacture of Iron*, embraced all the information then accessible to me, relative to the European practice of the new art.

Having therefore very little knowledge of an exact character as to what had been done by others, but a very clear idea of the *rationale* of the new process, supplemented by an absolute faith in the great future before it, I proceeded to evolve from my own internal sense of the fitness of things apparatus and methods suited to the general idea and environment of the proposed experimental works.

Difficult as this task was, it was made almost insupportably burdensome by the pronounced antagonism and outspoken opposition of nearly every influential person in Wyandotte. Among these was an individual holding a responsible position, who seemed to be possessed of a mental capacity suited only to the appreciation of ideas prevalent at the beginning of the sixteenth century, for he believed that the world was flat. 'For," said he, "if it was round, Detroit River would be running up-hill, which it couldn't do, ye know." When questioned as to the structure of the moon, this worthy replied that "he s'posed it was a sort of a reflector, like;" and on being asked what held this reflector up, he answered, with a great many profound shakings of the head, that "that is the thing of it."

I had been but a short time in Wyandotte before I came to know that I was regarded as little better than a mild sort of lunatic, or as a confirmed idiot, who might be tolerated but not for a moment encouraged, still less assisted.*

Notwithstanding the delays and annoyances caused by the multitudes of antagonisms encountered on every hand, the work progressed, so that on the return of Z. S. Durfee from England, in September, 1862, I was enabled to show him the converter in a nearly complete state, and was very much pleased to hear him say that it "looked very like converters that he had seen abroad." In the winter of 1862-63, the construction of the blowing-engine was commenced; but, owing to various interruptions occasioned by the war, strikes, and the fact that part of my time was occupied in supervising work at Chicago, the engine was not completed until the spring of 1864. This engine embraced several novel ideas, which I trust will be found of interest even now.

The plant was located in the old buildings belonging to the Eureka blast-furnace, some small additions being made thereto in which to place the blowing-engine and converter.

I never fully understood just why the blast-furnace aforesaid was called Eureka; the only theory at all satisfying to my mind being, that some expert in blast-furnace history, looking for an example of ancient practice that embodied the most faults in design, construction, and management, and being satisfied when he found this plant that further search was useless, had suggested the word as a most appropriate name for a furnace that more than satisfied his ardent desires for the discovery of the most archaic of metallurgical structures. . . .

An elliptical well, or more properly a reservoir, was located beneath the rear platform of the reverberatory furnace. A pipe conveyed water to this reservoir, and care was always taken (except in the following described instance) to have it filled with water before the commencement of a blow. The purpose of the well was to receive any steel that might remain fluid in the casting-ladle, in case its tap-hole should chill. If the well was full of water, it was a perfectly safe operation to turn two or three tons of fluid steel into it, thus cooling it in small shots and more or less irregular masses of manageable size, which could be utilized in various ways; whereas, had the metal chilled solid in the casting-ladle, the result would have been a mass of such dimensions as was practically valueless at the time in that locality. With this well is associated a comedy, which came unpleasantly near being a tragedy. After several conversions had been made in the works, I was called to Chicago, and left Wyandotte with the intention of being absent about a fortnight. Having no expectation that the works would be operated until my return, I left my assistant for the time being charged with the supervision of certain repairs, among which was the relining of the converter, an event that occurred at unprofitably frequent intervals. The first knowledge that I received that my assistant had got into trouble at Wyandotte was conveyed in a letter from Captain Ward, which read as follows:

DEAR SIR: I wish you would come immediately to Wyandotte and look after that man X—— of yours. He will kill somebody by and by.

(Signed) Yours truly, E. D. WARD.

I returned at once to Wyandotte, and ascertained that my assistant, at the request of Captain Ward, had attempted to run the works for the benefit of a large excursion party that he had brought down from Detroit on one of his steamers. With this party were the late Senators Wade, of Ohio, and Chandler, of Michigan, together with sundry judges, bankers, and merchants of repute.

I learned that my assistant had treated the captain's distinguished guests in rather an unceremonious manner; for having been unfortunate enough to have the tap-hole of the casting-ladle chill after successfully teeming two ingots, he ordered the ladle emptied into the well, which he had neglected to fill with water; and the result of turning two tons of fluid steel upon about a *barrel* of water which chanced to be in the well, was a terrible explosion, the metal flying in all directions. Senator Chandler was prostrated at full length in the pig-bed; Senator Wade was projected upon a pile of sand in a corner of the casting-house; others of the party were more or less burned and otherwise injured; while Captain Ward himself was blown bodily through the open doors of the building into the yard upon a pile of pig-iron. For a time, every thing was confusion; but it was soon ascertained that by great good fortune no one of the visitors was seriously hurt, and they all returned to Detroit thoroughly of the opinion that they did not care to see steel made by the "new process" again. . . . .

The blast-furnace was run by a contractor who was naturally and properly solicitous that no part of the iron made should be unaccounted for; hence one of the reasons for weighing the iron before it went to the converter. But as simple a matter as this was, it did not escape the criticism of Herr Unkunde Unheilschwanger, who insisted that, because iron expanded when heated, "there must be more weight in a hundred pounds of melted iron than in a hundred pounds of ordinary pig metal."* . . .

In the early part of the year 1864, the late Z. S. Durfee wrote me from England (whither he had returned in the fall of 1863 with the view of concluding the negotiations with Bessemer, and also of purchasing the United States patent of B. F. Mushet for the use of spiegeleisen in the manufacture of steel) that it was possible that his efforts to purchase Bessemer's American patents would not be successful, and he sent me rough sketches of a stationary converter from which the steel could be tapped after conversion very much in the same way as iron is tapped from an ordinary foundry cupola, and he urged the advisability of losing no time in having such a converter built. I accordingly at once commenced the study of the matter, and prepared drawings for a stationary converter. It is substantially of the same form as the sketches sent me, but differed from them in the substitution of inclined side for bottom tuyeres. This converter was built and erected in the works at Wyandotte, but no metal was blown in it until some time in the fall of 1865, some months after I ceased to be connected with the enterprise. In this converter, the upper and outer ends of the tuyeres are above the level of the metal in the converter, and their lower ends are but a few inches below that level. Therefore the pressure of blast necessary to overcome the ferrostatic head at the inner ends of the tuyeres was much less than would have been required had the tuyeres been inserted in the bottom. This arrangement also permitted the blast to be stopped without fear of the metal in the converter running through the tuyeres. One of my reasons for thus placing the tuyeres was the belief that such heavy pressure as we required for bottom-blown converters was not at all essential to the production of a good quality of steel. My reasoning was, that to expel the carbon from the metal under treatment, it was only necessary to bring in contact with it the requisite number of atoms of oxygen, which I believed (and still believe) could be better accomplished by a large volume and low pressure than by a small volume and high pressure of blast. I have had no opportunity of practically demonstrating this belief; but will here venture the prediction that one direction in which the genius of improvement will walk in our steel-works is that which leads to a great reduction of pressure of blast, and a corresponding diminution of the power required for its production. . . .

The engine that supplied the blast for the converter was constructed from working drawings made by the writer. It was intended to produce a pressure of blast of sixteen pounds per square inch, which was about double the pressure used at that time for any metallurgical work, and was regarded as very heavy; in fact, I was informed at the time of commencing the plans for this engine (the winter of 1863), that the pressure used for blowing steel in England and Sweden was but eight pounds. I adopted the higher pressure with the view of shortening the time required for a blow, in the full belief that I was taking a decided step forward in the practice of the pneumatic process, though in this I soon became satisfied that I was in error. But whatever mistakes I made in this matter of blast pressure, I had the comforting satisfaction of finding myself in most excellent company; for before my engine was finished, steel was blown in England with a blast-pressure of twenty-five pounds, a practice which has continued unto the present time.

In the works and with the machinery described, was produced on one of the early days of September, in the year 1864, the first Bessemer steel made in America. This event was a great disappointment to all the enemies of the new enterprise; as they had filled the air with predictions of failure, and poisoned it with the miasma of discouragement; and they immediately turned their attention to a general depreciation of the results attained, and the persecution, with renewed vigor, of all who were responsible for them. The great Herr Unkunde Unheilschwanger, seeing that "blowing cold air through melted iron" did *not* make it "chill up," suddenly declared that "'twas easy 'nuff to make steel! All ye'd gut ter du was ter pore th' iron in that ere pot und blow her awhile, und run in sum er that ere t'other met'l, und pore her out, und she's steel, ye know." In a paper read at the Troy Meeting of the American Institute of Mining Engineers, I mentioned briefly some of the crimes against progress perpetrated by the ignorant and mischievous gang, of which Herr Unkunde Unheilschwanger was the recognized chief, who, like Satan,

"Exalted sat, by merit raised
To that bad eminence."

Not content with burglarizing the laboratory, and endangering the lives of those who were employed therein, by plugging up the pipes of the oxyhydrogen blow-pipe, or with effecting the final destruction of the

* Indeed, the great Herr Unkunde Unheilschwanger, then the leader of metallurgical thought and practice in the vicinity, formulated the popular belief by openly declaring that "if that d—d Yankee expected to blow cold air through melted iron and not have t chill up, he *must be* a d—d fool."

* In connection with the matter of melting pig metal for the purpose of conversion, I will here state that it was at the Wyandotte experimental works in the summer of 1865 that the late Z. S. Durfee made the first attempt to melt pig metal in a cupola for use in the converting vessel, and I claim for him the origination of this practice, which is now so universally employed, and which has contributed so much to the economy of production in all our steel-works.—W. F. D.

laboratory itself, they invaded the sanctity of private correspondence; and no person or thing was safe from the virus of their tongues or the penetration of their eyes. In the month of January, 1865, soon after the destruction of the laboratory connected with the works, I received a letter from a friend, whose opportunities for observing the secret (as they thought) operations of this syndicate of sin were much better than my own. He says: . . . "I am pleased to hear from you again, and yet was sorry, for I know what your feelings would be upon returning home; as I was unfortunate enough to be at Wyandotte at the time the raid was being made upon your office and laboratory. I saw some things at Detroit in which Wyandotte men were concerned that sunk them in my opinion below the most contemptible of our race." . . . Then, after some more remarks, none too emphatic for the subject and occasion, he continues: . . . "Nothing in your vicinity in writing is safe from the perusal of any one who wishes to read, and any thing you don't care to have pirated, destroy." After some words relative to other matters, he concluded with this advice, "Take care of your letters." This advice I took particular pains to heed.

In those early days, the atmosphere in which I moved was heavy with the fog of discouragement. All the so-called practical iron men in the vicinity of Wyandotte were opposed to the new process. I well remember the sneers of contemptuous incredulity that greeted my statement that the time would come "when a steel rail could be made cheaper than an iron one;" and now that that time has arrived, as I look back upon my work at Wyandotte, with the added experience of twenty years to aid the retrospection, I do not hesitate to claim that it was as good a solution of the problem presented as was possible under the circumstances of time and environment.

This was followed by an interesting paper by Mr. Robert W. Hunt, of Troy, New York, on

THE ORIGINAL BESSEMER STEEL PLANT AT TROY.

In calling the attention of the Society to a short description of the original Bessemer steel plant at Troy, New York, I can not hope to present matter of much value; and can only crave your indulgence while placing on record the plans and practice of the first Bessemer plant that made a commercial success in America. My paper, taken in connection with that of Mr. William F. Durfee on the Wyandotte works, may possess some additional interest by drawing your attention to the wonderful progress that has been made in this march of metallurgy during the last nineteen years.

As is well known, there were rival patents bearing upon the pneumatic process. The Kelley and Mushet patents were owned by the Kelley Process Company, which built the Wyandotte works; and the various Bessemer patents belonging to Messrs. Winslow, Griswold and Holley, the latter firm erecting the Troy plant. Of course, this state of things caused great jealousy and rivalry. Mr. Durfee succeeded in starting his plant a few months before his Troy rival, and hence to him belongs the honor of having made the first heat of Bessemer steel blown in this country. Alexander L. Holley commenced the erection of the Troy works immediately upon his return from England in the spring of 1864, and made the first conversion of steel on February 16th, 1865. From the start, complete records of the works have been kept, and hence I am enabled to present the particulars of their early experience. But before so doing, let me call your attention to the arrangement of the plant. Its location was determined by the existence of a water-power and wheel that had been used to run a grist mill. This opportunity for cheap power was too good to be neglected; and every other consideration sank into oblivion. How well this rewarded the owners, you can judge by the detailed history that follows.

Two blowing-cylinders, "48 by 48," were attached to this old wheel, and the rest of the plant placed in a building 64 feet by 41 feet 8 inches, built for the purpose. The pig-iron was melted in the reverberatory furnace having a bed 7 feet long by 4 feet 9 inches wide, from which it was run through a gutter built in the floor to the wrought-iron runner, and through it into the wrought-iron converter, which was of course turned down to receive it. The runner traveled on a rail at its higher end and on a corresponding rail, to which its supporting rod was attached, at the lower or converter end; so that, after the blow was finished, it could be pushed over against the end wall of the building, and hence out of the way. A brick stack with a brick hood carries off the flame of the conversions. The recarbonizing metal was melted in a special furnace, and which worked into the same stack as the pig melting-furnace. The resulting metal from the conversion was poured into a ladle, which was supported by a cast-iron ram or crane. This ram was controlled by attaching the chain of a wooden hand-crane to it, and it was so swung over the molds set in the pit. These molds and their ingots were subsequently taken from the pit by the wooden hand-crane, and loaded on a car standing on the railroad track. The vessel was rotated by decidedly simple apparatus which depended upon intelligent labor for its power.

Such was the original Troy two-ton plant. And it is not now surprising that many difficulties were encountered in its management. Mr. Holley's mind was soon impressed with the advantages of melting in a cupola, and one was erected. It was provided with duplicate bottom sections, the extra one being pushed to one side. He also advanced beyond the English method by placing an accumulating ladle, resting on scales in front of the cupola, a wrought-iron runner conveying the metal to the runner already referred to. When the cupola practice was adopted, the spiegel furnace was torn down and the old pig melting reverberatory furnace converted in one for melting the recarbonizer that was conveyed through a cast-iron gutter. The cupola bottoms were raised and lowered by a screw. There was an oven for drying stoppers, with a chimney.*

As before stated, the first charge was made on February 16th, 1865, No. 2 Crown Point charcoal iron being used for the pig, and New Jersey Zinc Company's Franklinite for the recarbonizing metal. With this, the record begins: One heat was blown, using 2497 pounds pig and 175 pounds recarbonizer. From this, there were cast three taper ingots weighing 482, 491, and 561 pounds respectively, making 1534 pounds of castings, and also 706 pounds of scrap. Certainly a rather large percentage, and which, with steel rails at $27, we could hardly stand. But it was all figured out in the record, that is, "castings, 54·4 per cent; scrap, 26·4 per cent; loss, 16·2 per cent. 1¼-inch test piece bent double cold. Blast, 5 to 9 pounds. Blew well and hammered as well as possible. Scrap mostly a large scull, due to slow handling. Finer fracture than the charges made from the same brand of iron at Bessemer's works in England on November 30th, 1864. Welds pretty well, and hardens pretty well." This entry was evidently written in a hopeful spirit, and is in Alexander Holley's handwriting. The next trial was made on February 27th, using the same grade of irons. But 50 per cent of ingots were obtained; 29·8 per cent scrap and 20·2 per cent loss. The remarks being: "Blast, 10 pounds. Blew 22 minutes. Vessel not hot enough. Ladle nozzle too small—1⅛ inch." On the following day, the third trial from the same irons gave, "77 per cent of ingots; 3·8 per cent scrap, and 19·2 per cent loss. Vessel hot, and blew well, with from 8 to 10 pounds of blast. Metal came through bottom by side of tongue; stopped it with water. Steel all formed out of ladle. Nozzle, 1⅛ inch in diameter." We can believe every body went home happy that night. So the record continues from day to day, sometimes showing one heat to have been made, sometimes two, but always containing statements of greater or less difficulties encountered.

On April 4th, the product was increased to four heats. On April 27th, an ingot was made marked "Baldwin," with the following comment, "First tire ever made in America by this process. 'Bully Boy!'" On this same day, a "Philadelphia delegation were present, and were much pleased." Between May 17th and June 5th, the following changes are noted as having been made. On the former date, the shaft of the water-wheel was found to be rotten, which necessitated a stop. During it, the vessel was lengthened 18 inches, making it 10·6 inches over all. "The pit was enlarged. New tuyeres and nozzles substituted, and the Franklinite furnace raised 6 inches, to get a better flow into the vessel."

On July 20th, all was ready to try the new cupola. No. 1 Crown Point charcoal pig was used. "The iron melted in cupola in one hour after stopping tap-hole—half the time blower making 88 revolutions, half 100 per minute; run out very hot from ladle. Coal consumed 1226 pounds, iron melted and blown 2997 pounds, result—ingots 85·4 per cent, scrap 2 per cent, loss 14·4 per cent."

On July 25th, blows Nos. 132, 133, and 134 were made, and what was considered a great feat accomplished. It is thus told: "Melted in one hour after stopping tap-hole, charged cupola in half-hour after first change, it melted in three quarters of an hour. These three charges were melted and converted into steel ingots in 3½ hours. Average loss of the three blows 20·6 per cent."

I find it recorded, under date of July 28th, that the average consumption of coal in cupola was 1 pound to 4·2 pounds of iron melted.

About this time, a small cupola was built and tried for melting the recarbonizer. I can not find any drawing of it, and from the record of its failures I think it was soon abandoned, and the old reverberatory iron melting-furnace changed into a spiegel furnace.

On November 25th, they made an ingot, cast in a loam mold of a shape suitable to be put on top of an iron rail pile to make a steel-headed rail.

The constant trouble from low blast pressure led about this time to the abandonment of the water-wheel, the last charge having been blown with it on December 8th. Work was resumed on March 10th, 1866, with blast from a steam-engine. On the first day, 11 pounds of blast are reported with 35 pounds of steam pressure. On March 12th, the pressure was good, but on the next heat the "engine worked badly, the fires low, and the vessel had to be turned down twice." However, from this on, the record is much cleaner. The product for the month of March is reported as:

Steel made	145,698 pounds = 65 tons.
Scrap made	5,390 "

I find that on November 13th, 1865, the experiment was made of using chromium ore in the vessel; the resulting metal was called "scrap." The experiment was repeated on the 22d. This time, a triple compound of iron, chromium, and carbon was used. The result remained the same.

On April 3d, 1866, the attempt was again made, and repeated on the 6th. While ingots were obtained that stood hammering, they cracked and crumbled badly. In those days, "standing hammering" must have been somewhat different from our present idea. The 120 pounds of chromium pig metal were heated to a red heat and thrown into the vessel when it was turned down after finishing blowing; it was turned up again for one quarter of a minute, and then the metal was poured into the casting-ladle. This seems to have ended the chromium experiments.

An octagon ingot was cast on April 25th, 1866, which weighed 2924 pounds and was 15 inches in diameter. The mold was filled to within 12 inches of the top, and an iron bar 5 inches in diameter and 20 inches long was lowered into the metal to the depth of 4 inches. This formed a handle for forging. Most probably this was the first large ingot made in this country. On the 26th, another such ingot was made for a crank shaft forging.

May 2d, 1866, saw another experiment tried, by running 1500 pounds of metal into the converter, blowing it ten minutes, when it was entirely decarbonized; 3000 pounds more of pig were then run in and the vessel again turned up, the blast being on to mix the metal. It was then poured into the ladle and cast in the molds. These are described as being "sixes and sevens."

So charges were made in the month of May, yielding:

Ingots	81·5 per cent.
Scrap	1·8 per cent.
Loss	16·7 per cent.
Steel made	118 tons 1735-2240.

The two-ton plant continued to run with increasing success. The patent difficulties were settled, and the firm commenced the erection of a two 5-ton converter plant. This was finished early in 1867. And I find from an old statement it was "confidently expected to produce from 20 to 30 tons of iron or steel ingots every turn of ten hours."

Before the final abandonment of the two-ton plant, Mr. Z. S. Durfee assumed charge of the works, Mr. Holley having severed his connection to finish building the Pennsylvania Steel Company's plant at Harrisburg, Pa., after seeing the 5-ton plant at Troy about ready for work. Among other changes, Durfee pulled down the spiegel furnace, and put in a crucible or pot furnace, in which he melted his recarbonizer. It was then called ferro-manganese, and contained about 20 per cent of

* The removable converter bottom had not been invented, hence there was no bottom-oven provided.

manganese. This was melted in crucibles, and Mr. Durfee succeeded in producing some very good low carbon steel.

While we smile over these records of a past that to some of us seems so long ago—yet in time is but as yesterday—let us realize what these trials meant to those conducting them. Let us not overlook their earnest endeavors, their high hopes, many disappointments, but never-failing courage. Strong faith was required both by the capitalist and the engineer. Probably no industry ever made such gigantic strides, attained such advancement in the same number of years, as the Bessemer process in America. But the fire that burnt away its crudities also consumed great spirits. The bold investor, E. B. Ward, the cultivated Z. S. Durfee, the perfect gentleman, the constant patriot, John A. Griswold, have passed away, while to those of us who have been in the thickest of the fight comes more closely the death of that daring engineer, always advancing, ever right, warm, uncompromising friend, George Fritz; and saddest of all, the loss of him whose hand recorded most of that which I have presented to you, records of the actual wearing away of his great heart. Applied science triumphed, but Alexanper Lyman Holley died.

The papers were discussed by Mr. Holloway, the president-elect, of Cleveland, who, after dwelling on their value, recited an amusing little incident relating to the early introduction of the Bessemer process in this country, which came under his notice. Mr. Himrod, a leading Ohio blast-furnace man, gave expression to the opinion that the outlay for machinery for a Bessemer plant, which the Cuyahoga Steam Forge Company was then furnishing for the Cleveland Rolling-Mill Company, was outrageously in excess of what that simple process required. When pressed to give his reasons for such a decision, Mr. Himrod stated that it was in reality on a question of agitating the bath of molten metal, which could be accomplished by much simpler means. He had gone into the thing, and had made experiments. When urged for details, he stated that he had borrowed a ladle from an adjoining works, and had run pig-iron into it from his furnace. He fastened a potato to the end of a rod and stuck it into the bath, with the result, as he triumphantly confessed, that it had made a "h—ll of a balloo!" Mr. Stirling and Mr. P. Barnes related their experience in connection with the early Bessemer works at Troy, and Mr. R. W. Hunt then gave some data on blows recently made in the Clapp-Griffith stationary converter, to which we refer editorially.

THE UTILIZATION OF BASIC SLAG.

At the meeting held recently by the German naturalists and medical men at Magdeburg, Dr. A. Frank, Charlottenburg, read a paper on the utilization of the phosphoric acid contained in the slag of the basic Bessemer converters. The basic process, he said, furnishes a slag whose utilization is of enormous importance for agricultural purposes. In this process, we have to deal with very large quantities of phosphoric acid. The whole production of basic steel in Europe was in 1883 about 1,200,000 tons, of which 750,000 tons were produced by Germany and Austria. This latter figure corresponds to 25,750 tons of phosphoric acid or 56,250 tons of triple phosphate of lime. if the average percentage of the phosphorus in the crude iron is estimated at 1¼ per cent. As a typical analysis of the slag, the following may be taken, which is from the Peine Works: Silica, 6·20 per cent; sulphur, 0·56; phosphoric acid, 19·33; protoxide of iron, 19·24; and manganese lime, 47·60. The rest consists of clay, sand, alkalies, magnesia, and carbonic acid. More than half of the phosphoric acid of the slag is soluble in citrate of ammonia, and thus the idea was conceived to utilize the slag directly as it came from the converter in such cases where the soil to be manured was an acid one. Such a consumption, however, does not answer to the large production, and, of course, we must endeavor to purify and to concentrate the phosphates of the slag in such a manner that they may advantageously be employed for all other arable lands. Several processes have been proposed for this purpose. One method consists in burning the slag in order to render it by oxidizing as insoluble as possible in extracting the phosphate of lime and caustic lime by muriatic acid, and in precipitating the phosphoric acid as duplicate or triplicate phosphate of lime. This process is worked at present in Hoerde under the management of Mr. F. Massenez. But it can not succeed, owing to the present high rate of the muriatic acid, and the same may be said of a second series of processes by means of extraction, according to which the iron is withdrawn into the solution as perfectly as possible in order to precipitate phosphate of iron.

According to the method indicated recently by the author himself, that portion of the lime that is not united with the phosphoric acid is made caustic and extracted in a solution of chloride of magnesium; then the metallic oxides are made insoluble by burning, while the phosphates of lime are converted into hydrated sulphate of lime (which is precipitated) and phosphate of ammonia-magnesia in an acid solution by sulphates of magnesia and ammonia. Whether it will be possible to work this process on a larger scale depends on the value that is attributed at the experimental farmings to this form of phosphoric acid. As is evident from this paper, no method has yet been discovered for the commercial utilization of the phosphoric acid, in spite of various statements to the contrary.

ELECTRICITY IN COINING.—In spite of the greatest possible care, many of the pieces that are prepared for coins are either too light or too heavy. The first are remelted and the others are filed away until they have the proper weight. These operations cause the loss of valuable material, and interfere with the sharpness of the impression. W. F. Chandler Roberts, chemist of the London Mint, employed an electric current in connection with suitable acid baths, in order to regulate the solution of superfluous metal, having ascertained that the quantity dissolved was exactly proportioned to the time, if the current was kept constant. He also provided, in a similar way, for the galvanic deposit of additional metal upon coins which were too light. In both methods, provision was made for automatically breaking the circuit, when the right weight was reached. These processes can not be applied at the London Mint, where the law directs that every defective piece, whether too heavy or too light, shall be remelted. They have, however, been used with great advantage at the mints of Bombay and Calcutta.

THE HISTORY AND FUTURE OF BRITISH METAL MINING.—II.*

The time at which gunpowder was introduced in mining in England has been more definitely fixed than hitherto, by Dr. Hunt, who gives an abstract from an old register in the parish of Breage, referring to Thomas Epsley who died "at the ball and was buried at Breag on the 16th day of December in the year of our Lord Christ 1689." Epsley is spoken of as "the man that brought that rarer invention of shooting the rocks, which came here in June, 1689." Blasting does not seem to have been generally used even half a century later, since Thomas Tonkin writes in 1733, "They have of late had recourse to gunpowder, by boring holes in them [the rocks] in the nature of mining of towns besieged."

The great bulk of the tin obtained in Cornwall in the early times was from the stream deposits, as Tonkin, in 1733, writes in a manner that proves that shafts were then unimportant. Still the enterprise of the miners in the eighteenth century, and their perseverance and disregard of difficulties, are best shown by the work on a tin mine, called "The Wherry," near Penzance. In 1778, Thomas Curtis, a poor Breage tin miner, made a successful attempt to work a deposit known to exist 120 fathoms from the shore, on a shoal covered at spring tides with 19 feet of water, and covered ten months in the year. Three summers were consumed in sinking a pump-shaft, which had previously to be emptied before work could be continued at rare intervals. A frame-work of boards was then carried up from the mouth of a shaft to a hight of 20 feet. This turret of boards, made water-tight with oakum and pitch, was stayed with eight stout iron bars, and a platform of boards was lashed around its top, upon which a winze for four men was fixed. When drifting was begun, it was found that the sea-water leaked in and the surf during the winter months was such that work had to be abandoned. The next summer found Curtis again at work, and with great success. A bridge was built to connect the shaft with the shore, and in all £70,000 worth of tin-stone were raised from it, until, during one winter, an American vessel, breaking from its anchorage in Gwavus Lake, struck against the stage and demolished the machinery.

The second half of the eighteenth century witnessed the great impetus to mining due to the introduction of the pumping-engines of Newcomen, Trevethick, and Watt.

Copper mining in Cornwall appears to have obtained its first impetus from the arrival there, toward the end of the sixteenth century, of German miners and smelters. The Germans were also the leading spirits in the Keswick copper-works, in Cumberland, when Ulrick Fosse, in July, 1585, could boast of "melting 24 cwt. of ore every day with one furnace, God be thanked." Dr. Hunt quotes the following on the troubles that beset the metallurgist in these early days from a "Description of the Doeings of Jockim Gaunse and George Needham, at the copper mynes by Keswicke, in Cumberland, A. D. 1581," on "the nature and the number of the hurtful humours that were naturally bred in oure copper owre gotten in that countrie."

"The names of the ix. infectyve and evill humours:

"1. The first is sulphur, being a mineral substance which verie quickly taketh fire, and wil be consumed in smoke by blast, etc.

"2. The ii. corrupt humour is arsenique, by nature a kind of poyson, being in like manner a mineral substance, wil be consumed with fire into smoke, which is a very dangerous ayer or savor, and by its force maketh the copper white and brether than the sulphur doeth, etc.

"3. The iii. corruption is antimony, w'ch is in like manner a mynerale substance, and by roasting wil be consumed into smoke, etc.

"4. The iiii. corrupt humour is vitriall, in like manner a mynerale substance, and if the force thereof be not corrected by roasting. . . . it fretteth the copper and maketh it bretle and black coulered, etc.

"5. The vth corruption is calcator, being the mother or corpus of vitriall. and a mineral substance, etc.

"6. Allom is the vith corrupt humour, a mineral substance, and by nature a let to ye smeltinge of copper.

"7. The viith humour is iron, being one of the vii metals, but no minerale. etc.

"8. The viiith humour that is in our copper ore is a kind of black stone wherein the copper is bred and doth grow.

"9. The ixth and the last corrupt humour is a kind of white stone called sparr."

The German miners brought with them the divining-rod. Early in the eighteenth century, Swansea became a center of copper smelting. About the year 1725, only four copper-works existed in Cornwall, which apparently made a pool to keep down prices paid for the ores mined in the three principal mines. This predecessor of our combinations of to-day was broken by "a gentleman from Wales," who, visiting Cornwall, bid £2 more for large accumulations of ores, and carried off in all 3000 tons, "upon which he deservedly made very little, if at all, short of 40 per cent profit." Soon after this transaction, the system of selling ore by public "ticketings" was introduced; but even this does not appear to have met the difficulty, since in 1785 Thomas Williams, in a letter to Lord Uxbridge, writes: "The Cornish ores were sold to 11 different copper companies, to be by them smelted and brought to market in the metal. Those companies sometimes combined together to run down the value of the Anglesey copper. At others, they differed among themselves, yet always agreed in beating down the price of the ores in Cornwall, and buying cheap there, they were enabled to sell the metal at a low price, and we were obliged to do the same or be beat out of all the markets." The deepening of the Cornish copper mines, like that of the tin mines, caused great difficulty in handling the water. Savary's engine was first introduced about the year 1704, followed by the Newcomen engine in 1712, by the elder Trevethick's engine at Dolcoath in 1765, and by Watt in 1777 at Wheal Busy.

In Staffordshire, the Ecton mine was worked previous to 1686, and in Cumberland, the Keswick works, as already mentioned, were started by Germans, brought to England by Queen Elizabeth early in her reign. The famous Anglesea copper mines, the Parys and the Mona, were not discovered until 1768; but they were developed so rapidly that, in 1784, they had reached an output of 3000 tons fine.

* BRITISH MINING. A Treatise on the History, Discovery, Practical Development, and Future Prospects of Metalliferous Mines in the United Kingdom. By ROBERT HUNT, F.R.S. London: Crosby, Lockwood & Co. 1884. 8vo, 944 pages, with Index and many Illustrations.

It is interesting to notice that, among the Germans who were instrumental in developing the mineral resources of Great Britain, was Rudolph Raspe, who was born in Hanover in 1737, and died in Ireland in 1794, while conducting mining operations there. Raspe was a very learned but restless man, whose name and whose scientific work are now forgotten, but whose *Tales of Baron Münchausen*, written at Dolcoath in Cornwall, have outlived their author for more than a century.

The history of British lead and silver mining reaches back into the realms of tradition. The mines at Combe Martin and Beer Alston in Devonshire are said to have enriched Edward the First and Edward the Second, and were reopened by Queen Elizabeth, Combe Martin being discovered years before the reign of Henry the Seventh. The mines of the Mendip Hills were known in the reign of Edward the Fourth, a rude map drawn about 1480 being still extant, together with a curious copy of the laws governing the district. The famous lead mines of the Alston Moor District in Cumberland had royal protection in 1233, and Richard the Second granted privileges to Nicholas de Veteripont, which were confirmed to his son by Edward the Third. In 1629, the mines were reported exhausted; but in the eighteenth century, they were reopened. The Cardiganshire mines were certainly known in the time of Henry the Seventh, and were worked during the seventeenth century. In 1690, they were "boomed" by the owners, and in 1698 the public was favored with a highly colored prospectus, which reads curiously like some of the modern documents of that kind. Thus "with a stock of £20,000 and good management, the said mines would yield a yearly profit over and above all charges of £171,970 19s. 9d. for lead besides the silver, which is believed will yield, one tun with another, about £14 in silver per tun of metal, and may, in all probability, double the valuation of these mines." In 1700, the company was regularly formed under the title of "The Government and Company of Mine Adventurers in England." About 650 shareholders took the bait, embracing people of every class, peers, bishops, knights, farmers, and shopkeepers; but they never realized any thing, and the mines that started with such brilliant prospects collapsed amid a flood of papers and pamphlets of accusations and vindications.

THE DISTRIBUTION OF SAN JUAN COUNTY ORES.—V.

By Theodore B. Comstock.

THE MINERALOGY OF THE SIX RADIAL ZONES.

The Pride of the Rockies and Little Ida claims in Minnesota Gulch (right bank of Cement Creek) lie north of the axis of the galena-gray copper zone; but they carry large bodies of pyritous ores near the surface, with but little copper ore at present. Nevertheless, there is but little gold ($\frac{2}{10}$ of an ounce usually to the ton) and more silver in this material than is customary under similar conditions in the southern half of the zone, the ores of which it somewhat resembles. This may be possibly explained by the preponderance of marcasite (mispickel) and the intimate mixture throughout the mass of a rich "gray copper" mineral. At any rate, the closer study of this deposit only confirms the principle already announced, that the greatest variations from the normal type are to be found in the localities most subjected to hot spring action. An extensive belt of thermal springs has become extinct within a comparatively recent period along a line extending nearly parallel with the zonal axis. This area is quite wide where it crosses Cement Creek, but narrows considerably toward the outer edge of the zone, as in the Animas Valley, where it is only to be detected just below the mouth of Boulder Creek, upon the east side of the river, with some traces between this point and the mouth of Arrastra Creek.

The study of such phenomena is of untold importance to the correct solution of certain practical problems connected with the mining development of many of the properties on Cement Creek and its tributaries. I confess that there are still very many puzzling questions that must be left in large measure to such investigations as will be unwittingly made by miners in their blind search for hidden treasure; but I may venture to anticipate a little by stating what conclusions may fairly be drawn from our present knowledge. First, then, I believe that the departures from the typical character of the veins, which we find near the apex of the zone, where secondary action has been somewhat excessive, are not of more than superficial extent, and that the general character of the deposits will not be very much unlike at different points at a considerable depth. Again, I opine that those veins that present abnormal features at the surface will usually develop three tiers of deposition, one beneath another, in the following order:

1. Surface layer of sinter, containing base metal ores, contaminated with arsenic, antimony, etc.
2. A limited layer of rich silver ores, largely freed from the ingredients that compose the surface layer.
3. The unmodified normal vein, comprising the remainder of the workable deposit in depth.

The whole argument as to the validity of these deductions can not be given here; but it will be enough, perhaps, now to remark that there are not a few facts that seem to admit of no other explanation, and, what is more convincing, the development of the mines of this district has thus far indicated the correctness of the hypothesis, so far at least as the first and second layers are concerned. But it is very unsafe to generalize further without more detailed study than has yet been given to the subject in the field; nor is the experience of the miner in this particular district necessarily a guide to the deeper structure of veins in other parts of the great area we are discussing.

In speaking of some of the remarkable differences in the mineralogy of the two halves of this zone, it was noted that copper minerals usually carry the silver in the northern half of the zone (that is, the galena is usually not rich), whereas the galena is frequently one of the richest ores of the southern half, owing, however, to mechanically mixed "gray copper." There is far less of the banded character to the veins of the latter district, or perhaps it would be better to say that the different bands, though perceptible, are less distinct, as though the fissures had been more widely or violently filled. The "gray copper" is undoubtedly near freibergite; but it rarely, if ever, contains as much silver or copper as the type analyses of that mineral require, although it is apparently more highly charged with iron, the color and streak being darker also. I have never seen it well crystallized. In the King, Empire, Victoria, Ajax, and Silverton Park mines, on Sultan Mountain, and in the continuation of these veins down the Animas Cañon (Cleveland, Molus, Aladdin's Lamp, and other mines), this mineral is abundant in the quartz, and often quite separate from the galena, though rarely absent from that also. It is not as rich in silver, in any case, as are the light steel-gray copper minerals of Arrastra and Cunningham gulches, in the northern half of the zone. But it often carries from 80 ounces to 250 ounces of silver to the ton in large lots, with some gangue. In the North Star vein (Sultan Mountain), it is usually disseminated through the galena, but occasionally it occurs by itself.

There is some indication of the pre-volcanic history of this zone in the character of the gangues of the different veins. Those of the central portion of the area, away from the overpowering effects of the hot springs, carry their ores in highly siliceous matrixes, and extra-normal gangue minerals are chiefly such as have been derived from highly metamorphosed strata, as the granitic and schistose rocks. I have already referred to the chlorite that occurs in some of the veins. Other magnesian silicates and aluminous silicates are common, usually forming the selvage, or "gouge." These are usually present in all parts of the district; but there are certain peculiarities of some veins upon Galena and Sultan mountains, at opposite edges of the zone, that are restricted to these belts. Here occur calcareous gangues, often in great abundance. The Flat Broke lode, on Green Mountain, in Cunningham Gulch, is one mass of lime carbonate, studded with galena. This is evidently the filling of an old hot spring cavern, and the same deposit, highly siliceous, pursues an uninterrupted course for a long distance toward Red Peak, running alongside the large galena veins in the Gus Begole, Oscar Roedel, and other claims upon Galena Mountain, thence across the Animas Valley and through Tower Mountain by way of the Golden Star and other locations.

This remarkable outcrop deserves more than passing notice; but I can only speak here of its unusually tough character, which causes it to stand up in places above the general surface. In the Flat Broke, it is very wide and irregular in shape, and much less siliceous than farther to the southwest, and it appears to get even less durable toward the head of Cunningham Creek. As we follow it toward the apex of the zone, it gradually becomes toughened by the interlacing of quartz seams, so that upon exposed surfaces a coarse honeycombed texture is made apparent by the disintegration of the calcareous portion of the mass.

On Tower Mountain, opposite Howardsville, this belt is joined by a considerable deposit of ocherous earth, and similar beds are very abundant in Cement and Mineral creeks, following closely the lines of ancient hot springs already indicated. Sultan Mountain veins very commonly carry calcareous gangues in part. Aragonite is occasional in a few mines, abundant in some others, and it forms the principal part of the matrix in the Silverton Park workings at present. This mineral forms the gangue of the galena streak, the freibergite accompanying the quartz. This mine occupies a position in a peculiar mound that suggests also the occurrence of hot springs at one time along this line. Barite and fluorite are rarely, if ever, present in the veins of this zone, unless it be in the neighborhood of extensive secondary action.

It is hardly necessary to formulate rules for prospecting, as in the case of the other zones; but it may be well to remember the following, as a guide.

a. The barren edges of this zone, at the boundaries of the adjacent zones (Nos. 2 and 4), are fully as distinct as in those already described; but one who has not a very clear idea of the geography of the district may easily become so confused as to miss the position of the inferior belt, especially on the southern border.

b. A good indication is the abundance of "gray copper" (freibergite) in quartz, particularly when this mineral is in a separate streak.

c. The farther one goes from Red Peak toward the outer portion of the zone, the less liable is he to meet with unfavorable ores; but the veins must receive careful scrutiny in proportion to their distance from the crater area.

d. In the best veins, it is usually possible to separate the ores into two fairly distinct grades, according to their richness in lead or copper.

e. Zinc-blende may be taken as an unfavorable omen, though not always sufficiently so to condemn the vein for profitable mining.

4. *The Antimonial (Lost Peak) Zone.*—This area, as here understood, includes those veins that trend between S. 2 degrees W. and S. 68 degrees W. from Red Peak, the axis having a course approximately S. 35 degrees W. The zone is, therefore, nearly in a line with No. 1 (arsenical), already described, the latter having a median course of N. 38 decrees E. But this present wedge is twice as wide, and supposing it to have had practically the same origin, we may expect to find it less important as an industrial region, owing to the greater space over which equivalent energy has been expended. Such conclusion, at least, would be reached by an observer of the developments thus far actually made, although it must be acknowledged that far less investigation has been given to this area than to any other within the scope of our discussion. From what has been gathered, it is not apparent that the veins here are less valuable than elsewhere; but it would certainly seem that they are not as thickly distributed as in the opposite zone. Other conditions equal, if they are as numerous and equally important, they should lie, on the average, twice as far apart. Roughly speaking, this is about the condition of their distribution; and it will be fair enough to assume that what is now lacking in value will be to a large extent made up by future discovery. The average altitude of this zone is considerably less than that of the districts heretofore described, which leaves a much smaller portion above the timber-line. Consequently it is much more difficult to trace the veins on account of an accumulation of soil, and prospectors have not yet given this zone the attention it really deserves.

Antimony is much more characteristic of the belt, although arsenic is regarded as characteristic of one or two mines. While I am not prepared to deny this report, I have met no convincing evidence of the truth of the statement, and in not a few cases, my examinations of specimens furnished as examples have shown the presence of antimony to the exclusion of arsenic. There is certainly a sufficient excess of the former metal to entitle the zone to bear its name.

The vertical parent fissure, with the gold-bearing quartz, passes along the ridge of Red Mountain at the head of United States Basin and other small gulches running into Mineral Creek; thence along a spur of the

Red Mountain range, crossing Mineral Creek about half-way between Burro Bridge and Chattanooga; thence a little west of Burro Bridge across Treasury Mountain, and through the crags at the summit of the backbone of Lookout Mountain; thence through the ridges bordering the basins of Ice Lake and beyond. Its course is possibly a little west of what is here given arbitrarily as its trend, but it will vary but slightly from N. 35 degrees W.

In Ice Lake Basin, there are claims upon the axis that yield free gold, and the Decalogue, Magnet, and others upon both sides of the line have at times produced fine specimens of visible gold in flakes and nuggets. Like the arsenical zone, which yields somewhat complex compounds of lead and copper, this area is the *habitat* of a closely related antimonial series. The mines that have thus far exemplified this feature most typically are the Zufii, upon Red Mountain, three miles from Silverton, and a few properties that have been opened near the head of South Mineral Creek, in Ice Lake Basin. These two localities are several miles from each other, and the veins trend apart about 30 degrees, so that they may be used to illustrate the district in so far as their characteristics agree. At the same time, these areas being such as have been much modified by the secondary action of hot springs, the minerals that are now coming from the mines are most likely more base and less rich in silver than will be discovered in the deeper workings or in claims at a distance from the hot spring belts. There is, however, a much more general distribution of such relics in this zone than in the others, although they lie more in the southeastern half of it than elsewhere.

On Bear Mountain, in Snow Shoe Gulch, and a few other places, heavy deposits of galena have been discovered; but, so far as present developments go, bournonite* is by all odds the predominant mineral of the antimonial zone. It occurs in the Zufii, the Silver Ledge, and other properties, where it has been commonly mistaken for "gray copper." In these veins, it is usually of the steel-gray variety, though often in masses of iron-black color. The closely allied chalcostibite (antimonial copper glance; composition, sulphur, 29; antimony, 17; arsenic, 6; lead, 30; copper, 17; iron, 1) is probably often present, though I have not as yet been able to separate it from bournonite. There is rarely as much copper in the ores of this zone as the formula for bournonite demands, and iron is commonly much more abundant, the lead being ordinarily present in about the proper proportion (from 35 to 43 per cent) in the pure mineral. In the Silver Ledge vein, however, the lead has sometimes fallen below the normal, with copper near the typical amount (from 16 to 20 per cent). Jamesonite is very probably a constituent of some of the ores also. Its normal composition is sulphur 20, antimony 36, and lead 43, with usually enough iron, zinc, etc., to make up the remainder. Varying admixtures of two or more of the three minerals (bournonite, chalcostibite, and jamesonite) would produce all the abnormal occurrences yet noted. There is no apparent reason why we should not also find zinkenite, boulangerite, and geocronite (all orthorhombic sulph-antimonides, like bournonite and jamesonite). I have noticed the yellow spots from oxidation on ore from the mine in Ice Lake Basin, which probably indicates boulangerite; but other minerals prevent a clear determination thus far. Very perfect crystals of the elsewhere rare stylotypite (orthorhombic copper, silver, and iron sulph-antimonide) are abundant in the Excelsior mine, on Treasury Mountain, where they occur as beautiful imbedded prisms in a brown siliceous sinter, apparently of geyser origin. Stibnite (antimony glance) and the "gray copper" minerals (freibergite, tetrahedrite, stephanite, and berthierite already mentioned in these papers, with dyscrasite, or antimonial silver) may be sought in this belt, which is their natural *habitat*. Up to this writing, however, I have not detected more than one or two of them positively in the somewhat limited material I have been able to study. Stephanite and berthierite, both here popularly named "brittle silver," are occasional, usually at a distance from the seat of secondary action, in veins that carry their lead and copper in the form of simple sulphides (galena and copper pyrites), as the Last Chance, in U. S. Basin, and many of the claims on Bear Creek.

The antimonial zone has been explored near its central line, and to some extent on each side, beyond the Lost Peak crater. (I give this name provisionally to a prominent elevation lying between Ice Lake Basin and the uppermost eastern branch of the South Fork of Mineral Creek. It may have a well-recognized name among a few local miners, but this I have not been able to get by diligent inquiry. The name here used is adopted because the peak is hidden from nearly every common point of view, although very prominent from certain out-of-the-way places; as, the Zufii mine, etc.) At the head of Cascade in the limestone formation, some mines are worked that yield the characteristic modified minerals of the belt, with even less differences than one might anticipate from the local influence of calcareous beds. All in all, this whole zone has been usually regarded as a low-grade silver-bearing area, but there is little ground for this belief. On the contrary, there is every reason to look for some of the richest silver ores in this very region; but they must be sought at great depths, or in sections where hot spring deposits are not extensive. Hence Bear Creek, some of the eastern branches of the South Fork of Mineral Creek, Show Shoe Creek, Mill Creek, and a few little runs that come into North Mineral Creek opposite Chattanooga, are the most favorable points for working. These are the localities in which the simple sulphides occur in streaks more or less distinct from the silver compounds. The Paradise group and claims in Ruby Basin are very good examples of this. In other sections, where the characteristic highly colored deposits abound, the vein-minerals have become much changed at the surface by the action of hot springs, the result usually having been the deposition of complex refractory minerals, containing an excess of base metals, as compared with the silver.

The Zufii mine, some of the veins in Ice Lake Basin, and a large portion of the zone between these points, including Red Mountain from Zufii Creek to a point above Burro Bridge and a part of Lookout Mountain bordering the two forks of Mineral Creek, are the most modified areas. Remains of the hot springs are very abundant over much of this tract, as manifested in the rich coloring of the rock formations and their disintegration, as well as by the numerous pools and mounds and ferruginous deposits along the streams. We shall have occasion to refer more in detail to these relics when discussing the chronological order of the various formations, in connection with the history of vein-growth in this region.

The gangue is usually quartz, aragonite being characteristic only of such veins as outcrop in limestone, or are evidently environed by this material in some portion of their course.

This zone will justify more thorough exploration, and it will be well for prospectors to have in mind the following general principles, which may be relied upon as guides to the general determination of the economic value of their discoveries:

a. As in the other zones, the free gold veins must be sought in the highest ridges along a line near the center of the belt, as above indicated.

b. Large bodies of low-grade (in silver) refractory ores *may* be found in mounds, or in the midst of the red and yellow and blue earths of the hot spring areas, but the best surface ores and the most uniform veins will be discovered in places remote from these formations.

c. As a rule, in the refractory veins, those containing the most lead are the best, although, if copper be very abundant, there may be more silver.

d. There being a general similarity in the appearance of a number of the antimonial minerals, which often differ very materially in value, careful mineralogical determinations should be had in all cases of new discoveries.

e. Minerals that the novice would regard as "gray copper" or "brittle silver," are more likely to be these (or their allies) in reality, when they occur in separate streaks in veins carrying galena or pyrites and copper pyrites.

f. Those veins that carry the refractory, antimonial ores at the surface may become much more valuable at greater depths; hence, it is best, in locating, to select such portions as can be readily tapped far below the points at which the above-described hot spring deposits occur.

* In No. II. of this series of papers, this name was illegibly written, and therefore was printed boumonite. The proposed name of the new mineral should also have been *bournarsenite* instead of *boumarsenite*.

SUPERHEATED WATER IN BOILERS.—Hirsch, the well-known French engineer and author, reports to the Commission Centrale des Machines à Vapeur the results of experiments on the production of the superheated condition in the water of steam-boilers. Studying the history of such phenomena so far as they are recorded, and conducting a somewhat extended series of experiments, the conclusion was finally reached that there is no evidence, up to the present time, that boiler explosions may be caused by the conditions studied, or that such conditions ever arise in practice. If they occur at all, it is only in extremely rare instances, and as a consequence of a coincidence of circumstances seldom to be observed, and which are neither well understood nor well defined. The use of the thermometer is advised to determine the facts bearing upon this question. The commission to which the report is made approve and adopt these conclusions.

POWER OF WATER TO MOVE GRAVEL.—Mr. A. del Mar writes from San Francisco to the London *Mining World:* I notice with pleasure that English mining capital is more and more attracted to hydraulic mining. It is the surest kind of mining, because you can thoroughly prospect the ground beforehand. By means of a common ground auger costing a few pounds, and a couple of men, whose wages will not exceed a few pounds more, you can determine in advance the entire auriferous contents of a mine. It is the most profitable kind of mining, because the cost of washing a cubic yard of gravel rarely exceeds sixpence, and usually varies between one and two pence sterling; while the yield of gold is rarely less than sixpence, and usually varies between one and five shillings per cubic yard. It requires less capital to be sunk in machinery than any other kind of mining. The entire outfit consists of a wrought-iron pipe and nozzle to bring the water in, and wooden sluice-boxes to wash the gravel in. The pipe is always good for what it cost; the sluice-boxes can be reduced to boards, and in that condition will readily fetch half-price. The discrepancies that appear in the prospectuses of certain hydraulic mines capitalized in England concerning the power of water to move auriferous gravel induce me to offer a few remarks. There can be no general rule on this subject, because there is no general hardness of gravel. In many of the placer mines of this State, in the old Roman mines on the River Quiroga of Spain, and in some of the ancient placers of the Piedmont country in Italy, the gravel is exceedingly hard. Miners call it "cement." Its texture is that of cemented rubble, and only the heaviest streams of water can break it down. In other of the placer mines of this State, in those of the Rio Grande of Brazil, and in those of the river Boeza in Spain, the gravel is exceedingly soft. It runs so easily that water having no pressure at all will break it down. At the Hathaway mine, Nevada County, California, I have directed a 500-inch head of water, with 300 feet of pressure, upon a gravel bank for ten or fifteen minutes before it showed signs of yielding. At the Bahú mine, Brazil, I could not get from the existing ditches more than 80 feet of pressure, and yet this broke the bank down faster than I could wash the dirt in the sluices. To call this Brazilian stuff gravel is a misnomer. It is a fine red dirt, of the color and almost the fineness of snuff. Between these two extremes, there is every conceivable grade of gravel. There is also a great difference in the pressure of water, and, therefore, a vast range of efficiency on the part of water to move gravel. A few instances will afford some idea of how much this differs. There is a small hydraulic opening in Placer County, California, where the pressure of water is only 60 feet, and the quantity of water moved per miner's inch of water is only one cubic yard. At the North Bloomfield mines (now closed by injunction of the Supreme Court), the pressure of water varied from 180 to 260 feet, and the quantity of gravel moved averaged about four yards to the miner's inch. At a gravel mine in El Dorado County, the pressure was 350 feet, and this moved twenty yards of gravel to the inch of water. At the mines of Santa Lucia, Brazil, the property of Prince d'Eu, I moved twenty-five yards of gravel to the inch of water, the pressure being about 112 feet. In the mines of the Boeza, the pressure being 150 feet, and the gravel loose and uncemented, I calculated the work of water at ten cubic yards to the inch. In San Bernardino County, where I am erecting some works at the present time, I am to have a head of 200 feet, and the gravel being loose and friable, I have estimated on twenty yards to the inch. The sluices are of ordinary grade.

ROLLING-MILLS IN SWEDEN.*

By N. Lilienberg, M.E.

The Swedish rolling-mills for assorted bar-iron have generally three pairs of sixteen-inch rolls. The first pair, about five feet long, containing diamond grooves of from six inches to two inches is seldom changed. The second pair, about three feet six inches long, contains the grooves for different sizes and shapes, and is changed accordingly. The third pair, about two feet six inches long, is plain and polished, in order to give a smooth surface to the flat bars. In this pair are also frequently located standing grooves for plates too thick for rolling in the ordinary way. The upper rolls for the flats are chilled while the lower ones are soft. All the rolls for small rounds and squares, as well as the polishing rolls, are of course chilled. As the flats thicker than ⅞ inch can not conveniently be rolled by rolls sixteen inches diameter in the ordinary way, these are generally made in standing grooves, or, if the size is not particular, by simply drawing down squares in the polishing-rolls. In order to diminish the great number of rolls for different flats, universal mills have been recently adopted in many works having one horizontal and one vertical pair of rolls. As the pressure in this way can, of course, not be made to bear simultaneously on all sides of the bar, this rolling goes slower than by using adjustable collars. A Swedish rolling-mill for merchant bars generally makes eighty revolutions per minute, and when kept fully supplied by the welding-furnaces, turns out about two hundred tons per week of ordinary sizes, that is, squares from ⅜ inch to two inches, and flats from 1¼ inches to five inches wide. The driving-power is almost exclusively supplied by water-wheels and turbines. The suction turbines with horizontal axles are especially fitted for this work, on account of having the axle and gearing located in any convenient place between the water levels.

The rod-mills have rolls about nine inches in diameter, three high, and running about four hundred revolutions a minute. The first rolls are about two feet six inches long, and contain only diamond grooves. The second rolls are about one foot six inches long, and have ovals and diamonds. The last pairs have only two rolls alternately up and down, containing about two ovals or diamonds each; this arrangement is made in order to facilitate the handling of the rods. As a rule, no lighter wire rods than No. 5 are produced, while No. 4 is the ordinary size. The amount of power required for such a mill should be three hundred horse-power. This is, of course, in proportion to the length of the rods, and therefore the coil weight is entirely a matter of driving power, and lack of water is able to check the production of heavy coils. The demands of the buyer have lately increased from fifty to one hundred pounds and more, and therefore the rod-mills are taxed to their utmost capacity.

The expensive labors at the ordinary rod-mills; the large space required for receiving the coils, extending over the mill-floor on account of the difference in stretching; and the difficulty of making heavy coils uniformly, have recently caused the introduction in Sweden of continuous rod-mills. These are constructed on the principle of about ten horizontal pairs, ten inches in diameter, placed close to each other, the increasing speed being regulated by cog-wheels. The introduction of cylindrical gearings in the prolongation of the rolls has much simplified the construction as compared with the conical wheels on a main shaft previously used. The rods, commencing from about 1½ inches square, are stretched between the rollers, passing through screw-shaped guides. As the twisting, however, would produce too great a resistance at the high speed in the last three or four pairs, these are separated and arranged in a line, the rods being caught in the ordinary way.

The way of placing the grooves diagonally in the continuous mill, and thus avoiding the somewhat troublesome twisting in the screw-guides, has, as far as I know, not come into use, for unknown reasons. As an example of what can be produced in a continuous mill may be mentioned that Messrs. Washburn & Moen, Worcester, Massachusetts, showed at the Electrical Exhibition in Philadelphia one unbroken coil of No. 6 wire, weighing five hundred and twenty-five pounds.

THE EFFECT OF WET PERIODS ON BLAST-FURNACE WORKING.

Messrs. Taws & Hartman have written the following letter to the editor of the *Bulletin:*

In a paper read at the Philadelphia meeting of the American Institute of Mining Engineers in September, 1884, Mr. A. B. Emmons points out the fact of anthracite coal taking up water during a long spell of wet weather. This will account for one of the variations in running anthracite furnaces.

Between the extremes of dry and wet weather, anthracite coal will take up 2 per cent of moisture, as shown by his analysis. The filler weighs his unit of coal for the furnace correctly, but he makes no allowance for the moisture taken up during wet weather. The furnace then loses 2 per cent of its heating and reducing power. In addition to the above moisture, the moisture in the blast absorbs heat in front of the tuyeres. A furnace using 10,000 feet of air a minute on a dry day and 10,000 feet on an extremely wet day will require 4692 pounds of coal additional to counteract the moisture at the tuyeres, and will require 4002 pounds of coal to make up for the water in the coal. The extra 4002 pounds of coal should be added at once, so that there may be no loss in the reducing power of the furnace. To make up the deficiency caused by the moisture in the blast, the heat in the blast can be raised to 1300 degrees. The extra moisture in the blast increases its specific heat, which would in time rob the stove of its heat, if additional gas be not used, and thereby poorer iron will be made. When a furnace runs through a wet spell without change, it is simply due to the excess of heat stored up in the furnace. If the wet spell is long continued, poorer iron results. During hot, dry weather, the revolutions must be increased to give the furnace the same amount of oxygen. Mr. Emmons has done well in calling attention to this absorption of water by anthracite coal.

* From a paper on the Manufacture of Charcoal Iron in Sweden, read at the St. Louis Meeting of the U. S. Association of Charcoal Iron-Workers.

TOUGHENING (PURIFICATION) OF GOLD (SILVER, ETC.) IN THE CRUCIBLE.*

By James C. Booth, Ph.D., Melter and Refiner, U. S. Mint.

In all operations in the arts, economy, especially the avoidance of needless wastage, is of importance in direct proportion to the value of the material operated on.

While a loss of 10 per cent may be and is tolerated in working iron in the fire, the United States government holds the officers of the Mint responsible, in working gold, for any wastage beyond ·001 ($\frac{1}{10}$ of one per cent), and in silver, beyond ·0015. In practice, the actual loss is usually far within that range. In general, the tolerance of loss, in working the metals, is inversely as their commercial value.

The recent progress of knowledge and skill in the arts is well shown in the improved commercial character of some of the commoner metals. When I first examined the copper of commerce, in 1850, with reference to its use for minor coinage, or for alloying gold and silver coin, I found that a large amount of the best commercial article contained about 98 per cent copper, and that it often made hard or brittle alloys. We now employ copper averaging 99 per cent pure, with small quantities of nickel, silver, oxygen, silica, and the usual intruder into every thing on earth, iron. In a few instances, 50,000 pounds of extra refined copper (from Pope, Cole & Co., Baltimore, Md.) yielded, to a specially fine analysis (by Booth, Garrett & Blair), about 99¾ per cent copper. In like manner, a remarkable change has occurred in the silver market. About 1850, the best commercial silver usually assayed 99 per cent, and in 1853, I took credit in exhibiting a pile of about ten tons of silver that averaged nearly $99\frac{5}{10}$ per cent. At the present time, a large amount of the good silver of commerce, from the mining regions, averages $99\frac{9}{10}$, and sometimes attains $99\frac{95}{100}$; failing only by $\frac{5}{1000}$ of absolute purity.

The gold of commerce generally requires toughening or purifying to fit it for coinage or for jeweler's use, as it consists of bars, with silver, somewhat improved by melting, of lumps and grains of ore, and of old jewelry, containing tin, lead, zinc, and all the cheap elements that ingenuity, greed, and deception can use to dilute and cheapen the precious metal, without wholly obliterating its coveted yellow color and its toughness. Some really tasteful jewelry, of fair quality to the eye that chooses to judge for itself, contains only one fourth of gold, and some still less.

The lumps and grains are melted to drive off mercury, etc., and are then refined, together with good silvery bars, by acid processes, termed quartation or parting. Where tin is present, as in jewelry, the nitric acid process is preferable, and after thoroughly washing out nitrates, muriatic acid, drenching the residue, dissolves out the tin, and the residue is pure gold. Iron is a frequent enemy to the ductility of gold, an extremely small percentage rendering it hard or brittle, as in the case quoted in the *Journal of the American Chemical Society*, vi., 182. The principle there developed is to remove all the embrittling elements, with the least practicable quantity of the valuable metal, on one side (to be subsequently purified); and on the other, to have all the rest of the gold practically pure. The loss of gold in the fire is in proportion to the length of exposure and to the quantity exposed; and the process described eminently guards these points. A single practical illustration will make the principle clear. Suppose a melt of 5000 ounces of gold, containing ·001 (5 ounces) of embrittling impurity, are separated, by a short working in the fire, into 100 ounces skimmed off impurity (consisting of 95 ounces of gold, and 5 ounces of embrittling matter, together with flux) and 4900 ounces of practically pure gold; then only 95 ounces are exposed to further possible wastage in the fire.

TOUGHENING OR PURIFYING SILVER FROM LEAD, ETC.

The principles and, to some extent, the practice above applied to gold, may be applied to silver adulterated with lead, tin, zinc, etc.

In spite of the great improvements in preparing silver bars for the market, as noted above, we often received them alloyed with lead, etc., and quite unfit for coinage, some ten or fifteen years ago. Recently they have generally been unexceptionable. There was no reason for having inferior silver in the market, because the Western smelters then had cupels, and knew how to use them; but the lower price of the inferior silver was an irresistible temptation to a purchaser. I bore the brunt of the mistaken purchase; for the question given to me for solution was, to refine a few tons of plumbic silver, without a cupelling hearth; for even if I had desired one, there was no room for its erection in the Mint. Since I solved the question successfully, and by a rather novel method, it seems to be worth describing. At one time, I smelted a lot of some 50,000 ounces of commercial silver bars, in melts of about 3500 ounces each, and treated each melt in the same way, as follows: It was melted, with the addition of about an ounce or more of anhydrous borax, which greatly facilitates fusion, and, to a limited extent, prevents volatilization, although forming only a paper-thick covering to the melted metal. A covering of bone-ash (from ⅛ to ¼ inch thick) having been sprinkled over the surface, crystals of soda-niter are here and there dropped through the covering, and after effervescence has somewhat progressed, a black-lead dipper, held in the tongs, is moved around the top, in interlacing circles, to spread the oxidation, and the metal is then more thoroughly mixed by plunging the dipper to the bottom of the metal, moving it up and down once or twice, and, after lifting it out full, by pouring it back into the metal. This operation of oxidizing throughout is advantageously repeated, and more than once, if the silver is known to be foul with lead. All these operations being rapidly performed, the surface is hastily skimmed by a triangular crucible (so as to have always a flat side for skimming), experience guiding the melter to take off all the fluxed matter, with as little silver as is conveniently practicable. The whole time of oxidation and skimming is of but a few minutes' duration, so that no chance is given to the oxidized metals to revert to the metallic condition, in the presence of their tempters, carbon and melted metal. The processes of oxidizing and skimming are repeated until the *look* of the remaining silver, or the test of a cast strip, proves sufficient purity of metal. In the case here specially noted, the working of 12 melts occupied between one and one and a half days to resolve them into over 49,000 ounces of silver sufficiently pure and tough for coinage, and less than 1000 ounces

*A paper read before the American Chemical Society.

of silver with litharge, and other oxides, in the skimmings. These last consist of bone-ash, cemented by litharge, borax, and alkali into mixed soft and hard sponge or brick, with some grains of silver entangled in the mass.

The treatment of the skimmings constitutes the chief and, I believe, novel peculiarity of the process. The whole residues having been charged into pots, with the addition of some charcoal, to aid in reducing the litharge, and of pearlash, to make the slags thinner, was melted in a covered crucible, at a full red heat, and allowed to cool quietly, so as to make a king of all the reduced metal, with a cinder or slag above it. When cold, the slag and cinders were ground and sifted to recover metallic grains. The cold kings were put into a crucible, and gradually heated, by a long-continued heat, from below the melting-point of lead, to a full red heat, and the eliquated metal, at different heats, collected separately. The first runs were nearly pure lead, so as to be cut with the same facility as the soft lead of commerce.

There was only a slight wastage of silver in all the above operations, and but little loss of lead. I found the whole process a very short method of procuring nearly the whole of the silver from its obstinate alloy with lead, and attended with a trifling wastage; and I have good ground for believing that a little experimental practice might easily lead to its further improvement, so as to be substituted for cupelling, where the latter is not convenient. The depressed hearth of a reverberatory might readily be used as the black-lead crucible, and other modifications devised according to the exigencies of the case. These remarks are not designed to disparage the admirable process of cupellation, but merely to show that we are not necessarily confined to the last. In fact, the process I have indicated *is* cupellation, with a movable cupel, and oxysalts used instead of a blast.

It is hardly worth drawing the plain conclusion that where lead is thus removed from silver, zinc, tin, antimony, etc., will be oxidized at the same time, and caught either in the metallic residues (kings) or as oxides in the cinders. So efficient, economical, and easy of execution is the process that one leaps to the conclusion that where silver contains one or more of the above oxidizable metals, lead may be added and the whole worked off with ease. Direct trial has proved it.

PURIFICATION OF PHOSPHOR-BRONZE.

The question having been propounded to me about a year ago by a worker in copper alloys of removing the phosphorus from phosphor-bronze, I applied the principle herein developed, of using the greater oxidizability of the phosphorus and skimming it off, with a cover of lime on the melted metal. Although I had the time of but a half-day to test the process, and in spite of no previous experience in skimming, I succeeded so far as to prove that a simple and effectual process can readily be evolved from the hints I have given in this paper.

SWEDISH HEARTH AND WELDING-FURNACES.

The *Foreign Abstracts* of the British Institution of Civil Engineers contain the following, which is from the German of G. A. Forsberg: The author describes a modification of the Swedish Lancashire hearth finery that has been introduced at the Skutskär iron-works. The hearth is of the rectangular form usual in Sweden, but differs from the ordinary construction in having a third tuyere in the back wall, that opposite to the working or front side. The side-walls are formed of hollow iron castings, which are cooled by allowing the blast to pass through them, whereby it becomes heated before arriving at the tuyeres. The hearth is covered by an arched roof of brick-work, carrying a hopper closed by a slide, into which the charcoal is charged and dropped into the fire as required, instead of the old plan of shoveling it in through the working-door in front. The waste flame, on its way to the chimney, passes over a bed in which the pig-iron for the following charge is brought up to a strong heat before its introduction into the melting-hearth. A comparative trial of one of these hearths against one of the ordinary kind with two tuyeres, carried on for a period of four weeks, gave the following results: The two-tuyere hearth produced an average of 265 cwt. of blooms a week, with a consumption of 5⅛ bushels of charcoal per cwt. The three-tuyere hearth produced 366 cwt. a week of bloom iron, with a consumption of $4\frac{2}{10}$ bushels of charcoal per cwt. The loss in the metal in working was about the same in both cases, namely, 12·93 per cent, or 1·1485 cwt. of pig-iron were required to make 1 cwt. of bloom iron. The author suggest a method for further increasing the production of this class of furnace by doing away with the melting of the pig-iron in the refining-hearth. For this purpose, the heating-bed for the metal in the flue is to be converted into a melting-bed, which is kept warm by the waste flame during the actual firing period, and receives the heat necessary for melting from a gas-producer, placed at right angles to the working axis of the hearth. Two hearths, placed back to back, communicate with the same stack, and are served by a producer common to both. The gas being only required during the melting period, the producer is damped during the refining of the metal in the hearth. The gas-producer may be worked with inferior fuel, in which case the melting of the pig is done at less cost than in the fining-hearth, where charcoal must be used. The welding-furnace described by the author is a gas furnace with a flat bed about 20 feet long, and low arch, standing within its own blast-heating apparatus, the latter being a series of short upright and horizontal pipes, the former also being part of the structural iron-work of the furnace. The horizontal pipes are placed below the bed, and correspond in some degree to the long horizontal air-way in Bicheroux's furnace. The gas-producer has a stack 10 feet high, shaped somewhat like that of a charcoal blast-furnace, the bottom being closed by a grate arranged to work upon a central axis. The charging is effected by a gas-tight covered hopper and valves. The gas passes by a siphon up-take and down-come within the same mass of brick-work as the stack, to a chamber forming the ash-pit of the furnace, where it meets the heated air in jets from a square pipe in the roof, a short distance in front of the fire-bridge. The producer is worked with waste short ends of deals and planks previously dried at from 104 to 150 degrees, the consumption being equivalent to 2·7 bushels of charcoal, supposing the wood to be equal to 63 per cent of the latter. The loss on the blooms heated for rolling into merchant iron was 11·5 per cent. A further modification of this furnace is provided with two similar gas-producers that are worked alternately, the fuel charged wet in one drying, while in the other it is converting into gas. For the former purpose, the gas-delivery passage is closed by a valve at the bend of the gas delivery siphon, and the charging-valve of the hopper is opened while heated air from the hot-blast tubes is passed through the wet wood from below, until hygroscopic water is converted into steam.

CHILLED ROLL CASTING.—Messrs. Taylor & Farley, the well-known roll-makers, of the Summit Foundry, West Bromwich, England, have just completed a very large pair of chilled rolls for Messrs. Bolckow, Vaughan & Co.'s new plate mill at the Eston Steel-Works, Middlesborough. The rolls referred to are 30½ inches diameter, finished size, and have been cast with a hole through the center, this hole being about 7 inches diameter in the middle part of the roll, and tapered down to a smaller size at the neck and wabbler ends, in accordance with the design of Mr. Franklin Hilton, the Steel Company's engineer. These rolls have been so cast hollow with the object of counteracting the unequal expansion and contraction, which is so frequently the cause of the breakage of chilled rolls, having regard to the well-known difficulties inseparable from the casting of chilled rolls, more especially rolls of large diameter—difficulties which are increased by coring out. On being turned, these rolls presented a splendid working surface with a perfectly regular chill three quarters of an inch deep, and are absolutely free from blow-holes or other defect; indeed, they will stand microscopic inspection. Experienced manufacturers of iron and steel who have inspected these rolls have pronounced them to be a magnificent pair. The large and powerful plate mill above mentioned was successfully started on the 16th of October, in the presence of Mr. Bolckow, Mr. Windsor Richards, and a number of other gentlemen of eminence in the steel and iron trade.

ANOTHER EXPLANATION OF THE POCAHONTAS EXPLOSION.—Mr. James Russell, "a well-known mining engineer," of Columbus, Ohio. was interviewed by a reporter of the Charleston *Daily Times*, and delivered himself as follows:

"This is what is called a green mine. That is, the coal is being worked at least 200 years too soon. I could explain this point more thoroughly if we were in a 'green' mine. At a certain stage of the formative process, there is to be found a substance known among the miners as nitro-oil. This is scattered about in pockets, and so completely hidden from the miner that he comes upon it before he is aware of the danger. It is as explosive as nitro-glycerine, being discharged in the same way."

"Is this oil found in all mines?"

"No; only those that are called green. A great many mines are worked a hundred years before the coal has reached a workable stage. Coal in which the process of formation has been completed, is found in blocks and layers, and the dangerous 'nitro-oil' is found to be thoroughly distributed through it, thus producing what we call coal-gas."

"Has the Pocahontas coal ever been analyzed?"

"Yes; not long ago I sent two pounds to Professor Aymer, of Columbus, who discovered by analyzing it that it contained of this explosive 73 per cent."

FURNACE, MILL, AND FACTORY.

The National White Lead Works of F. W. Gerdes & Co., in Willow Grove, near Pittsburg, Pa., on the West Pennsylvania Railroad, were burned November 1st. The loss is $45,000.

On the farm of John Snyder, six miles from South Schenectady, a large deposit of steel-molding sand has been discovered. Experts pronounce it the finest in the United States. The supply is almost inexhaustible. A large steel manufacturing house in the East has ordered a large quantity of the sand.

Furnace No. 1, of Andrews Brothers & Co., Youngstown, Ohio, has been put in blast, and is working well. It is probable that No. 2 will be lighted in a short time.

The Sulphur Mines Company, of Virginia, will erect at the Arminius Mines, Tolersville, Louisa County, a sulphuric acid plant to burn 50 tons of pyrites a day.

The National Wire Company, of Chicago, Ill., has made an assignment to A. M. Evans. It was incorporated in April, 1882, with an authorized capital of $300,000, of which $68,500 were paid in. A. B. Stone was president.

It is reported that the Solid Steel Castings Company, of Newark, New Jersey, is financially embarrassed.

RAILROAD NEWS.

The Tennessee Coal, Iron, and Railroad Company's report for October shows that 14,428 tons of coal and 9025 tons of coke were received directly from the mines, making a total for the year of 209,029 tons.

The Chicago & Great Southern Company, which consolidated in 1883 with the Chicago & Block Coal Railroad Company, has gone into receiver's hands, Philip B. Shumway, of Evanston, Ill., being appointed. The company's capital stock was $3,000,000; $2,000,000 first mortgage 6 per cent bonds have been issued.

The receivers of the Philadelphia & Reading Railroad Company will purchase, on and after November 17th, 1884, the interest and coupons due November 1st, 1884, of the following divisional coal land mortgage bonds of the Philadelphia & Reading Coal and Iron Company: West Flowery Field, Big Schall, Fishing Creek Improvement Company, Helfenstein, Raudenbush, Weaver, *et al.*, and Ely & Riehle.

COAL TRADE NOTES.

ALABAMA.

Mobile advices say that a shipment of coal from Mobile to Aspinwall has been made as an experiment, the result of which will determine whether the export of Alabama coal in the direction indicated will become a permanent feature. The coal is consigned to the Pacific Mail Steamship Company for its own use, and for the purpose of deciding, on trial, whether it is available for its purpose, on the basis of adaptability and economy.

CANADA.

PROVINCE OF MANITOBA.—A vigorous effort is making to increase the staff of miners at the Saskatchewan coal mines. This company is putting coal down in Winnipeg at $7.50 a ton; and to meet the demand, the company aims to increase the output to 300 tons a day.

IDAHO.

A preliminary report of the geological survey for coal in the great Sioux Nation reservation in Idaho, made under the direction of the Secretary of the Interior, shows that lignite beds six feet in thickness occur in the horizontally imbedded

sandstone sixty miles west of the Missouri; but they are of local extent, and no beds of sufficient area have been found to justify mining even for domestic uses. If coal-beds of value exist in the Sioux reservation, they are confined to the northwest corner, on the tributaries of the Cannonball River, where lignite beds are reported, and to which point the survey did not extend.

ILLINOIS.

The Illinois Mining and Coal Company, at Chicago, has been incorporated with a capital of $100,000; incorporators, Horace H. Stoddard, Theodore C. Slusser, and Andrew J. Madden.

MARYLAND.

Report for the week ended October 29th: Hoffman, Eckhart, New Hope, and Alleghany, full-time. Borden mine, 5 days. Borden Shaft, Blaen Avon, Miller, and Ocean, full-time. Midland, 2 days. Old 'Coney, 5¾ days. New 'Coney, 4½ days. Koontz, 3 days. Jackson, 2¼ days. Detmold, Pekin, Swanton, Potomac, and Hampshire, full-time. Franklin and Phœnix, half-time.

OHIO.

At Youngstown, Witch Hazel shaft is on full-time. Manning shaft is working steadily. The Pine Hill Coal Company is driving three new entries, and expects to add largely to its force of employés in a short time.

PENNSYLVANIA.

ANTHRACITE.

The Mine Inspectors' report for September shows the following:

Pottsville District—Samuel Gay, Inspector: Accidents, 5; killed, 1; injured, 4. Total number of employés, 6536; average number of days employed, 17½; number of tons of coal shipped, 157,108 14.

Shenandoah District—Robert Mauchline, Inspector: Accidents, 16; killed, 6; injured, 10. Total number of employés, 12,645; average number of days employed, 17; number of tons of coal shipped, 355,394 03.

Shamokin District—James Ryan, Inspector: Accidents, 17; killed, 3; injured, 14. Total number of employés, 12,960; average number of days employed, 20⅛; number of tons of coal shipped, 345,100 10.

COKE.

The 4413 idle ovens reported at our last report, says the Connellsville *Courier*, now amount to 4525. This increase is due to no particular cause, but is the result of a general average of changes. Lemont has fired 25 additional ovens, and Little Emma, for the first time for over a year past, is running full, while the terrible explosion at Youngstown has caused the temporary suspension of the 70 ovens burning there. Orders have fallen off slightly. The average daily shipments are now 500 cars, 25 cars less than two weeks ago. The decrease comes from Chicago and Cleveland, and is due to a temporary overstocking. The short car supply is now confined to Pennsylvania cars for Eastern trade, instead of for Fort Wayne and of others for the West, as was the case a fortnight ago. This lack of transportation has caused some of the works to lose some time this week. Prices remain at $1.10 a ton for furnace orders. Labor is plenty, and wages remain at the old figure, there being no disposition on the part of the pool to make any reductions.

NATURAL GAS.

The Canonsburg Iron Company's No. 2 well, at Canonsburg, struck, October 30th, at 1800 feet, will be drilled ten feet deeper for a larger volume of gas. The well No. 1, which was got at 1200 feet, has not diminished in pressure. The wells are evidently in different sands.

The street committee, at Pittsburg, have affirmatively recommended an amendment allowing the Westinghouse Company to lay one pipe instead of two.

The Westinghouse Company expects to get into Pittsburg with its mains by January 1st next. In three weeks, Springdale, Tarentum, and Sharpsburg will be supplied. The company has now three wells at Tarentum, two at Murraysville, four at the Westinghouse property at Homewood, and one at the racetrack, where a sixth venture is in process of drilling. The gas will be furnished private families, some time in the indefinite future, at twenty cents a thousand cubic feet. Arrangements will be made to supply it at low pressure, in the thinly populated districts, by means of governor valves, and in thickly settled districts by means of the double pipe. It is said that the company has already a custom list that will bring in $100,000 a year.

OIL.

ASSOCIATED PRODUCERS' COMPANY, OF BRADFORD.—A charter has been issued to the Associated Producers' Company, of Bradford, McKean County. The company proposes producing and selling oil. The capital is $1,000,000.

WEST VIRGINIA.

On October 31st, William Mitchell, of Chicago, Ill., who has been boring for gas sixteen miles north of Wheeling, struck it at a depth of 1407 feet.

GENERAL MINING NEWS.

ARIZONA.

PIMA COUNTY—QUIJOTOA DISTRICT.

Work in the different tunnels, winzes, and drifts is pushed right ahead. The grading is nearly completed, wood contracts for 1000 cords and more are let, the pipes for Burleigh drills will soon be laid, and the machinery for an air-compressor is on the ground. It is also expected that the sinking on the double-compartment shaft will be at once begun, and a force of men employed at the grading for reduction-work. J. W. Mackay has just inspected the properties.

CALIFORNIA.

MONO COUNTY.

MAY LUNDY.—Nothing further has been heard about the reported sale of this mine, and it is now the general impression at Homer, says the *Index*, that no sale has been made, and that the sale "racket" was played on the creditors in order to get a settlement at seventy cents on the dollar.

BODIE DISTRICT.

Reports for the week ended October 27th:

BODIE CONSOLIDATED.—During the past week, 140 tons of tailings were worked at the mill, the average assay value of which is $6 a ton. The crushing of ore has begun.

NEW STANDARD.—The owners are steadily prospecting. It is reported that they have concluded negotiations for the purchase of one of the numerous hoisting-works now idle in Bodie, and will soon move it to the ground, and begin work on an extensive scale.

STANDARD CONSOLIDATED.—There were extracted and shipped to the mill 528 tons of ore and 700 tons of tailings. Received from the ore 604 ounces of crude bullion, and from the tailings 206 ounces. Shipped to the company one bar of bullion valued at $9218.27, of which $6617.64 was from two weeks' run on ore and $2600.63 from two weeks' run on tailings.

COLORADO.

CHAFFEE COUNTY.

DORN CONCENTRATOR.—A ton of Hortense ore has been shipped to the Dorn Experimental concentrator at Salida, for the purpose of testing the machine.

NEW YORK & TORONTO.—A strike of eighteen inches of fine carbonate and oxide ore in the New York mine, the property of this company, is reported. The new shaft in which the strike was made is down only twenty-two feet.

CLEAR CREEK COUNTY.

ATLANTIC-PACIFIC.—Indications point to the early resumption of work on this tunnel.

COLORADO CENTRAL.—Some ore has been worked by the Pay Rock mill; and if the result proves satisfactory, a mill similar to the Pay Rock will probably be erected at this mine in Leavenworth Gulch.

DELAWARE.—The pool working this mine has suspended operations. The large amount of water and hard rock, it is said, discouraged them.

DUNDERBERG.—The lessees are taking out some good ore, but nothing is doing to put this property in working order.

LITTLE MATTIE.—The trouble at this property has been settled. A new Chicago company will take charge of it, and operations will soon be resumed.

REPUBLICAN MOUNTAIN SILVER MINES.—Mr. J. Warren Brown, of New York, is at the mines overlooking the work which has been done on the company's property during the past past few months, and planning work for the winter. This company owns some of the most valuable properties on Republican Mountain, embracing eight or ten patented claims. Some of the richest ore-bodies ever found on the mountain were found in the veins that they have been systematically developing for many months. Fine bodies of ore have been disclosed in the recent developments, but it is the intention of the company to push development and open up large reserves before doing any stoping. The work for nearly a year has been confined to tunneling, sinking, and drifting.

SNOW DRIFT.—A contract has, it is stated, been let to the Union Manufacturing Company, Georgetown, to furnish a full plant of machinery for this mine, on Republican Mountain. It is the intention of the company to work this property very extensively during the coming season.

DOLORES COUNTY.

GRAND VIEW.—The smelter will be idle for the next few months, but it will be started up in the spring for a continuous run. The mines will be worked and the tunnel on the 4th level will be continued from 400 to 500 feet beyond its present terminus, which work is calculated to place the mines in much better shape for ore production and facilitate working.

PASADENA.—Colorado papers report a successful result of the run at this smelter. The smelter will be in operation all winter. The coal mines of the company, seven miles from Rico, are worked full force, to yield an adequate supply for the winter's run.

GILPIN COUNTY.

CALIFORNIA.—The main shaft has attained a depth of 1700 feet, and the sinking of another additional 100 feet has begun. The company is extending the 1500, 1600, and 1700-foot levels to the boundary lines of the property.

DENVER GOLD COMPANY (LIMITED).—Many improvements are making at the mill and in the mine, and the output from the mine will shortly be largely increased.

KOHINOOR & DONALDSON.—The new plant of machinery received recently by this company for placing over the Champion mine on Bellevue Mountain, as also the hoisting rig and skip, have been started up, every thing working easily.

HINSDALE COUNTY.

FRANK HOUGH.—The mine is shipping via Silverton. The ore is arsenical copper and lead, as heretofore.

JEFFERSON COUNTY.

The copper mines near Golden are again worked, and show good prospects.

LAKE COUNTY.

The Leadville *Herald* reports the following:

The fact that so many of the producing properties of the camp are worked under lease, and the reticence of lessees in imparting any information regarding their product, account in a large measure for the dearth of local mining news.

The question of sinking a shaft within the city limits is reviving. With sufficient capital to prosecute the work properly and provide suitable machinery to handle the water that would undoubtedly be encountered, the question as to whether or not Leadville is underlain by an immense mineral deposit would be solved.

CHRYSOLITE.—The mill now managed by this company is treating daily about fifty tons of ore from the dumps of the company's mines. About three thousand tons have been treated up to date. A general clean-up will be made about December 1st, which will determine the success of the enterprise.

CROWN POINT.—About fifty tons of ore are produced daily, most of which goes to the Manville smelter. The value in silver is from 25 to 175 ounces to the ton and from ten to thirty per cent in lead.

IRON SILVER.—The shipments from the company's properties for the month of October will about correspond with the September output.

MANVILLE.—The roasting-ovens at the smelter will be completed in a few days. The works at present are running two stacks; and when the ovens are completed, the third stack will be blown in. The ore receipts at these works are largely increasing.

LA PLATA COUNTY.

The new smelter at Animas City has fired up and will begin operations.

OURAY COUNTY.

NATIONAL BELLE.—The working force has been rapidly increased since the recent sale of the property, and at present numbers nearly 20 men. A large quantity of carbonate ore is ready for shipment.

YANKEE GIRL.—This mine is working steadily, with small shipments.

PARK COUNTY.

LAST CHANCE.—The concentrating mill that is building for this company is pushed along rapidly, and it is expected to place some of the machinery in position soon.

PITKIN COUNTY.

VALLEJO.—Judge Goddard has issued an injunction against this mine, a Aspen, on application of a party claiming an interest in the property and in all royalties.

SAN JUAN COUNTY.

Mr. Theodore B. Comstock reports the following: Demand for good properties is increasing; several good sales have been consummated; others are on foot. Mining is gradually becoming a business here in which thoroughly trained engineers are appreciated.

CROWN POINT.—This mine, on Solomon Mountain, is showing well for work done on assessment for this year. The ore is high-grade galena and gray quartz. A mill-run on ore from this mine at Comstock & Co.'s mill recently was, weight, 5260 pounds; assay per ton, gold half an ounce; silver, 53 ounces; lead, 4 per cent; copper, 4½ per cent.

EMPIRE.—Lewis & McCann are working this mine under lease. The ore is jigged by hand with fair results.

MOLUS.—The owners of this property, the Molus Extension and Aladdin's Lamp, are making arrangements for heavy shipments of high-grade ore.

NIAGARA CONSOLIDATED.—The contract on the Cuba is nearly completed, but work will be continued to cover the required assessments for other claims.

NORTH STAR ON SOLOMON.—Work continues and regular shipments are made.

NORTH STAR ON SULTAN.—The vein was struck October 20th, in the cross-cut, at a distance of about 1300 feet from the entrance. From two to three feet of

ore similar to the usual product is now showing. This is of the same quality as the ore mined in the workings above, but better than the general average shipped in 1882–83. New buildings are erecting at the mouth of the tunnel, and preparations are under way for a large output. This mine, long worked for other than dividend purposes, will probably now be handled for the benefit of its owners. Mr. Theodore E. Schwarz, the well-known engineer, is in charge.

PRIDE OF THE ROCKIES.—This property, recently purchased by A. J. Hamilton, of Cleveland, Ohio, in connection with the Little Ida claim, for the Buckeye State Mining Company, is very promising. But little work has been done, but preparations for winter operations are well advanced. The ore is iron and copper pyrites with gray copper (freibergite) intermixed. Assays of small lots have yielded from 89 to 320 ounces of silver. Fifteen tons of ore taken from the shaft (only 15 feet in depth) carry 50 ounces of silver and $\frac{3}{10}$ ounce gold, as shown by mill-runs of several tons, with little or no assorting.

SAMSON.—This is now operated by the board of directors in a business-like manner, economically. The ten-stamp mill is about ready to begin work, and shipments of the silver ore are made daily to Silverton. The concentrator will not be rebuilt. Judge A. M. Jackson is the manager, with Mr. Barnes as superintendent. Joseph Luce acts as metallurgist. Mr. Stahl has withdrawn from the management.

SILVERTON PARK.—This mine is temporarily idle. Some parties are negotiating for lease.

VICTORIA & AJAX.—Several lots of ore have been shipped, running from 70 to 155 ounces of silver to the ton, with lead from 13 to 31 per cent.

SUMMIT COUNTY.

It is reported that a fine body of mineral has been struck on Sheep Mountain, in the vicinity of the Robinson mine.

GRIER.—This stamp mill has been purchased by the Lillian Company, of Leadville, and it is now shipping from Robinson. The mill is of twenty stamps capacity, and will probably be enlarged to forty stamps. It will probably be erected in Iowa Gulch.

DAKOTA.

FATHER DE SMET.—The superintendent writes, under date of October 18th, as follows: I herewith inclose you express company's receipt for bar No. 194, containing 1204·75 ounces of gold, the result of run of mill for the first half of October. The outlook at the mine shows no new features this week. Very little improvement has taken place in the Eureka cut ore. Justice and Golden Gate ore-bodies, however, continue to produce well, and, as the shipment just made indicates, make a very good general average for the mine, which, from present appearances, will be maintained for some time. No improvement has yet been found in the character of the ore in the south breast east cross-cut. The report for the week ended November 1st shows ore extracted from first second, and third levels, 3000 tons. Ore milled, 3000 tons.

IDAHO.

IDAHO & ALTURAS.—A suit has been brought by Messrs. Mackintosh, R. C. Chambers, and A. Hanauer, of Salt Lake City, against the owners of this property to compel them to receive the $42,000 agreed on and to give a title to the mine.

MEXICO.

The *Mexican Financier* reports the following: The government of the State of Sinaloa has authorized Mr. Galso Gaxiola to develop the gold regions on the borders of the Sinaloa River and extending from Chicorato through Terahuito, Bacubrito, Barahui, and Lajas to a point on the same river situated west of Terahuito.

Messrs. Mariano and Conrado de Castro have been granted the right to work the iron ore-deposits in Tepuche, near Culiacan. The extent of the tract is about 4000 by 3000 meters, and includes the hill called the Fierro.

The mining company established by Frederic Ernest in the island of San José, situated in the Bay of California, north of La Paz, has ordered new machinery from California and is only waiting its arrival to begin work.

A number of French mining engineers recently visited Mulegé, Lower California, having been commissioned by European capitalists to explore the rich copper mining districts in that region, with the object of investment, if the reports are satisfactory.

A new shaft in the Porvenir mine, in Hidalgo, now sinking, will bear the name of Guillermo Segura, in memory of the engineer of that name who, together with his companion, Juan Blasquez, projected it a few days before the former's decease.

The *barras* of the Dificultad mine, in Real del Monte, have recently risen very rapidly, and are quoted now at $60,000, with a probability of increasing still more in price as soon as the water in the lower portions is extracted by the pump lately put in operation. It is stated that the results to be obtained at that depth will be much more satisfactory than those at present.

A new pumping-engine from the foundry of Messrs. Harvey & Co., of Cornwall, is expected to arrive soon in Vera Cruz, for use in the San Cayetano el Bordo mine, in Hidalgo.

MICHIGAN.

COPPER MINES.

ALLOUEZ.—The mine will be worked during the winter. The report that it would close down has been denied.

CALUMET & HECLA.—According to the Houghton *Mining Gazette*, the fire back of the eighth level is out, and the full operations of the industry are under headway again. The fire, except in the way of delay and lessening somewhat the October output, has inflicted no damage to the underground plant of the mine. We have no accurate figures to form a basis; but from what data we have, we are inclined to believe that the product this month will probably be about a third less than the yield in September, which will no doubt be made up, before the close of the business year.

MONTANA.

SILVER BOW COUNTY.

ANACONDA.—Mr. William McCaskel has resigned the superintendency of the Anaconda smelter. Mr. McMaster, who has for many years successfully managed the company's vast gold mining interests in the Black Hills, Dakota, has been compelled to retire, owing to ill health, and Mr. McCaskel has been appointed to fill the vacancy.

LEXINGTON.—The south cross-cut at the 650-foot station has at last reached the ledge, and the work during the present week is expected to show something definite as to the character and extent of the ore-body.

PARROTT.—The new concentrator and blast-furnace of this company will soon be in active operation. The company will treat 400 tons of ore daily, of which about 325 tons will be concentrated before treatment in the furnaces.

NEVADA.

EUREKA COUNTY.

EUREKA CONSOLIDATED.—The trial of Percy Jacobus has been postponed to November 7th.

NEW MEXICO.

NEW YORK & NEW MEXICO MINING AND SMELTING COMPANY (LIMITED).—The Emma, Rescue, Hidden Treasure, and Texas or Two Ikes claims, which were purchased five years ago by this company, will now be worked on an extensive scale. It is probable that the company will erect its own reduction-works. All arrangements will be completed by the 1st of November.

UTAH.

SALT LAKE COUNTY.

NORTHERN CHIEF.—The most pressing claims have recently been paid off by the Eastern parties who are directing the movements at Salt Lake City, and only about $3000 remain unsatisfied. The mill has been boarded up, and all work, both there and at the mine, will be suspended until spring.

PATENTS GRANTED BY THE UNITED STATES PATENT-OFFICE.

GRANTED AUGUST 5TH, 1884.

302,914. Self-Dumping Car and Platform for Mines. Isaac Kirk, Warren, Ohio.
302,951. Ore Separator and Concentrator. Le Grand Skinner, Erie, Pa.
302,956. Mining-Machine. Sebastian Stutz, Pittsburg, Pa.
302,957. Mining-Machine. Sebastian Stutz, Pittsburg, Pa.
302,958. Mining-Machine. Sebastian Stutz, Pittsburg, Pa.
302,959. Coal and Ore Mining Machine. Sebastian Stutz, Pittsburg, Pa.
302,969. Coal Mining Machine. John F. Wheless, Nashville, Tenn.
302,974. Regenerative Steel Furnace and Brick employed therein. William G. Bell, Alleghany City, Pa.
302,978. Air-Compressor. David A. Brislin, St. Louis, Mo.
303,036. Rolling-Mill. Arthur J. Moxham, Louisville, Ky.
303,053. Combined Drill and Countersink. Charles P. Russell, Greenfield, Mass., Assignor to the Wiley & Russell Manufacturing Company, of Massachusetts.
303,070. Cylinder-Head for Steam-Engines. Harris Tabor, Alleghany, Assignor to the Westinghouse Machine Company, Pittsburg, Pa.
303,083. Steam-Engine. H. Herman Westinghouse, Pittsburg, Pa., Assignor to the Westinghouse Machine Company, same place.
303,084. Piston-Valve. H. Herman Westinghouse, Pittsburg, Pa., Assignor to the Westinghouse Machine Company, same place.
303,085. Steam-Engine Governor. H. Herman Westinghouse and Arthur G. Brown, Pittsburg, Pa., Assignors to the Westinghouse Machine Company, same place.
303,125. Rock-Pulverizer. William Corcoran, San Francisco, Cal.
303,136. Middlings-Purifier. David Lanley Ellis, Brookville, Assignor of one fourth to Michael H. Risinger, Saltsburg, Pa.
303,150. Manufacture of Steel. Robert Hadfield, Sheffield, County of York, England.
303,151. Steel. Robert Hadfield, Sheffield, County of York, England.
303,195. Glass-Flattening Furnace, and Means by which Sheets of Glass are Moved through the Leer. Cleon Tondeur, Ithaca, New York.
303,199. Apparatus for Burning Petroleum as Fuel. William B. Yates, Adams, Mass.
303,203. Hot-Blast Stove. John F. Bennett, Pittsburg, Pa.
303,204. Apparatus for Charging Heated Air to Blast-Furnaces. John F. Bennett, Pittsburg, Pa.
303,205. Blast-Furnace Accessory. John F. Bennett, Pittsburg, Pa.
303,206. Method of and Apparatus for Feeding Stock to Blast-Furnaces. John F. Bennett, Pittsburg, Pa.
303,207. Blast-Furnace Plant for Using Gas. John F. Bennett, Pittsburg, Pa.
303,208. Blast-Furnace Stove. John F. Bennett, Pittsburg, Pa.
303,232. Process of Separating Gold and Silver from Arsenide of Iron. Edward Probert, Eureka, Nev.
303,236. Phosphorized Alloy of Copper and Aluminium and Process of Making the Same. Thomas Shaw, Newark, N. J.

GRANTED AUGUST 12TH.

303,257. Furnace-Door. Henry I. Bearup, Elkhart, Ind., Assignor of one half to Wesley Smith, Adrian, Mich.
303,277. Apparatus for the Manufacture of White Lead. George Hand Smith, London, County of Middlesex, England.
303,278. Manufacture of White Lead. George Hand Smith, Rochester, New York.
303,280. Roll for Crushing-Mills. Arthur S. Hobby, Cincinnati, Ohio.
303,296. Process of and Machine for Coating Surfaces. Joseph A. Laemle, Stapleton, New York.
303,321. Friction-Clutch. Francis H. Richards, Springfield, Mass., Assignor to the Pratt & Whitney Company, Hartford, Conn.
303,339. Pump. Morris D. Temple, Chicago, Ill.
303,340. Pump. Morris D. Temple, Chicago, Ill.
303,344. Operating the Pistons of Rock-Drills. Richard Uren, Houghton, Miss.
303,363. Machine for Drawing Bolts. Henry E. Coy, Mansfield, Ohio.
303,392. Submarine Rock-Breaker. Thomas F. Lonney, East New York, New York.
303,456. Furnace for Desulphurizing and Oxidizing Ores. Julio H. Rae, Boston, Mass.
303,506. Process of and Device for the Construction and Repair of Tunnels and Shafts. John C. Goodridge, Jr., New York City.
303,514. Process of Extracting Oxides of Cobalt from Ores. Henri Herrenschmidt and Marmaduke Constable, Sydney, New South Wales.
303,571. Furnace for Roasting Zinc and other Ores. Edward C. Hegeler, La Salle, Ill., Assignor to the Matthiessen & Hegeler Zinc Company, same place.
303,586. Furnace for Reducing and Smelting Ores. James Cosmo Newbery, John Lister Morley, and Harry Cleveland, Melbourne, Victoria.
303,596. Train for Rolling Metal. William A. Sweet and John E. Sweet, Syracuse, New York; said John E. Sweet Assignor to said William A. Sweet.

REISSUE.

10,507. Apparatus for Extracting Gold and Silver from their Ores. Richard Barker, London, County of Middlesex, Assignor to Electro Amalgamator Company (Limited), of London, England.

GRANTED AUGUST 19TH.

303,613. Pump. William S. Blunt, New York City.
303,645. Apparatus for the Manufacture of Small Castings. Samuel Johnston, Brockport, New York.
303,693. Amalgamating-Pan. Julius A. Bidwell, Ivanpah, Cal.
303,701. Steam Pumping-Engine. Leon B. Carricaburu, New York City.
303,702. Pump. Leon B. Carricaburu, New York City.
303,703. Steam-Actuated Valve. Leon B. Carricaburu, New York City.
303,704. Steam-Actuated Valve. Leon B. Carricaburu, New York City.
303,705. Steam-Actuated Valve. Leon B. Carricaburu, New York City.
303,706. Valve-Gear for Steam-Engines. Leon B. Carricaburu, New York City.
303,773. Mold for the Manufacture of Chilled Car-Wheels and similar Castings. George Wilhelm August Wiesing, Lime Rock, Conn., Assignor of two thirds to Phineas E. Merrihew, Fairhaven, Mass.
303,779. Manufacture of White Lead. William Virgo Wilson, London, England.
303,889. Machinery for Concentrating Ores, etc. Thomas Budworth Sharp, French Walls, Smethwick, County of Stafford, England.
303,921. Metallic Roofing-Shingle. William H. Cusack, Nashville, Tenn.

GRANTED AUGUST 26TH.

304,001. Machine for Bending and Molding Sheet Metal. George Hayes, New York City.
304,002. Machine for Shaping Sheet Metal for Architectural Purposes. George Hayes, New York City.
304,027. Evaporating-Pan. John F. Porter, Red Wing, Minn.
304,040. Coal-Hoisting Apparatus. William Snee, West Elizabeth, Assignor, by mesne assignments, to William Guckert, Alleghany City, Pa.
304,079. Evaporating Apparatus. John A. M. Cox, Indianapolis, Ind., Assignor of one half to Ewald Over, same place.
304,093. Rock-Drill. Peter Perry Gadway, Detroit, Mich., Assignor of one half to Frederick B. Sibley, same place.
304,094. Rolling-Mill. George C. Gardner, Chicago, Ill.
304,109. Miner's Drilling-Machine. John W. Keeney, Coalburg, West Va.
304,125. Ore-Grinder. Austin B. Paige, Chicago, Ill.
304,218. Mine Water-Gate. George H. Memorank, Ashland, Pa.
304,241. Elevator and Conveyor. Morrill A. Shepard, Lebanon, Ill.
304,259. Ore-Sample Machine. David Williams Brunton, Denver, Colo.
304,260. Process of Obtaining Ammonia from Ammonium Sulphate. Eustace Carey, Holbrook Gaskell, Jr., and Ferdinand Hurter, Widnes, County of Lancaster, England.

FINANCIAL.

NEW YORK, Friday Evening, Nov. 7.

Politics absorbed all interest in New York City during the week, and in consequence business at all the Exchanges has been unusually light. No special feature has been presented in the mining market, the sales amounted to 27,300 shares, as against 45,755 shares for the preceding week.

The largest business was done in Standard Consolidated; the price dropped down still further, the lowest during the week being 45c. and the highest 58c.; 4440 shares were sold. A report has been issued on the condition of the mine, to which we shall refer next week. Bodie Consolidated also took a downward course. A small lot was sold at the beginning of the week at $1.80; the price, however, did not remain at this point, and the second sale reported shows a much higher figure—$2.85. Consolidated Pacific remains quiet with steady prices, and sales amounting to 2900 shares.

The announcement of a dividend of $300,000 by the Horn-Silver Mining Company seems to have had no effect on the sale or the price of the stock. The business, which has been very large for the past weeks, has greatly diminished, the sales amounting to only 2785 shares, as against 16,470 shares the preceding week, showing a decrease of 13,685 shares.

Leadville stocks received but little attention. Of the other Colorado stocks, Colorado Central and Robinson Consolidated show the largest sales.

Nevada stocks were almost entirely neglected, and the continued announcements of new assessments by some of the Comstock companies seems to smother all interest in these once famous mines.

The tables printed elsewhere give a complete summary of the market.

SAN FRANCISCO MINING STOCK QUOTATIONS.

Daily Range of Prices for the Week.

Name of Company.	Closing Quotations. Oct. 31.	Nov. 1.	Nov. 3.	Nov. 4.	Nov. 5.	Nov. 6.
Albion						
Alpha						
Alta	1.00	.90			1.00	1.00
Argenta						
Bechtel						
Belcher	.65					
Belle Isle						
Best & Belcher	1.62½	1.50			1.62½	1.50
Bodie	2.00	2.25			2.37½	2.75
Bullion						
Bulwer						
California						
Challar	2.12½	2.00			2.25	2.12½
Con. Pacific	.90	.90			.90	.95
Con. Virginia						
Crown Point	.95	.95			.95	1.00
Day						
Elko Cons						
Eureka Cons						
Exchequer						
Gould & Curry	1.00	.95				1.00
Grand Prize						
Hale & Norcross	3.12½	3.12½				3.75
Independence						
Martin White		.40				
Mexican	1.00	.90				1.00
Mono						
Mount Diablo						
Navajo	3.75	3.75				3.75
Northern Belle						
North Belle Isle						
Ophir	.85	.75				.85
Overman						
Potosi	1.00	1.00				1.12½
Savage	1.25	1.25				1.37½
Scorpion						
Sierra Nevada	.90	.90			1.00	.90
Silver King						
Tip-Top						
Union Cons	.80	.75				.80
Utah	.60					
Wales Cons						
Yellow Jacket	1.75					1.75

MEETINGS.

Hope Mining Company, No. 417 Olive street, Room 7, St. Louis, Mo., annual meeting of stockholders and election of thirteen directors, November 10th, from nine A.M. to twelve o'clock M.

DIVIDENDS.

Big Bend Hydraulic Mining Company, of California, has declared dividend No. 18, of $6000, payable on and after November 5th.

Horn-Silver Mining Company, of Utah, has declared dividend No. 15, of $300,000, payable on and after 15th inst.

Lehigh & Wilkes-Barre Coal Company, of Pennsylvania, will pay three and a half per cent interest on the registered income bonds of this company issued for funding coupons detached from the consolidated mortgage bonds, on and after the 17th inst.

Syndicate Mining Company, of California, has declared a dividend of ten cents a share, payable on the 10th inst.

DIVIDENDS PAID BY MINING COMPANIES DURING THE MONTH OF OCTOBER AND FROM JANUARY 1ST, 1884.

Name of Company.	Location of mines.	Paid during month of October.	Since January 1st, 1884.
Adams, S. L	Colo.	$15,000	$45,000
Alice, G. S.	Mont.		100,000
Atlantic, C.	Mich.		40,000
Bassick, G. S.	Colo.		100,000
Big Bend Hydraulic, G.	Cal.	6,000	12,000
Bodie Consolidated, G.	Cal.		300,000
Bonanza King Con., S.	Cal.		150,000
Bulwer Consolidated, G.	"		10,000
California, G.	Colo.		31,500
Calumet & Hecla, C.	Mich.		800,000
Carbonate Hill, S. L.	Colo.		10,000
Catalpa, S. L.	Colo.		30,000
Central, C.	Mich.		40,000
Copper Queen, C.	Ariz.		200,000
Cosmopolitan, S.	Utah.		25,000
Derbec Blue Gravel, G.	Cal.	10,000	60,000
Dunkin, S. L.	Colo.		10,000
Father de Smet, G.	Dak.	20,000	160,000
Franklin, C.	Mich.		80,000
Hecla Con., S.	Mont.	15,000	180,000
Homestake, G.	Dak.	25,000	250,000
Hope, S.	Mont.	12,000	36,000
Horn-Silver, S. L.	Utah.		900,000
Idaho, G.	Cal.	23,250	186,000
Iron Silver, S.	Colo.		100,000
Jocuistita, S.	Mex.		150,000
Kentuck, S.	Nev.		21,000
Leadville Con., S. L.	Colo.		20,000
Lexington, S.	Mont.		240,000
Little Chief, S. L.	Colo.		40,000
Morning Star, S. L.	Colo.		25,000
Moulton, G. S.	Mont.		50,000
Mount Pleasant, G.	Cal.		15,000
Ontario, S.	Utah.	175,000	750,000
Original	Mont.		27,000
Oro Grande	Cal.		9,000
Osceola, C.	Mich.		62,500
Oxford, G.	N. S.		6,000
Paradise Valley.	Nev.		40,000
Plymouth Con., G.	Cal.	50,000	500,000
Quicksilver, Pref., Q.	"		12,900
Quincy, C.	Mich.		280,000
Rooks, G.	Vt.	12,500	31,000
Security, G. S. L. C. & I.	Colo.		50,000
Sierra Bella, S.	N. Mex.		30,000
Sierra Grande, S.	N. Mex.		160,000
Small Hopes Con.	Colo.	37,500	262,500
St. Joseph's L.	Mo.		25,000
Standard, Con., G.	Cal.		75,000
Syndicate, G.	Cal.		50,000
United Verde, C.	Ariz.		60,000
Valencia Mica Co., M.	N. H.	3,750	7,500
		$305,000	$6,854,900

G., gold; S., silver; L., lead; C., copper; Q., Quicksilver; C., coal; I., iron; M., mica.

ASSESSMENTS.

Companies.	States.	Amount per share.	Delinquent in office.	Day of sale.
Alaska Mining and Milling Company	Alaska.	$0.70	Nov. 15	Dec. 5
Caborca	Mex.	.05	Nov. 1	Dec. 1
Challar	Nev.	.50	Dec. 2	Dec. 23
Cons. California	Nev.	.50		
Excelsior Water & Mining	Cal.	.50	Nov. 5	Nov. 26
Golden Fleece Gravel Mining Co	Cal.	40.00	Nov. 18	Dec. 8
Gould & Curry	Nev.	.50	Nov. 28	Dec. 22
New Basil Cons. Gravel Mining Co	Cal.	.05	Oct. 27	Nov. 17
Sierra Nevada	Nev.	.50	Nov. 26	Dec. 15
Standard	Cal.	.25	Dec. 1	Jan. 5
Utah	Nev.	.50	Nov. 28	Dec. 16

PIPE LINE CERTIFICATES.

Messrs. Watson & Gibson, petroleum brokers, No. 49 Broadway, report as follows for the week:

The market immediately preceding and immediately subsequent to a hotly contested national election has naturally been dull and featureless. The lowest price during the week was 69½c. on last Saturday, and the highest was 75c. on Wednesday. The production of all the wells at Thorn Creek, Baldridge, is now about 7300 barrels, or less than the output the first day of Armstrong. The wells there are declining. Oil is strongly held, the short interest is considerable, and the domestic demand for refined oil is heavy. These are the factors in the market.

The following table gives the quotations and sales at the New York Mining Stock and National Petroleum Exchange:

		Opening.	Highest.	Lowest.	Closing.	Sales.
Nov.	1	$0.71⅞	$0.73¼	$0.69⅞	$0.72⅜	4,572,000
	3	.73½	.73½	.71½	.72¼	3,957,000
	4	....	....	....	....	....
	5	.74	.75	.73¼	.73⅞	3,976,000
	6	.74	.74¼	.71⅝	.73½	4,906,000
	7	.73¼	.74⅛	.72½	.73⅝	4,938,000
Total sales						22,349,000

Boston Copper and Silver Stocks.

[From our Special Correspondent.]

BOSTON, Nov. 6.

The market the past week has ruled extremely dull, and there is not much to be said about it. The dealings were mostly in Calumet & Hecla, which early in the week was quite firm at $140, but in the absence of buying orders and an order to sell at best, the price was forced down to $135. Since then, there has been a little better demand, and later sales were made at $137½@$138, closing to-day at $137 bid, $140 asked. There were no sales of Quincy this week, but at one time $32 was bid for it, and none offered; later, the best bid is $30. The stock is very strongly held, and there seems to be no disposition to part with it at present prices. A small lot of Osceola sold at $9, an advance of $1 over last sale; $8½ was bid to-day, and $9 asked. Pewabic sold at $1½; last sale was $1¼. The rest of the list is dull and featureless.

In silver stocks, Harshaw sold at 50c., first sale since August 5th, at 40c. At the Boston Mining Exchange, the only feature is Bowman Silver, and that is very dull, with but little stock offering for sale. The reports from the mine continue to be of a favorable character, and there is a disposition to buy at 10c., which is freely bid for it, and only small lots offered at 12c. Consolidated Pacific, very steady at 90@92½c. Dunkin, 20c. bid, and offered at 22c., with but little doing.

3 P.M.—There was no material change this afternoon. A small lot of Osceola sold at $9, and offered at that. Calumet & Hecla, $137 bid, $140 asked. Quincy, $30 bid. Atlantic, $6½ bid, $7 asked. Bowman Silver, 11c. bid, 13c. asked.

BULLION MARKET.

NEW YORK, Friday Evening, Nov. 7.

Date.	London. Pence.	N. Y. Cents.	Date.	London. Pence.	N. Y. Cents.
Nov. 1	50⅜	109	Nov. 5	50¼	108¾
3	50⅜	109	6	50¼	108¾
4	50¼	108¾	7	50¼*	108¾*

* Weak.

United States Assay-Office at New York.—Statement of business for the month ended October 31st, 1884:

Deposits of gold:		
Foreign coin	$566,000	
Foreign bullion	1,690,000	
United States bullion	538,000	
United States bullion (re-deposits)	241,000	
Jewelers' bars	105,000	
Refined gold	160,000	$3,300,000
Deposits of silver:		
Jewelers' bars	18,000	
Foreign coin	4,100	
Foreign bullion	72,600	
United States bullion (contained in gold)	9,300	
United States bullion (re-deposits). Arizona	2,200	
Colorado	7,600	
Idaho	6,000	
Lake Superior	2,800	
Montana	2,000	
New Mexico	51,800	
Utah	21,200	
	113,000	
Refined silver	285,400	596,000
Total deposits		$3,986,000
Gold bars stamped	$2,877,535	
Silver bars stamped	527,632	3,405,167

Foreign Bank Statements.—The governors of the Bank of England, at their regular weekly meeting, advanced the bank's minimum rate of discount from 4 to 5 per cent. During the week, the bank lost £534,000 bullion; and the proportion of its reserve to its liabilities was reduced from 35 11/16, to 34⅝, against 43⅜ per cent at this date last year. The weekly statement of the Bank of France shows a loss of 2,650,000 francs gold and a loss of 1,400,000 francs silver.

METALS.

NEW YORK, Friday Evening, Nov. 7.

Copper.—The week has been an exceedingly dull one. A rumor was circulated that the Lake companies had made a sale of twenty millions of pounds for export, but it has been contradicted, and probably

lacks any foundation. Current sales are light, but engagements for shipment abroad continue on a liberal scale. Offers are on hand from abroad for Lake copper at £58 10s., but have not been entertained.

In England, the market has further receded, the latest cables giving Chili Bars £52 12s. 6d., and Best Selected, £58.

Tin.—The market has been quiet, closing at 16⅝@16¾c. for Straits, spot, large lines, England cabling to-day £74 12s. 6d.

Lead.—Business has been exceedingly dull, no wholesale business whatever being reported. The best bids obtainable are 3·55c., and lead forced on the market would not fetch more than that.

Messrs. John Wahl & Co. send us the following dispatch to-day from St. Louis :

Our market has declined slowly since our last report. Refined lead has sold in small quantities at 3·42½@3·40c. At the latter figure, both hard and soft lead are freely offered, but are not taken. Sales will scarcely foot up to more than 200 tons of Refined lead at 3·42½c., and 200 tons at 3·40c.

From Chicago, Messrs. Everett & Post send us the following :

Our market is quiet and dull, prices remaining unchanged at nominally 3·40c. There is but little doing, and the demand is only from hand to mouth, buyers expecting a decline and are holding off. Stocks are accumulating in some quarters.

Spelter.—The market continues dull at nominally 4·40c. for Common Domestic. England cables £14 10s. for Silesian.

Antimony.—There has been no change. We quote 10c. for Hallett's, and 10¾c. for Cookson's.

IRON MARKET REVIEW.

NEW YORK, Friday Evening, Nov. 7.

American Pig.—The week has been a very light one, business being very much restricted, with the exception of the sale of a round lot of Gray Forge iron at $16 at furnace.

We quote standard brands : No. 1 Foundry, $19.50 @$21 ; No. 2, $18@$19 ; and Gray Forge, $17@$18, with outside brands from $1@$1.50 lower. Foreign Bessemer is nominally $18.50@$19. There has been some business in Spiegeleisen at $26 for 20 per cent.

Scotch Pig.—The demand is exceedingly light.

We quote ex ship and to arrive : Langloan, $21.50 ; Summerlee, $20.75 ; Dalmellington, $20 ; Gartsherrie, $21 ; Eglinton, $19.25@$19.50 ; and Glengarnock, $20@$20.50.

At the Metal Exchange, the following cable quotations have been received : Coltness, 59s. ; Langloan, 58s. ; Summerlee, 53s. 6d. ; Gartsherrie, 55s. ; Glengarnock, at Ardrossan, 49s. 9d. ; Dalmellington, 47s. ; and Eglinton, 44s. 6d. Warrants, 43s. 4d.

Steel Rails.—A number of small orders have been taken at ruling figures, and there are some others pending. The leading works quote $28@$29 at mill.

Old Rails.—We quote $16@$16.50.

Philadelphia. Nov. 7.

[From our Special Correspondent.]

Pig-Iron.—For well-known reasons, the iron trade has been exceedingly dull, and except in one or two branches, nothing whatever can be reported that is not already known to the trade. There is a certain amount of business transacted every day, and it covers all kinds of crude iron ; but it is a kind of business that makes very poor material for an iron report. So far as can be ascertained by careful inquiry, about as much iron is going into consumption at this time as a month ago, and about the same amount is making. Some companies are making preparations to increase their production, should circumstances warrant, and strange to say, the belief is once in a while expressed that we are to have a considerable improvement in business during the winter. Statements like this are refreshing, although the correctness of the opinion is to be questioned. Iron has been selling every day since Monday, at $19.50 for No. 1, and $18 for No. 2; some little sells above and below these figures. Gray Forge is selling under $16, but not much above $16.50. Some parties are holding iron at $17, and think they will get their price, as soon as this, that, and the other thing, are out of the way.

Foreign Irons.—There has been no movement in Bessemer ; quotations, $19. No sales of spiegeleisen have been reported ; quotations are $23@$30, according to percentage. Ferro-Manganese, $70@$72.50 for 75 per cent.

Muck-Bars.—Several small lots of Muck-Bar sold this week at $28.50 ; some parties are holding at $29@$31, but are not known to have got that figure, although the iron is worth it.

Merchant Bar.—This kind of iron might as well be omitted, as neither store-keepers nor manufacturers have been selling any thing, business being at an actual stand-still, although manufacturers say there must be an improvement. Quotations are 1·80@1·90c. for Refined, and 1·65@1·75c. for Common. It was thought that some of the car-works would have orders in for car iron, but these are still hanging fire.

Plate and Tank Iron.—Some two or three hundred tons of plate and tank in small lots were called for this week, for prompt delivery, but nothing was done in a large way. Quotations are 2@2·10c. for Plate ; 2·15@2·25c. for Tank ; 2·75c. for Sheet ; 3·75c. for Flange ; and 4c. for Fire-Box.

Nails.—The news from the factories in the interior this week is without feature. There is a rumor that some machines will be thrown off until business improves. There are also some offers for nails at a price that has not yet been accepted. The ruling price is $2@$2.10.

Wrought Pipes and Tubes.—The reports in this branch are very unfavorable, so far as new business is concerned. A few large orders on hand enable mills to run pretty fairly. Discounts are 45 and 30 per cent for Butt-Welded Black and Galvanized respectively, and 65 and 45 for Lap-Welded Black and Galvanized. Boiler tubes, 60 per cent.

Sheet-Iron.—There are no changes in the sheet-iron market, and rates are unchanged.

Structural Iron.—Not a single item of interest can be scraped up in structural iron. Angles are quoted at 2·10c. ; Bridge Plate, 2·25c. ; Tees, 2·75c. ; and Beams and Channels, 3 50c.

Steel Rails.—The inquiry for small lots of steel rails is on the increase, and this is the only new feature in the market. Prompt delivery is insisted upon. A good many buyers need the rails at once, and are paying for the accommodation.

Old Rails.—Old Steel Rails have been ordered here at $14@$17. But very little business is done in them.

Scrap.—No single large sale is reported in scrap this week, and quotations are unchanged.

COAL TRADE REVIEW.

NEW YORK, Friday Evening, Nov. 7.

Anthracite.

It is quite generally reported that there has been an improvement in the demand for domestic sizes, and the conviction is expressed that the November trade will prove quite lively. So far as other sizes are concerned, statements are conflicting, some are in the fortunate position of being forced to buy from their neighbors, while others have large quantities on hand.

Bituminous.

There are no features in this trade, the tonnage continuing heavy while prices are still low.

Philadelphia. Nov. 7.

[From our Special Correspondent.]

Stocks at Port Richmond this morning are 95,000 tons. The vessels loading will carry off 15,000 tons, leaving 80,000 ; but the arrivals from the region will pull the figures up to over 100,000 before the close of the week. A good deal of this coal is of the larger manufacturing sizes. The different companies are breaking up this coal into domestic sizes, because of the increasing domestic demand, both in local and outside markets. From 1200 to 1500 cars a week are going West. The mines resumed work on Wednesday, and the first shipments will arrive to-morrow. The facilities for handling coal are now very complete with all the companies, and orders can be filled with wonderful dispatch. Vessels at Port Richmond are loading with wheelbarrows from stocks on wharf much more slowly than from cars. There have been no meetings held here, but several interesting office talks have been held. The manufacturing demand everywhere is the subject of complaint, but there is no remedy for it, and no hope for any early improvement. The local demand has been very light all the week, on account of the distraction of the attention of consumers ; but some prominent retailers say their delivery capacity will be fully engaged after next Monday. The *Record* sales foot up over 13,000 tons, so far. The public seems satisfied with the quality of coal received, but rebates are not allowed to all, and for this and one or two other reasons, the retailers are obliged to watch the progress of the crusade without being able to help themselves, At the same time, a large amount of Schuylkill coal is coming here, and is sold directly from the cars, without screening. The coal companies here have received a few inquiries for large stocks, more with the view on the part of buyers to sound the market. There is a great deal of political talk going on, and prophecies good and bad are indulged in. It is impossible to get any thing from the bituminous operators. They claim that next year they will double their surplus figures, but will not be able to shade prices any, and will have to rely for an increasing market upon the preference of buyers. They expect also to have more favorable freight rates, by which they will be enabled to reach Eastern markets in a relatively better shape. A great deal of bituminous territory will be in a condition for development. But the probability of a moderate demand stands in the way of the opening of mines or the building of side-tracks. Clearfield shipments for the past week were 64,246 tons, against 56,682 tons for the same week last year, an increase of 7564 tons ; and an increase this year, over last year's production, of 261,664 tons. The Cumberland production for the past week is 42,048 tons, against 35,723 tons for the same week last year, an increase of 6325 tons, and an increase for the year of 158,097 tons. The Cumberland people represented here talk big of what they will do next year in the way of crowding their coal on to Eastern markets ; but the obstacles due to railroad controlling influences will cripple them in that direction.

Buffalo. Nov. 6.

[From our Special Correspondent.]

The warmth manifested by our citizens in the late Presidential contest would, if reduced to the ratio of the quantity of caloric extracted from a ton of coal, paralyze the coal trade for the winter. There is no news stirring in the hard and soft coal trade or in the coke business. But little coal will go forward by lake from now to the close of navigation; orders are about all filled.

The following particulars are obtained from a communication of Mr. F. A. Bell, of our city, relative to a trip made through Canada over the Canadian Pacific Railroad route a few weeks since. He says that between Port Arthur and Winnipeg some coal has been found. For hundreds of miles, there are but few trees or timber of any kind, and settlers must depend upon other localities for fuel, whether of coal or wood. Coal has been found 200 miles west of Winnipeg, and there is a semi-bituminous coal found at Medicine Hat, on the Saskatchewan, 650 miles west of Winnipeg : at the latter place, some coal has been raised, but the operations have been abandoned. There is a fair coal to be had in the Rocky Mountains ; but it is too far west to be available for the settled regions. He further states that, "in spite of the claim of coal deposits all along this line, coal sent to Port Arthur by lake from Buffalo is thence taken by rail to the Rockies for use on the railroad engines." One would think that, rather than haul coal this long distance, the native article, even if not a first-class one, would be developed ; but Mr. Bell shows why it will not pay to bring it Eastward : "Coal much more valuble can be sent from Buffalo to Port Arthur for $1 a ton, and this would pay for hauling it scarcely 200 miles from the mountains, full 900 miles west of Winnipeg." Mr. Bell went over the railroad for the express purpose of locating and developing coal, but has given up the notion in view of the facts and figures obtained.

Receipts of coal by lake from opening of navigation to November 1st were only 830 tons. Shipments for the month of October were 220,250 tons ; for the season of 1884, 1,270,180 tons—a large increase this year, as compared with the figures of 1883, which were 1,100,690 tons, and in 1882 934,800 tons.

Receipts by Lake Shore & Michigan Southern Rail road for the month of October, 4670 tons ; namely 3120 tons for Buffalo, and 1550 tons for other points

NEW YORK MINING STOCKS.

DIVIDEND-PAYING MINES.

Name and Location of Company.	Highest and Lowest Prices per Share at which Sales were Made.												Sales.
	Nov. 1.		Nov. 3.		Nov. 4.		Nov. 5.		Nov. 6.		Nov. 7.		
	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	
Alice, Mon.													
Amie Con., Co.									.04				1,000
Argenta													
Bassick, Co.	3.50												100
Belle Isle, Ne.											.52		800
Bodie Cons., Ca.	1.80								2.85	2.40			650
Breece, Co.													
Bulwer, Ca.	.50								.50		.60		1,400
California, Ne.													
Cal. & Hecla, Mich.													
Castle Creek													
Chollar													
Carysolite, Co.													
Cons. Va., Ne.													
Copper Queen													
Dunkin, Co.	.20		25	.23									800
Eureka Cons., Ne.	3.30								3.15		3.25		500
Father de Smet, Dk.									4.00				100
Findley, Ga.													
Gold Stripe, Ca.													
Gould & Curry, Ne.													
Grand Prize, Ne.													
Green Mountain, Ca.			1.30								1.50		300
Hale & Norcross, Ne.													
Hall-Anderson, N. S.													
Homestake, Dk.									9.75				100
Horn-Silver, Ut.	5.50		5.50				5.50		5.13	5.00			2,785
Independence, Ne.													
Iron Silver, Co.													
Leadville C., Co.													
Little Chief, Co.	.28												100
Little Pittsburg, Co.							.25						100
Martin White, Ne.													
Navajo, Ne.									4.00	3.95	3.85	3.80	800
Northern Belle													
North Belle Isle, Ne.	.30										.35		1,200
Ontario, Ut.													
Ophir, Ne.											.80		100
Quicksilver Pref., Ca.													
" Com., Ca.													
Robinson Cons., Co.	.40	.30							.36	.35	.37		1,450
Savage, Ne.													
Sierra Nevada, Ne.									.95	.92	1.00		500
Silver King, Ar.									4.00				25
Spring Valley, Ca.									1.06				50
Standard, Ca.	.54	.50	.51	.45			.50	.49	.52	.45	.58	.57	4,440
Stormont, Ut.													
Tip Top, Ar.													
Vilina, Ar.													
Yellow Jacket													

NON-DIVIDEND-PAYING MINES.

Name and Location of Company.	Highest and Lowest Prices per Share at which Sales were Made.												Sales
	Nov. 1.		Nov. 3.		Nov. 4.		Nov. 5.		Nov. 6.		Nov. 7.		
	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	H.	L.	
Albion	.15												100
American Flag													
Barcelona, G.			.10								.09	.06	2,000
Bechtel Con., G.													
Belvidere													
Best & B'lcher, G. S.													
Big Pittsburg, S. L.													
Bradshaw, S.													
Bull-Domingo, S.L.													
Cal., B. H., G.													
Central Ariz'na, S.	.20												300
Climax, Co.													
Colorado Central.	.65		.65	.63			.62		.66	.65			2,600
Cons. Imperial													
Con. Pacific	.90	.87	.90				.92	.90					2,900
Decatur													
Durango, G.													
Eastern Oregon													
Goodshaw, G.													
Harlem M. & M. Co.													
Hortense, S.													
Lacrosse, G.													
Mariposa Pref., G.													
" Com., G.													
Mexican, G. S.													
Mono													
North Standard, G.													
N. Horn-Silv'r, S L.													
Pri'n't'l & Miller, S.	.09						.09		.10	.09			900
Rappahannock, G.													
Red Elephant, S.													
Ruby, of Arizona.													
Silver Cliff, S.													
Sonora Con.													
South Bodie, G.													
South Bulwer, G.													
South Hite													
South Pacific.													
State Line, 1 & 4, S.													
" Nos. 2 & 3, S.	.02												600
Sutro Tunnel	.13												100
Taylor Plumas													
Unadilla, S.													
Union Cons., G. S.	.80								.80		.85		500

Tables giving dividends and assessments will be printed the first week of each month. Dividend shares sold, 17,300. Non-dividend shares sold, 10,000.

The receipts for the last week in October were 1332 tons, namely, 900 tons for Buffalo, and 433 tons for other points.

The receipts by canal for the fourth week of October were 4547 tons; the shipments, 976 tons. For the month of October, receipts, 26,307 tons, and the shipments, 4135 tons. From opening of navigation to November 1st this year, 127,876 tons, as compared with 108,460 tons in 1883. The shipments were 29,012 tons, as compared with 24,352 tons in 1883, an increase in both up and down movement.

Coal freights closed last week thoroughly unsettled, lower, and demoralized; shippers engaged considerable tonnage for Chicago and Milwaukee, which relieved them of all pressing necessities. The movement from the mines this week will be light, in consequence of the shut-down. The engagements since my last letter were at the following rates: $1@75c. to Chicago and Milwaukee; 25c. to Sandusky, Toledo, and Detroit; to Saginaw, Bay City, and Duluth, on private terms; and 90c. to Racine. The severe storm that prevailed on election day and evening settled down yesterday; since then, there has been severe cold with considerable ice in our streets and the water of the lake very cold also. Freight by lake this morning is quoted as "nominally unchanged."

No better evidence of the stagnation in our lake traffic can be given than the fact that the insurance for November in the twelve (12) pool companies has been cancelled on at least 150 vessels of all sizes and classes; among these are many of the best-known grain and coal carriers.

The shipments by lake from October 30th to November 5th, both days inclusive, were 29,000 net tons; namely, 17,400 to Chicago, 4390 to Milwaukee, 1000 to Detroit, 3460 to Toledo, 650 to Sandusky, 830 to Saginaw, 70 to Bay City, and 1200 to Duluth.

Receipts by lake for the week, none.

No charters by canal for the past week.

The receipts of coal at Duluth for the week ended November 1st were 5646 tons; for the season to date, 273,687 tons.

Boston. Nov. 6.

[From our Special Correspondent.]

The restriction of anthracite coal production for the week ended November 5th is needed. The market is at present quite dependent upon the weather, and the weather is not on the side of the coal dealers. At the present time, Boston retailers are undoubtedly carrying light stocks for this time of the year. Being in a position to order at short notice, with facilities for prompt delivery, they propose availing themselves of that advantage. On the other hand, those not so well placed with reference to prompt dispatch—the retailers at outside points dependent upon water delivery—are as well stocked as usual. Those outside retailers dependent upon rail freight are not so well supplied, as a rule, as their brethren of the water freight.

The demand from manufacturers for anthracite coal is *nil*. The dullness and weakness in steam sizes bear witness to this fact. A low figure would buy broken coal to-day. The companies have a large accumulation, and are anxious to move the coal. As it is, trade waits for the life and activity that must come from a cold snap. The advance in freights has a strengthening influence, and it is thought that rates will be maintained.

The f. o. b. quotations continue unchanged, and it looks as though our former statement, that there would probably be no change during the remainder of the year, would be realized. We quote f. o. b. prices as follows:

At New York, Stove, $4@$4.15; Broken and Egg, $3.50@$3.65; Pea, $2.40; individual coals, $3.75@$3.90 for Stove, $3.25@$3.50 for Broken and Egg. At Philadelphia, $3.90@$4 for Stove, $2.20 for Pea, $3.30@$3.50 for Broken and Egg. Special coals, $4.85@$5 for Broken, $5.35@$5.50 for Stove.

In the bituminous branch of the market, this port has nothing new to offer. Dealers have been able to devote all the time to politics that they wished. Contract deliveries constitute the only movement. Delivered prices have been advanced a little by the advance in freights, and from $3.60 to $3.75 is now quoted.

There is a firmer tone to freights, and the customary fall and winter rates are about reached. Whether or not they will be maintained is doubtful.

We quote: New York, 95c.@$1; Philadelphia, $1.10; Baltimore, $1.15; Newport News, $1@$1.10; Richmond, $1.15; Cape Breton, $1.60; Bay of Fundy, $1.55.

There is a less trade than there has been, owing to the weather. An agreement is sought among dealers to establish an advance of 25 cents a ton, and it is thought that it will be carried through. We quote:

White ash, furnace and egg	$5.50
" " stove and nut	5.75
Red ash, egg	6.00
" " stove	6.25
Lorberry, egg and stove	$6.75@ 7.00
Franklin, egg and stove	7.50
Lehigh, furnace, egg, and stove	5.75
" nut	5.75

Wharf prices, $4.50 for Broken, $4.85 for Stove.

Columbus, Ohio. Nov. 4.

[From our Traveling Correspondent.]

The coal trade of Ohio, in common with all industrial and commercial interests, has suffered considerably from the stagnant condition of trade caused by the suspense awaiting the result of to-day's ballot. Still business has been fairly active at many of the mines particularly those of the Massillon District. The mines along the Valley (Cleveland, Akron & Canton Railroad) have been doing exceptionally well, considering the fact that their market depends largely on the consumption at the shops, factories, etc., at Cleveland. The mines of Rend and others on the Ohio Central not included in the railroad company's property, and so not in the receiver's hands, are doing a lively business.

In the Hocking Valley District, the Columbus & Hocking Coal and Iron Company and the Ohio Coal Exchange firms are putting out an average of about 150 cars a day. The strike continues, although quite a number of the old miners who were members of the Union have signed contracts at 50 cents a ton for one year, and are at work. There is a reported scheme among the strikers to take possession of the mines to-day, while many of the guards will necessarily be absent from their post to vote; but up to this hour—noon—there has been no signs of such a movement reported. The burning mines are all banked, and will not be disturbed for some time, at least. There are various opinions as to the length of time the striking railroads will hold out and hold together. Some think that the end is likely to be reached very soon; while others do not look for a general "give in" much before the first of January. One thing is certain, the struggle has been an expensive and unpleasant experience for all concerned. And there can be no question that the Hocking Valley coal has lost *prestige* in the general market that will require much effort to regain. Lake business has about ended, and every body seems waiting for the election to come off and for business to resume activity.

STATISTICS OF COAL PRODUCTION.

Comparative statement of the production of anthracite coal for the week ended November 1st, and year from January 1st:

Tons of 2240 lbs.	1884. Week.	1884. Year.	1883. Week.	1883. Year.
Wyoming Region.				
D. & H. Canal Co..	64,449	3,204,123	103.153	3,429,617
D. L. & W. RR. Co.	87.580	4,217,102	119,117	4,231,691
Penna. Coal Co.....	22,675	1,078,840	40,116	1,254,240
L. V. RR. Co.....	16,808	1,149,088	26,709	1,174,340
P. & N. Y. RR. Co..	3,102	186,266	5,420	180,898
C. RR. of N. J	*	*	*	1,202,078
Penn. Canal Co....	†	384,991	14,755	431,427
North & West Br. RR.....	17,001	681,312	18,046	413,463
	211.615	10,881,723	327,916	12,317,754
Lehigh Region.				
L. V. RR. Co.....	68,966	3,785,330	104 568	4,229,116
C. RR. of N. J.....	*	*	*	1,126,889
S. H. & W. B. RR..	1,019	133,173	2,113	31,450
	69,985	3,918,503	106,681	5,387,455
Schuylkill Region.				
P. & R. RR. Co	187,523	9,209,973	268,579	7,927,347
Shamokin & Lykens Val.....	*	*	*	950,363
	187,523	9,209,973	268,579	8,877,710
Sullivan Region.				
St Line&Sul.RR.Co.	1,656	60,739	1,193	57,551
Total...	470,779	24,070,937	704,369	26,640,470
Increase.....	.....	.....	.....	.....
Decrease.....	.....	2,569,533	.....	.....

* Included in tonnage of the Philadelphia & Reading Railroad.

† Reports not received.

The above table does not include the amount of coal consumed and sold at the mines, which is about six per cent of the whole production.

Total same time in 1879.....22,123,522 tons
" " " " 1880.....19,576,972 "
" " " " 1881.....22,541,225 "
" " " " 1882.....24,399,908 "

Comparative Statement of the Production of Bituminous Coal for the week ended November 1st, and year from January 1st:

Tons of 2000 pounds, unless otherwise designated.

	1884. Week.	1884. Year.	1883. Week.	1883. Year.
Cumberland Region, Md.				
Tons of 2240 lbs....	52,793	2,410,036	51,912	2,138,848
Barclay Region, Pa.				
Barclay RR., tons of 2240 lbs.....	6,054	248,399	9,375	273,744
Broad Top Region, Pa.				
Huntington & Broad Top RR., of 2240 lbs	4,442	168,806	.....	148,012
East Broad Top....	.....	.....	1,103	36,223
Clearfield Region, Pa.				
Snow Shoe.....	3,486	152,152	7,362	206,071
Karthaus (Keating)	2,151	45,015	.....	.....
Tyrone & Clearfield	64,308	2,627,579	56,024	2,354,383
Alleghany Region, Pa				
Gallitzin & Mountain....	13,673	338,426	9,723	367,856
Pittsburg Region, Pa.				
West Penn RR.....	7,745	237,939	8,716	328,352
SouthwestPenn.RR.	2.830	106.122	3,693	99,740
Pennsylvania RR...	6,038	233,115	17,347	526,159
Westmoreland Region, Pa.				
Pennsylvania RR...	31,570	1,100,530	10,179	1,145,237
Monongahela Region, Pa.				
Pennsylvania RR...	4,216	129,976	.....	.....
Total.....206,354		7,798,095	175,431	7,624,625
Increase		173,470	.....	.....

FREIGHTS.

Coastwise Freights.

Per ton of 2240 lbs.

Representing the latest actual charters to November 6th.

PORTS.	From Philadelphia.	From Baltimore.	From Elizabethport, Port Johnston, South Amboy, Hoboken, and Weehawken.
Alexandria.....	.65@.70	.....	.....
Annapolis.....	.....	.....	.....
Albany.....	.....	.....	.....
Baltimore	.58‡	.....	.....
Bangor.....	.....	.....	.....
Bath, Me.....	1.10	1.15	1.00
Beverly.....	1.10@1.15	.....	1.00
Boston, Mass.....	1.10@1.15	1.15	1.00
Bristol.....	1.00	1.10	.....
Bridgeport, Conn.	.....	1.05	.60
Brooklyn	.....	1.00	.....
Buffalo, N. Y.....	.....	.....	.....
Cambridge, Mass.	1.15‡	.....	1.00‡
Cambridgeport..	1.15‡	.....	1.00‡
Charleston, S. C..	.75	.65@.70	.....
Charlestown.....	1.10	.....	1.00
Chelsea.....	1.10	.....	1.00
City Point.....	.....	.....	.....
Com. Pt., Mass...	1.15	.....	1.00
E. Boston.....	1.10@1.15	.....	1.00
East Cambridge.	1.15@1.20	.....	1.00‡
E.Gr'nwich,R. I.	.....	.....	.70@.75
Fall River.....	1.00	.....	.....
Galveston.....	.....	.....	.....
Gardiner, Me	.....	.....	.....
Georgetown, D.C.	.65@.70	.....	.....
Gloucester.....	1.15@1.45	.....	.....
Hartford.....	.....	.....	.....
Hackensack...	.....	.....	.....
Hudson..... ...	.....	.....	.....
Lynn.....	1.20@1.35	.....	.....
Marblehead.....	.....	.....	.....
Medford.....	.....	.....	.....
Millville, N. J....	.....	.....	.....
Milton.....	.....	.....	.....
Newark, N. J.....	.....	1.20	.....
New Bedford	.95@1.00	1.00	.75
Newburyport	.....	.....	.....
New Haven.....	.....	1.05	.60
New London.....	.....	1 10	.65@.70
New Orleans.....	.....	.....	.....
New-Berne.....	.....	.....	.....
Newport.....	1.00	.....	.70@.75
New York.....	.85§	.95@1.00	.....
Norfolk, Va.....	.60	.....	.....
Norwich.....	.....	.....	.70
Norwalk, Conn ..	.....	.....	.60
Pawtucket.....	.....	.....	.....
Philadelphia.....	.....	.....	.....
Portland, Me.....	.80*	1.15	1.00
Portsmouth, Va..	.60	.....	.....
Portsmouth, N.H.	.....	1.25	1.10
Providence.....	.95@1.00	1.10	.70
Quincy Point.....	.....	.....	.....
Richmond, Va...	.75@.80	.....	.....
Rockland, Me....	.....	.....	1.00
Rockport	.....	.....	1.10
Roxbury, Mass...	1.10‡	.....	.....
Saco.....	.....	.....	.....
Sag Harbor.....	.....	.....	.....
Salem, Mass.....	1.10@1.30	.....	1.05
Saugus	.....	.....	.....
Savannah.....	.75	.80@.90	.....
Somerset.....	1.00	1.10	.....
Staten Island....	.....	.90	.....
Trenton.....	.....	.....	.....
Troy.....	.....	.....	.....
Wareham.....	.....	.....	.....
Washington.....	.65@.70	.....	.....
Weymouth.....	.....	.....	.....
Williamsbg, N.Y.	.....	1.05	.....
Wilmington, Del.	.....	.....	.....
Wilmington, N.C.	.....	.....	.....
St. Thomas, W. I.	.....	.....	.....

* And discharging. † And discharging and towing. ‡ 3c. Per bridge extra. § Alongside. ‖ And towing up and down. ¶ And towing. ** Below bridge.

Comparative Statement of the Transportation of Coke over the Pennsylvania Railroad for the week ended November 1st, and year from January 1st:

Tons of 2000 pounds.

	1884. Week.	1884. Year.	1883. Week.	1883. Year.
Gallitzin & Mountain (Alleghany Region).....	2,920	114,037	1,143	65,701
West Penn. RR...	.....	24,865	3,784	90,375
Southwest Penn. RR.....	30,593	1,780,559	45,488	1,768,583
Penn. & Westmoreland Region, Pa. RR...	4,681	163,993	4,332	184,241
Monongahela, Penn. RR... ...	950	61,262	.....	.....
Pittsburg Region, Pa. RR.	.....	136	1,743	12,354
Snow Shoe (Clearfield Region)....	457	19,323	630	15,659
Total	39,601	2,164,175	57,120	2,136,913
Increase	.....	27,262	.....	.....

The increase in shipments of Cumberland Coal over the Cumberland Branch and Cumberland & Pennsylvania railroads amounts to 158,097 tons, as compared with the corresponding period in 1883.

Belvidere-Delaware Railroad Report for the week ended November 1st:

	Week.	Year. 1884.	Year 1883.
Coal for shipment at Coal Port (Trenton).....	3,856	93,106	105,657
Coal for shipment at South Amboy.....	13,053	540,417	508,048
Coal for distribution.....	22,978	673,597	606,284
Coal for company's use	4,650	154,724	136,747
Total.	44,537	1,461,844	1,446,736
Increase	.....	15,108	.....
Decrease.....	.....	.....	.....

DIVIDENDS.

HORN-SILVER MINING CO., 44 WALL ST.,
NEW YORK, Oct. 31, 1884.

DIVIDEND NO. 15.

A dividend of $300,000, being three per cent on the capital stock, will be payable to stockholders of record on and after November 15th, at the office of the company. Transfer-books will close on Wednesday, November 5th and reopen Monday, November 17th.

W. S. HOYT, Secretary.