

THE ENGINEERING AND MINING JOURNAL



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

VOL. XLV. JANUARY 14. No. 2.

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SUBSCRIPTION PRICE, including postage for the United States, Canada and Mexico, \$4 per annum; \$2.25 for six months; all other countries in the Postal Union, \$5. All payments must be made in advance.

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

Advertising Rates.—See page XVI.

THE SCIENTIFIC PUBLISHING CO., Publishers.

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

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An interest in mining is best developed by making the mines profitable to those whose money is invested in working them, and not in making mines a medium for swindling investors by false representations, whether made designedly or in ignorance. It is not the speculator who sells a prospect or a mine (even to a foreigner) at ten or a hundred times its value who benefits "mining," however liberal he may be toward those who aid him to carry his scheme through, but it is the legitimate profit to the investor or which comes from working the mine that benefits the industry and induces the further investment of capital in developing mines.

It is the investor who goes into mining and not the one who goes out that needs protection.

THE value of the vast amount of statistical information contained in the ENGINEERING AND MINING JOURNAL of the 7th inst. has been fully recognized by our readers, and the courtesy of our copper, lead, and zinc producers in furnishing us with their figures of production has been

greatly commended. It is always a pleasure to find our work appreciated, and we thank those who have been so kind as to express their appreciation. We can not refrain from quoting at least one of the letters received.

Professor W. B. PHILLIPS, of the University of North Carolina, writes: "I trust you will allow me to congratulate you upon the issue of the JOURNAL for January 7th, 1888, No. 1 of Volume XLV. It is, if I may be pardoned the expression, a wonderful example of professional activity and professional accuracy, and speaks in the most emphatic terms of the discriminating zeal with which you carry on this great work. During my 'studentzeit' at Freiberg, I used to look over the sixty odd journals, containing more or less of mining information, that came to the reading room. I thought then for reliable news none of them were as good as the ENGINEERING AND MINING JOURNAL, and a further and closer acquaintance with it has confirmed this opinion.

"I am sure that [this first number of the new year is but an earnest of what we may expect through the entire volume, and through every other volume as long as the JOURNAL remains in your hands.

"Long may it stand at the head of journals devoted to legitimate mining and smelting."

FREDERICK MERCUR.

This distinguished engineer died on the 11th inst., at his home in Wilkes-Barre, Pa., from typhoid fever, at the age of 51 years.

Mr. MERCUR studied at the Rensselaer Polytechnic Institute, Troy, N. Y., and subsequently entered the service of the Lehigh Valley Railroad Company, where he rose rapidly until he had responsible charge of very important works, such as the building of their line from Penn Haven to Wilkes-Barre, in the Wyoming Valley, and the extension up the Susquehanna to Waverly, N. Y.

When the Lehigh Valley Railroad Company became interested in coal mines in 1867, Mr. MERCUR was made general superintendent of the mines, and in that position displayed great ability and good judgment. The Prospect Shaft, Henry Colliery, Wyoming Colliery, and other mines which came under his management were probably the most fiery mines in this country, and perhaps in the world, and it is an unanswerable testimony to Mr. MERCUR's skill and ability as a mining engineer, that at none of these mines has there ever been any large or destructive explosion, such as we so frequently have to record as occurring in European coal mines. Few engineers in this country have had a wider or more complete knowledge of anthracite mining and of the dangers and difficulties attending it.

In the discharge of his duties, Mr. MERCUR went December 30th to Shenandoah, Pa., to direct the work of extinguishing the fire in the Packer colliery, and he there contracted the sickness which so quickly carried him off in the prime of an honorable and useful career. Mr. MERCUR was born at Towanda, Pa. His father was the late Henry S. MERCUR, of Towanda, and his uncle, the late Chief Justice MERCUR. His brother, Col. JAS. MERCUR, is Professor of Civil Engineering at West Point, and one of his two sons is at present a student at Lehigh University.

Mr. MERCUR enjoyed the respect and personal affection of all who became acquainted with him, for he combined in an unusual degree the courtesy of the thorough gentleman to every one, high or low, with the firmness and sense of justice which characterized the successful manager of great enterprises.

OUR SEACOAST DEFENSES.

The annual report of the Chief of Engineers, which has just been published, contains the usual detailed account of the numerous river and harbor improvements prosecuted during the year ending June 30th, 1887. It is disheartening to note the penny-wise-pound-foolish manner in which large sums are frittered away by doing less than ought to be done at important points and making up for this economy by extravagance in useless tinkering. So long as the River and Harbor Appropriation Bill continues to be considered by Congressmen as a means of distributing money in their respective districts, for the purpose of increasing their own popularity, a reform can scarcely be expected. Yet until such a reform in the basis of estimates for annual expenditure shall have been secured, discussion of method of disbursement and administration will be fruitless of good.

This is, however, by no means the most discouraging part of the report of the Chief of Engineers. For, shiftless as the legislation concerning rivers and harbors may be, it is still positive. Something is done; and so far as the absurd whims of Congress will permit, it is well done on the whole. But the absolute indifference and neglect shown by Congress toward the subject of national seacoast defense is worse than foolish or whimsical. It is positively wicked.

To this subject the Chief of Engineers gives but a few paragraphs. We quote the most important:

"Seacoast Fortifications.—The works upon which the defense of our coasts

depends have been so fully discussed in former annual reports of the Chief of Engineers, as well as in the recent report of the Board on Fortifications or other Defenses, appointed by the President under a special act of Congress, 1886, that no further remarks seem to be either necessary or appropriate. From the facts presented in these reports bearing upon the condition of our seacoast defenses, it must be evident that immediate action is demanded to place them in a proper condition to resist the attacks of an enemy.

"From the difference of opinion which exists among certain non-military experts as to the character of armor to be used in land defenses it has been argued that the whole subject of seacoast defense is in an unsettled and tentative condition, and that the policy of inaction now existing should still continue. But the facts will not warrant this conclusion, as more than nine tenths of the armament recommended for our seacoasts is not to be mounted behind iron protections, but in rear of earthen covers surmounting and shielding the masonry magazines, bomb-proofs, and store-rooms. Particularly is this true of the rifled mortars, which must hereafter play an important part in the defense of our channels and fairways, and there is no reason why the erection of the batteries required for them should be delayed a single month. Neither is armor required for guns mounted on lifts or disappearing carriages; in a word, proper sums may judiciously be expended and much progress toward placing our coasts in a defensive condition may be made, indeed must be made, before the question of armor demands consideration.

"*Torpedo Defense.*—Congress having failed to pass a fortification bill at its last session, no funds have been available for torpedo expenditures since July 1, 1886.

"Submarine mines, in the present condition of our coast defenses, constitute our chief reliance in case of war. They require time for fabrication and safe positions from which to operate them by electricity. For these reasons appropriations should at once be made (1) to provide submarine mining material, and (2) to construct the casemates, shafts, and galleries needful for the reception of the batteries, electrical apparatus, cables, etc. Last year the annual appropriation failed to pass, and in the two preceding years the funds were nearly all restricted to the item of movable torpedoes, for which there is no urgent necessity. Several of them are now on hand, but their function is a subordinate one, and the purchase of mines should not be interrupted on their account.

"At present we have nothing modern to oppose the entrance of hostile fleets into our chief ports, except a few incomplete mines in store at four of them. But submarine mines belong to a complex system, every part of which must be ready or the whole fails. As well expect a chronometer to keep time with one wheel as to expect mines to bar a channel without cable-shafts or casemates, and all the other appliances which enter into the system. After years of experiment the details of our system have been perfected; the cost is small; the material when properly stored is imperishable; careful work and time are indispensable in its fabrication; hence there should be no further delay in providing an adequate supply for this defense of our entire coast."

There is a tone of dignified despair in these brief statements, at which we can scarcely be surprised, when we remember how utterly powerless have been the repeated representations of our military engineers and our mercantile communities, to arouse Congress to a sense of its duty and the nation's danger. Self-respect forbids an officer of the government, charged with the duty of its defense, to reiterate forever useless pleas before so stupid and reckless a body. The truth has been told them often enough.

Last year we heard plenty of talk from suddenly self-educated warrior-statesmen, to the effect that forts, guns, and ships were not necessary to defend our ports: torpedoes had revolutionized warfare, and our torpedo system would perfectly protect us. This proposition was absurd enough, as all competent judges know; but it contained at least this truth, that torpedoes are universally admitted to be an important element in harbor defense. If there was reasonable difference of opinion on other parts of the scheme of fortifications recommended, this at least might have been seized upon with unanimity, and supported with efficient vigor. But no; Congress would not even do what all are agreed ought to be done. In the significant words of the report above quoted, "no funds have been available for torpedo expenditure since July 1st, 1886." The stores of material already accumulated are barely kept from rust and decay, but not replenished as their natural waste requires, still less enlarged to meet the necessities of an actual emergency. The training of a sufficient corps of operators, without which they would be useless, cannot be secured; and at this hour there is not a gun mounted on a system of torpedo or any other defense in existence at any port of the United States, which could not be defied by a single ironclad vessel.

Is it not a scathing comment upon this scandalous condition of affairs, that the commandant of our principal torpedo station, at one of the principal forts supposed to defend New York, can find no better use for the war material in his charge than to wind his worthless old cannon with worthless old torpedo-cable, and try experiments in electro-magnetism? All honor to the ingenuity of Major KING, who can do even so much as that with these obsolescent reminders of governmental fatuity. But he and other skillful and patriotic officers ought not to be reduced to such scientific pastimes, while so-called statesmen—

Once there was a man. His fences were down; his roof was rotten and leaky; the rusty bolts were dropping from his doors, and his shutters, hanging from broken hinges, revealed the windows in which old hat-crowns had taken the place of panes. By dint of spending nothing on the preservation or defense of his house, he had accumulated a stock of money, and the silly old fool spent all his time alternately gloating and worrying over his "surplus."

Your pardon, reader; we have deceived you. There was no such man. It takes more than one man to be such an aggregated idiot as that. But what sounds so preposterous of a single person is true of a body of men who have been intrusted with the government of the United States, and who wonder and protest occasionally because ordinary folks seem to regard their performances with angry contempt. *

CORRESPONDENCE.

We invite correspondence upon matters of interest to the industries of mining and metallurgy. Communications should invariably be accompanied with the name and address of the writer. Initials only will be published when so requested.

All letters should be addressed to the MANAGING EDITOR.

We do not hold ourselves responsible for the opinions expressed by correspondents.

Trough Lixiviation.

EDITOR ENGINEERING AND MINING JOURNAL:

SIR: Mr. C. A. Stetefeldt, in his "criticism" on my system of Trough Lixiviation, as published in the JOURNAL of December 10th, endeavors only to show defects, and with the exception of the very last sentence, in which he says that the principle upon which the rapid solution of the silver chloride is based is a novel and correct one, does not even devote one word to the merits of the new system. Such a one-sided and unfair criticism I surely did not expect from the pen of Mr. Stetefeldt. In his endeavor to demonstrate defects, he makes in some instances objections to trifling points which in themselves can not be objectionable, as they are shared in common by both the old and new method.

In the following I will reply to Mr. Stetefeldt's six objections:

Objection No. 1. He asserts that I propose to abolish the cooling floor entirely, and take the red-hot ore as it is discharged from the roasting furnace direct to the base-metal leaching. There is not one sentence in either of my two articles on trough lixiviation that could lead to such an assumption, and I am at a loss to see how Mr. Stetefeldt can be under such an impression, especially as he says in his objection No. 2: He (Hofmann) propose to dump the red-hot ore as it comes from the roasting furnaces into bins, etc. Now, this shows that, while proposing to abolish the cooling floor, I do not intend or propose to take the ore directly from the furnace to the base-metal leaching. There was no need of his calling my attention to the well-known fact that the chlorination of the silver of an imperfectly roasted ore continues after discharge if left for several hours in a red-hot condition. I dump the ore in bins or let it drop into them directly from the furnace, if I use a Howell, where it can lay a few hours. I have, therefore, provided for a continuation of the silver chlorination outside the furnace. I can not see why this should only be possible to accomplish on a cooling floor by banking up the ore, and why a bin should not answer the purpose better.

This, his objection, is based on a wrong assumption, and has, therefore, to be excluded from consideration.

Objection No. 2. Here Mr. Stetefeldt combines in one sentence the proposed mechanical feeding of the hot ore and my hot ore cooling device, and says that this will work only on paper, and that wherever attempts of this kind have been made, they resulted in failures. The device to cool the ore quickly by dropping it through a tube in which sheets of water are properly arranged had never been used before, and if he says it works only on paper, he is expressing his opinion on a thing which he has not investigated.

That a continual drawing of a uniform quantity of hot ore from a bin offers difficulties, I am perfectly aware of, and this is the only pertinent objection of the six. But to consider the difficulties as insurmountable because it has been tried in some localities without success is a rather lame conclusion. I do not pretend to have solved the problem, still I believe that my present device, though not perfect, will do fair work, at any rate will be preferable to the costly and wasteful cooling floor manipulations. The main difficulty which chloridized hot ore offers to a uniform mechanical removal from a pit is, that the ore in cooling, when left in a bulk sticks, and does not readily sink in proportion as it is carried out. In conformity with this property, which, however, not all kinds of ores possess, I construct the bins shallow, only four feet deep, and accessible from the top, so that in case of any irregularity the ore can be poked down. One man will be sufficient to attend to this, which, if Howell's furnaces are used, where the ore drops automatically in these bins, will be a trifling expense, as compared with the present cooling floor manipulations. For the removal of the hot ore I use a conveyor screw, which, together with the conveyor trough, is placed below the bin, so that the bottom and sides of the trough are exposed to the air, and thus kept comparatively cool. Only five feet of the screw are under the pressure of the hot ore. The diameter of the worm is 12 inches, in order to take along larger lumps. The shaft itself, over which the cast-iron screw segments are slipped, is 4 inches in diameter and 11 feet 3 inches between the journals. In order to keep the journals cool, the shaft consists of three parts, which are coupled together close in front of each box. The coupled pieces of the shaft do not touch each other, so that the heating of the ends which rest in the boxes has to be done through the coupling flanges. To avoid this, I make the flanges 15 or 18 inches in diameter, and let them rotate through water which is contained in a vessel so attached that nearly one half of the flanges are always in water. A continual but small stream of water passes through the vessel.

As the ore will have to lie several hours in the bin before it is removed, and as the conveyor trough is exposed to the air, the ore immediately surrounding the worm will not have that high temperature at which cast-iron is much affected. Ores which harden or stick too much can be removed from the bins with a hoe, through a door, and drawn in portions into a short conveyor trough, one end of which open, in shape of a hopper, is placed right under the discharge door of the bin. A roasted ore which had lumped once and then is removed does not harden again. From here the ore is carried away by the screw uniformly.

Though neither of these devices can dispense entirely with manual labor, they save a great deal of such labor. I call attention to the manipulations on the cooling floor, where the hot ore has to be spread evenly over the floor, then sprinkled with water, which makes the valuable dust fly with the emerging steam. Then the ore has to be turned, and in some places where the ore has not been well moistened by the first sprinkling, another volume of dust will emerge. Then the ore is shoveled into a long pile alongside the car-track, and from there shoveled into the cars. The cooling floor with its manipulation is surely a very primitive and costly arrangement of our mills.

If the problem to draw continuously a uniform quantity of red-hot chloridized ore from a bin or hopper has not yet been solved, it may not be as Mr. Stetefeldt thinks, because the difficulties are unsurmountable,

but it may be, because there was no special advantage resulting from such a device, and the subject was dropped when difficulties were encountered. So far as I know attempts had been made to dump the wasted ore from a Bruckner furnace into a hopper underneath, and from there to convey it by means of a long conveyor screw to the cooling floor. If the only object was to convey the ore to the cooling floor there is no advantage in that, because it is quicker and easier to discharge the furnace into two cars, which are large enough to take the whole charge, but now, when the object of such a device is to avoid the cooling floor manipulations entirely, the subject has assumed importance, and the problem will be satisfactorily solved before long.

My system of lixiviation makes it possible to do, entirely away with the cooling floor, while such is not possible with tank lixiviation, and I strongly pointed this out in my articles; still I did not represent it as an essential part of my method. In my article of September 10th, 1887, I say: "The feeding is performed either by means of shovels if the ore is damp, or by mechanical appliances if it be hot and dry."

Objection No. 3. Mr. Stetefeldt objects strongly to my assertion, that the wash water can be allowed to run to waste, because in producing at once a sufficiently diluted solution of base-metal chlorides, the same will not dissolve any silver, and calls it a rather bold statement. This objection involves only the theoretical question, whether by producing at once a dilute wash water some silver chloride will be dissolved or not, even if the resulting solution is dilute enough not to dissolve as such chloride of silver. That the solving energy of the wash water for silver chloride is a function of its concentration in certain salts, he admits, and thereby also that a weak base-metal solution, which can be obtained in trough lixiviation, will dissolve less silver. Can this be an objectionable feature of the new system? Is it not an advantage?

It is true, I did not express myself quite correctly, and ought to have said that it will not retain any dissolved silver if sufficiently diluted, as very small quantities of silver will dissolve if the hot ore is dropped into water, even if the resulting solution is dilute enough not to dissolve chloride of silver. It seems that the water which penetrates the hot ore first becomes hot and concentrated enough to dissolve some silver, but in presence of sufficient water, the silver will not remain dissolved, but will be precipitated again as chloride. The rapid current in the trough, which is equal to a vigorous shaking of the solution in a flask, will assist greatly to collect the precipitated silver in flakes, which then settle easily. By passing through the series of large tanks, the main portion, if not all of them, will settle in the tanks, and will subsequently be extracted by the process of silver leaching. It will be an easy matter to convey the wash water after leaving the last tank into a large pit outside the mill, which will afford the required time for settling that part of the silver chloride which eventually may be carried out. As no separate treatment of the base-metal solution is required for regaining the silver, the solution actually can be allowed to run to waste, after passing the series of tanks and the large pit outside. My statement, therefore, is correct, in so far as the practical result in the works is taken in consideration, and does not authorize Mr. Stetefeldt to call it a bold statement.

Fresenius, in his "Quantitative Analysis," page 176, sixth edition (German) states: "Aqueous solutions of metal chlorides (the chloride of sodium, potassium, ammonium, calcium, zinc, etc.) dissolve silver chloride in quite noticeable quantities, especially if concentrated and hot. By diluting them sufficiently with cold water, the dissolved silver precipitates so perfectly that the filtrate is not colored by sulphureted hydrogen." Mr. Stetefeldt, however, says that only a part of the silver chloride will be precipitated by diluting the solution.

I have first applied and recommended the above fact as the cheapest and most effective mode of regaining the silver dissolved by the wash water. First, I endeavored to accomplish this by introducing the water below the ore, but not finding it efficient enough I collected the wash water in special tanks, and diluted it there. [See Notes on Lixiviation, ENGINEERING AND MINING JOURNAL, December 8th, 1888.] Thus I regained in Silver King 85, and in Cusihiuriachic 84 per cent of the dissolved silver by diluting the wash water to three times its volume. This percentage would have increased by adding more water. This, however, would have necessitated the erection of more tanks, which the small amount of unprecipitated silver did not warrant.

If an ore contains sufficient copper to make its saving an object, or if not sufficient water can be had, what hinders the operator to produce concentrated base-metal solution, and treat the same for its copper and silver in the usual way? It is one of the grand advantages of trough lixiviation that the strength of the resulting solution can be regulated at will.

Objection No. 4. Mr. Stetefeldt calculates how much more grade is necessary for a mill with the trough system than with ordinary tank lixiviation, and figures it at 49 feet, to which he liberally adds 7 feet to benefit the inclination of the troughs, and makes a grand total of 56 feet. The extra 7 feet are not necessary, as three quarter inches fall per foot of triangular trough is sufficient in all cases.

Assuming his figure of 49 or even 56 feet, it is ridiculous to represent this as a serious obstacle. I would agree if this grade would be required as a sudden drop, but it is divided through the whole works down the slope of the site, and no unusual sudden fall of the grade is required, neither any unusual large excavation. I do not propose to bring all the departments of the works under one roof, but have the furnaces, bins, and agitator in the main mill building, and, according to the grade of the site, about 50 or 100 feet further down the leaching works. The base-metal leach trough connects the furnace building with the base-metal department of the leaching works, and enters the building near the roof, which gives sufficient fall for the balance of the trough. The settling tanks of the base-metal department are placed on a higher platform, in order to give the required grade for the silver-leach trough without necessitating extensive excavations. The building of the silver department is immediately attached to the base-metal building and covered with a shed roof.

In most mining regions there is no want of grade, and if a mill is built as I propose, there will be no difficulties encountered by the millwright to construct the building. In fact it is a much better plan not to have all departments under one roof, as a precaution against a total destruction

of the works by fire. In cases where there should not be grade enough, the pulp after leaving the agitator can be elevated to the grade required for the base-metal leach trough.

If the system of trough lixiviation has to be introduced in works which are arranged for tank lixiviation, it can be done without making much alteration of the general plant. In this case I would confine trough lixiviation only for the extraction of the silver, and leach the base metals in tanks. Base-metal leaching, as a rule, does not take longer than 4 to 6 hours, exceptionally nine hours. By erecting 4 tanks of 8 tons capacity each, it would give 16 hours' time to each tank charge in a mill of 48 tons daily capacity, for filling, washing and sluicing. These four tanks will have to be placed about 16 feet above the rim of the present leaching tanks, which, I think, can be arranged in any mill, if not inside, so outside and covered with a shed, especially as they can be placed in any part of the mill which offers the proper elevation, as the silver-leach trough can easily be arranged to lead to the silver department. The most suitable place will be near the cooling floor, from whence the ore can be elevated and charged into the tanks by means of cars.

In my first article on trough lixiviation (ENGINEERING AND MINING JOURNAL, September 10th, 1887) I sketched the complete system for a new mill, but where circumstances demand a modification it can easily be done, and still offer great advantages, as the principal merit of the new system, besides being continuous, is the quick extraction of the silver combined with the facility it offers to bring the ore at once in contact with any required quantity of the solvent, by which many hitherto encountered difficulties can be overcome. I can not imagine that Mr. Stetefeldt really considers the extra grade required to be an obstacle to trough lixiviation, and have no doubt he will withdraw his objection on reconsidering it.

Objection No. 5. This objection refers to the operation of filling the tanks. Mr. Stetefeldt thinks that in order to obtain clear solutions the trough system will require as many, if not more, tanks for the silver leaching plant alone than the ordinary method, and more than double the number including base-metal leaching. In answer to this I have to say, that this is not so, and that his statement is neither based on facts nor on actual observation.

Chloridized ore does not slime like raw ore; if stirred up in water it settles quickly. In the North Mexican mill I had not the continuous system, but allowed the stream to enter one tank until the solution came near the rim, then turned the stream into another tank and left the first tank to settle. When clear the solution was decanted as close as possible, and the steam turned in again. This was repeated until the tank was properly charged. The ore of the North Mexican, not containing any sulphureted minerals, was very dusty after roasting, still it never took more than two or three hours to settle quite clear. I observed, also, that while the tank was filling and the pulp went down in the center of the tank, the solution near the sides and the farthest off from the charge drop, after assuming a depth of about 18 inches above the ore, was almost clear to the depth of two or three inches. This indicates the quick settling of chloridized ore. Sulphureted ore when chloridized is more sandy and will act still quicker than the North Mexican did, and I am sure that in most cases eight tanks for each department, as laid out in my sketch, will be more than necessary. After the whole system is in regular rotation, the surface of the solution will assume the same level in all the tanks, and the solution will pass quietly from one tank into the other. By taking extra precaution to avoid diametrical streams, by placing two or three boards, or better, strips of canvas, in a perpendicular position across each tank, say to a depth of 6 to 18 inches, as it may be found necessary, the solution in the tanks will be kept pacific and nothing will cause the once settled particles to rise again. If we take two tanks of the row of eight to be disconnected for washing and sluicing, and a third one in the operation of filling, it will leave five tanks for settling the slimes. These five tanks, 14 feet in diameter, and filled 3½ feet deep with solution, will contain 2692.5 cubic feet, or 20,193 gallons. Assuming 40 tons the daily quantity of ore to be treated, and that it will require ten times its weight of solution, or 24,000 gallons in 24 hours, we have 16.6 gallons per minute, flowing in and out, which is not a heavy stream. It will take over 20 hours to fill these five tanks. As the flow from one tank into the other is caused more by displacement than by an actual stream, and as only the clearest part of the solution from each tank flows into the succeeding one, it can readily be seen that the solution leaving the last tank will be clear.

Mr. Stetefeldt further points out that after the whole system is in regular rotation, the fine slimes will rest immediately upon the filter and the charge of a tank will consist of as many stratas of ore of different fineness as there are tanks in the system, less one, and that in consequence the filtering must become slow.

I do not dispute that the filtering will be slower than that of an ore charged in the ordinary way, but we have to consider: (1) that the trough system requires but a very limited use of the filter. In base-metal leaching I have to replace that part of the wash water which is absorbed by the ore, by fresh water, and this again by hyposulphite solution. In silver leaching I have only to replace the hyposulphite solution by water. These three operations are divided in the two departments and not in one as represented by Mr. Stetefeldt. Every leacher knows that these three operations have also to be done in tank lixiviation, and that they are the least time-consuming operations of the whole process. (2) That the charge of a tank will not consist of quite so regular stratas as Mr. Stetefeldt thinks, for the reason that the heavy sand will sink through the slimes and partly displace them, hence will get more or less mixed with the fine. Furthermore, it must not be overlooked that, as the charge in the tank is not agitated, the quantity of slimes which will be forced into the next tank will be comparatively small at the time its turn for charging has come. Besides, a vacuum pump will hasten the filtration in case of need.

Objection No. 6. Mr. Stetefeldt says: "The swift stream of hyposulphite solution in the silver leaching trough causes an additional exposure of surface of the solution to the air, and, in consequence, a more rapid deterioration of the hyposulphite salts."

This objection is based on the result of a microscopical examination of the defects of trough lixiviation. The deterioration of the solution by the action of the air is more than replaced by the continual supply of hyposulphite salt which it receives from the precipitant. In Silver King

I had the same solution for over two years and a half in constant use, without adding one pound of hyposulphite salt, and had even to let some of it run to waste, because it increased more than desirable, notwithstanding the deteriorating influence of the air.

Trough lixiviation is a great improvement on tank lixiviation. It is more economical, allows a quick extraction of the silver, and possesses many advantages over the old system, which I will fully demonstrate as soon as an opportunity is offered me to erect such works.

Very truly yours,
 OTTOKAR HOFMANN.
 WEST END, ALAMEDA, Cal., Dec. 30, 1887.

SOME ASPECTS OF THE LABOR QUESTION.*

By E. W. Raymond.

THE EARNINGS OF THE STRIKING COAL MINERS.

The most recent aspect of this many-sided question is presented by the strikes in the anthracite coal region. This forms a peculiarly convenient text for me, because, in the first place, the facts in the case are matter of record, easily verified; in the second place, I can speak largely from personal knowledge, having been for many years connected with anthracite mining, and being at this time a director of one of the companies whose men have been on strike since September last; and in the third place, the anthracite trade has been singled out as the object of loose denunciation, inspired partly by ignorance and partly by the spirit of mischief. The "coal barons," the "greedy monopolists," the "grasping and tyrannical corporations," engaged in this business, and their deep conspiracies against the rights of man and the public welfare, are the stock in trade of orators and editors. Even those who condemn now and then the misguided violence, the secret tyranny, and the open bad faith of the Mollie Maguire or the Knights of Labor in the anthracite region, are in the habit of adding that no doubt these men are the victims of the crushing oppression of ill-gotten wealth and arbitrary power. In dealing with this case, therefore, I am able to confute, by the clearest evidence, the most wanton of falsehoods.

The Schuylkill region was the scene of the earliest large development of anthracite mining, and furnished for many years more than half the anthracite sent to market. Up to about the beginning of the war, mining in this region was carried on by private operators and small concerns. Coal was accessible near the surface, expensive openings were not required; pumping was in many cases not necessary at all; little timber was employed underground, and that little was growing close at hand. That the profits of mining were not absorbed in extortionate transportation charges is evident; for the Reading Railroad and the Schuylkill Canal, which did this work, were not prosperous in those days. Anybody could start a coal mine, and hundreds of operators did so. Yet the net result was, that before the war, of all the individuals engaged in mining in Schuylkill County, only three had made money.

The war brought a change which was not a permanent improvement. The great demand for a smokeless fuel on the part of our navy, and the sudden increase of steam machinery in many other fields, aided the general speculative spirit, and stimulated the anthracite business in an unhealthy way. Successive crops of operators had been swept away, and new ones, ignorant of the risks of the business, and fancying that they could succeed where others had failed, had taken their places. The set that occupied the coal regions during the latter part of the war doubtless realized, for a while, large profits. This sketch of the history of the Schuylkill region fairly represents the Lehigh and the Wyoming regions also.

The result was this: individual operators, mostly not owners of the land, but working under leases, and bent on realizing as much as possible within a limited period, were mining with reckless haste and waste, and with frequent interruptions, due to mining accidents, glutted markets and labor disputes, while the miners, demoralized by the preceding high prices, were demanding whatever they could extort from this precarious business. Of the coal in a given bed, more than one third was left underground and never recovered, another third was wasted in breaking and sizing for market, and about 30 per cent finally reached the consumer. Permit me to say in passing, that this is precisely the state of things which would come to pass, only in more aggravated form, if the theory of Mr. Henry George should be applied to the anthracite region. Apart from all questions of the abstract beauty or equity of that theory, it would simply, in the case of anthracite lands, produce a mad race for immediate development and profit, and rapidly lead to the practical destruction of this precious and unique source of national wealth, unless the State should interfere to regulate the industry throughout—which I do not understand to be a part of Mr. George's scheme.

It was perfectly clear that one thing only could avert impending ruin—namely, the ownership of the coal lands by the producers of coal. That, and that only, would permit and promote a wise prudence, a husbandry of resources, the erection of permanent improvements, such as good dwellings, thorough timbering, expensive machinery for hoisting and ventilation, and a thousand other things calculated to insure steady working, and safety. Seldom have the inexorable laws of business wrought a result so thoroughly satisfactory to the political economist and the philanthropist as the concentration of the anthracite coal lands in the hands of a relatively small number of proprietors.

It was also clear that larger capital would be required than individuals could, in most cases, furnish. It is generally impossible to operate a single anthracite colliery with profit. The producer should control several collieries, so that when one is for any reason crippled or idle, another can supply the customers, whom he has acquired with pains and cannot afford to lose by such an interruption. Large stocks of coal must be carried to meet the peculiar fluctuations of the demand without violent changes in the working force. Immense sums must be laid out in work unproductive at the time, and useless when the colliery is idle or exhausted. The company of which I am a director has expended some two millions of dollars without receiving a single dividend, and must make still further expenditures before its product will be large enough to en-

able it to realize the small profit of 19 cents per ton, which is the average of one of its most prosperous rivals.

The inevitable and beneficial result of these conditions was that the anthracite business fell into the hands of incorporated companies, wielding large capital. In a number of instances, these companies owned also lines of transportation to the seaboard. Into the causes of this fact, I will not here enter. I am concerned only to show that its results, however unsatisfactory to the stockholders and bondholders, have not been injurious to the miners or the public. That the transportation of coal has not been a source of exorbitant profit, may be inferred from two facts: first, the history of the carrying companies, several of which have passed through bankruptcy; and secondly, the price for which coal has actually been brought to market. That the mining companies have not realized exorbitant profits can be shown from their full published reports, which prove that upon the capital they have employed the net returns have been smaller than those of any other large business—much smaller than the depositors in savings banks receive. Under the present system, a ton of anthracite is mined in the depths of the earth, broken, cleaned, sized, and sent over a hundred miles to market for an average price of say \$5 per ton. If the railroads and canals make but little profit from this, and the companies receive as little, let us see what is paid to labor.

I need not tell you that the wages throughout a given region rule, in this industry, about alike. I will take, therefore, as a specimen the Lehigh Coal and Navigation Company, commonly called the Lehigh Company, one of those whose men, in obedience to the orders of their labor union, went on a long strike last September. The figures which I shall give you are not random estimates. They have been taken from the pay-rolls of the company, with such care and thoroughness that the calculation of the first item I shall name alone involved the continuous labor of four clerks for two weeks.

A detailed analysis of the pay rolls of the Lehigh Company for the eighteen months from January 1st, 1886, to June 30th, 1887, shows that every miner, good, bad, or indifferent, skillful or unskillful, working by contract for the company during that period, averaged \$2.72 for every day worked. During the year ending June 30th, 1887, the collieries were running every day, excepting Sundays, holidays and fifteen days besides, namely, four days at the close of September, seven days at the close of May, and four days at the close of June. This, however, would not fairly represent the amount of employment given to the workmen. Some kinds of work go on continuously, other kinds are more frequently suspended. As the best estimate that can be deducted from a patient and honest examination of the figures, it may be said that the Lehigh Company's contract miners averaged during the year about twenty-two days' work per month—certainly over 20 days—and received, therefore, as an average per man at least \$55 per month, or \$660 for the year. It has been asserted that out of this sum the miner has to pay his assistant laborer, and also to buy powder, candles and other supplies. This is false. The above figures represent the remainder after all these items have been subtracted. The hours of labor do not exceed ten, and contract-miners often get through their work between 7 in the morning and 3 or 4 in the afternoon. The majority of the men work by contract, and were therefore paid as above. But many kinds of labor about the colliery can not be so paid; and for these the wages in August last, just previous to the strike, were as follows per day: to miners, \$1.93; the laborers employed as assistants by the miners underground, \$1.66; the ordinary underground laborers of the company, \$1.52. Below these in wages come the drivers, ranging from boys of 15 or 16, who drive one mule each, and receive 90 cents per day, up to young men who drive teams of 5 or 6 mules, and receive \$1.52. Outside labor was paid from \$1 to \$1.25 per day. Finally, the light labor of picking the pieces of slate out of the coal is performed by boys of 12 years and upwards, and by old men, incapable of heavier tasks. The smallest boys get 26 cents, and the wages for pickers ranges from this amount to 73 cents per day.

Concerning these coal-pickers, it must be admitted that their work is dusty, and that they are a grimy-looking lot. But the labor is not hard; it is performed in a sitting position, in buildings warmed by stoves or steam-pipes; and the boys themselves, as they come racing and tumbling and shouting out when work is over, are not conscious of hardship in their lot. Their earning undoubtedly add much to the comfort of their families. Our analysis of the pay-rolls of the Lehigh Company for the month of July last, shortly before the strike, shows that out of 1417 families, 40 earned in that month an average of \$150, 16 earned between \$120 and \$130, 25 earned between \$110 and \$120, 45 earned between \$100 and \$110; 55 earned between \$90 and \$100; and 74 earned between \$80 and \$90.

The rates of mining labor above given, as to underground mines and laborers, are based on a settlement made about twelve years ago, according to which wages were to go up and down with the price of coal at New York—that is, the average price of the five sizes, lump, broken, egg, stove and chestnut coal, as fixed by the New York Lehigh Coal Exchange, an association of salesmen. This price is regularly advertised. Of course a good deal of coal is sold for less; but the advertised asking price is the basis for calculating wages. When that price is \$5 per ton, certain wages are to be paid to miners, laborers, etc., by the day. Miners on contracts make, as we have seen, considerably more. The basis wages, that is, the daily wages when coal sells at \$5 in New York harbor, are \$2.10 for miners and \$1.80 for laborers employed underground by the company. For every ten cents per ton additional price of coal, one per cent is added to the wages; and for every ten cents fall in price, one per cent is deducted. Ten cents is 2 per cent of \$5. Hence we may say, speaking roughly, that of 2 per cent advance, the miner gets half, while the other half is divided between the mining companies and the railroad and canal companies. Thus, for instance, in August last, the average selling price of coal was \$4.20, or 80 cents below the basis. Consequently wages were reduced 8 per cent; miners received \$1.93 per day, and laborers \$1.66, as I have already stated.

This arrangement was accepted as equitable a dozen years ago. That it has worked well, appears from the significant fact that it has been a very rare thing for any miner to leave the Lehigh Company and seek work elsewhere. It is, as will be seen, an attempt to make the working-men participate in the profits of the business. It has been strictly and honorably adhered to by the companies, except that when about 1884, the price of coal went below \$4, so that the wages would have to be re-

* Extracts from a paper read before the New York and Brooklyn Association of Congregational Churches, Brooklyn, Jan. 10, 1888.

duced more than ten per cent, it was decided that the men should not suffer to the extent required by the agreement; so that, voluntarily, and notwithstanding the agreement, the employers paid the wages for a price of \$4. About the beginning of this year the extreme depression passed away. As soon as the price advanced above \$4, wages were increased, and the miners who did not strike when they were getting more than their share struck after the increase for a still higher increase. I will add but one fact more: During these twelve years the cost of living has decreased, the cost and risk of mining (apart from wages) has greatly increased, and several companies have been bankrupted.

During the last five years the employes of this company have paid \$66,505 for building lots. In the towns upon its lands there are now 1173 private houses to 440 owned by the company. Time will not permit me to explain here the admirable systems for relief in case of disabling accident or death, and other arrangements for the benefit of the workmen, which nearly all of the great anthracite companies have established, which the men are entirely free to accept or decline, and which an increasing majority of them accept. But I must say here that no two men in this country deserve more credit for universal and patient philanthropy in this respect than Eckley B. Coxe and Joseph S. Harris, who have been singled out for special abuse by the instigators of the Lehigh strike. And I will add, that all philanthropic endeavors to better the condition of the working miner in the coal regions have invariably found their most bitter enemies in the labor agitators. They do not want the workman to own his own home, or have an interest in the profits of the business, or the hope of a pension, or any thing else that will tend to make him contented and disinclined to strike. These things, they say, are tricks of the employer to prevent the demand for higher wages. The workmen should constitute a separate, organized, trained, hostile body, having no interests in common with their employers, and ready at any moment to obtain fresh conquests by force or the show of force.

The great strike of last fall did not originate in any distress of the mining population. It did not originate with the common laborers, but with the miners, who were getting the highest wages. It was part of a deliberate plan to conquer once for all the anthracite business—and this was part of a wider and wilder plan, to rule the country, in spite of law and justice, by a comparatively small minority of its laborers, arrogating to themselves the title of representing "labor." A reaction was setting in; the workmen themselves were losing their allegiance to their deluded and deluding leaders. A demonstration of some kind was required; and the anthracite region furnished in many respects a promising field. The plan was to make a sudden demand upon the operators of the Lehigh region, and enforce it with a strike, to the support of which the miners of the other regions were expected to contribute. Then after the Lehigh collieries had been forced to yield, the Schuylkill and the Wyoming regions were to be attacked in succession in the same fashion. The Wyoming miners did not heartily co-operate with their contributions, and the strike was apparently doomed to swift failure. For the Lehigh operators, knowing that to yield was ruin, resolved unanimously to resist. But, unfortunately, the great Reading Company, occupying the Schuylkill region, was just in the throes of reorganization after previous disasters, and could not afford to imperil its existence by the complications of a labor conflict. Accordingly Mr. Corbin made a written agreement with the organization to which his miners belonged, that the Reading Company would grant the advance of wages demanded until January 1st, on condition that if no similar advance should be given before that time in the other coal regions the men should return to the former scale of wages with the New Year. This unfortunate bargain made it directly the interest of the Schuylkill miners to support the Lehigh strike; and it was evident at once that no settlement could be reached before the end of the year. That period has now passed; the Reading miners have repudiated their solemn contract, after enjoying all the benefits of it; and public sympathy is again invoked for the causeless and fruitless suffering which will result.

They talk about arbitration; but how can arbitration be introduced with parties who do not keep faith! Arbitration has been tried in the coal regions before. When the arbitrator decided in favor of the miners, the employers submitted. Then the miners made a new demand, and the arbitrator decided that it was unreasonable, whereupon the miners rebelled. The simple truth is, that in this case, and in many, though not all, others of recent times, the impelling spirit is that of the highwayman; the appeal is to brute force; the cry is, "We have the power; we will not argue the case; stand and deliver!" And the answer must be as plain: "You have not the power you fancy; you shall not rob and terrorize the individual or the community; and until this fundamental issue is settled, all other questions shall wait. Improvements in social conditions are important; but the defense of simple liberty and justice is supreme!"

Alas, that newspapers and politicians—and clergymen—should be engaged in obscuring this plain situation!

THE FOUNDATION PRINCIPLES OF PROGRESS.

Christianity is especially set to guard the principles on which all progress toward the elevation of mankind is founded.

These principles have been admirably stated by Hon. Abram S. Hewitt, now Mayor of New York, as follows:

"The three cardinal and unchangeable facts of humanity are the individual, the family and society. There is and can be no other basis for government or religion. The fundamental characteristic of the individual is personal liberty; of the family, love; and of society, justice!"

Liberty, love and justice! These three abide; and we might add, the greatest of these is Love, for it really includes the other two. The philanthropy which destroys liberty on the one hand, or distorts justice on the other, is spurious. For love must seek, not the temporary pleasure, but the highest good of its objects. The liberty of every man is bounded by the liberty of every other. Within these boundaries it is sacred. To protect it is the highest function of government. This protection involves the maintenance of order. But order may be maintained by tyranny. Hence we must go a step further, and require that kind of order which secures liberty—namely, justice. Justice comprises the protection of the individual, and hence of the community, against

violence and against fraud. In the sphere of justice all men should be equal—equally entitled to protection, equally bound to keep their word, equally able to invoke the aid of the law to exact the keeping of promises made for due consideration to them.

That these principles are fundamental our constitution expressly declares in the safeguards which it provides for personal liberty, the rights of property, and the obligation of contracts. Unless civilization be a failure, and all progress a chimera, then this much is settled; that anything which proposes to remedy real or supposed evils by impairing either liberty or justice is a step backward, not forward.

Now, such proposals are rife in our day. It is seriously declared that the so called laboring classes are to be elevated *en masse* by destroying the freedom of the individual to work where, for whom, and at what rate he pleases. Workingmen are exhorted to make voluntary abdication of this liberty; those who will not do so are terrorized or assaulted; employers who assert their corresponding rights as free men to make contracts with free men are "boycotted." The violation by the laborer of a contract so made is lauded as a resistance to oppression. It is even declared to be his duty to inflict violence and loss upon parties in no way connected with his dispute; to spread distress throughout the community by way of coercing a summary concession of his claims; nay, even when he has no complaints, he is urged to use all these terrible forces for the simple purpose of punishing those of his fellow-laborers who will not become subjects of the central, secret, irresponsible tyranny he has set up, or who, having once sworn allegiance to it, fail to pay their dues, upon which its salaried officers live.

Along with this voluntary suicide or violent assassination of liberty, we hear noisy assaults upon the existing forms of justice. All property is robbery; wage-receiving is slavery; the police are not the ministers of order but the myrmidons of despotism. We must have socialism, communism, anarchy, beginning with impartial, indiscriminate murder, that the reign of true brotherly love may come in.

Now, is there no special reason at this time for such outcry? Are all these labor troubles imaginary, the result of wild harangues and criminal conspiracies? Certainly not. There is hardship, though mostly not where the greatest tumult appears.

There has been from 1873 to the present time, with but slight and temporary relief, a peculiar commercial depression throughout the civilized world. The tariff, too many silver dollars, too few silver dollars, intemperance, taxation, the surplus, the banks, the extortions of capital, the extortions of labor, superabundant harvests, deficient harvests, Republican mismanagement, Democratic mismanagement—do not explain it. It has affected most severely the most enterprising nations. And it is unquestionably the result of one chief cause, namely, the sudden destruction of some occupations, and the sudden revolution in nearly all, produced by the cheapening of production and transportation, the opening of new sources of supply, the substitution of new materials and new processes and machinery for old—all resulting from the rapid extension of labor-saving inventions. An admirable summary of this great change will be found in the series of articles by Hon. David A. Wells, in the *Popular Science Monthly*, particularly the second of the series, published last August. I will give but a few typical examples:

The Suez Canal, opened in 1869, gave "the death-blow to sailing vessels." According to some authorities, 2,000,000 tons of shipping previously employed in the East Indian trade, were virtually destroyed at once. The work of commerce with India began to be carried on by steamers, a great number of which were built in 1870 to 1873. But these were nearly all made useless within three years by improvements in marine engines; and since 1876 these improved steamships have been discarded in favor of still better ones, saving some 20 per cent in fuel consumption. All these changes ruined many capitalists, and threw many employes out of work.

Again, the reduction of the voyage to India from 6 or 8 months to less than 30 days, and the establishment of telegraphic lines to the East, have destroyed completely the warehousing and distributing system which made London the center of the commercial world. Similar effects have been produced, or are in progress, upon the Australian wool crop, which was formerly shipped to England, and even upon the foreign market for American wheat.

Before 1875 steamships did not compete seriously with sailing vessels for bulky freights. They had to carry too much coal. Now they are larger, run more cheaply, and are fast monopolizing the sea. The number of men employed in ocean commerce has been reduced more than one half per weight carried and ocean freights.

The extension of railways and the introduction of the Bessemer process by which steel rails can be cheaply made, has cheapened land transportation to a still greater extent, so that the rich fields of Dakota and Manitoba and the cattle on the plains of the West have come into the markets of the world. The land question, which underlies all other troublesome questions of the day in England, has been raised by the invention of Sir Henry Bessemer, more than by any other one cause.

But cheap steel and steam have had much wider effects than this. The most stable measure of value known to mankind for centuries had been, that a day's labor was worth a bushel of wheat. To day, on the plains of Dakota, machinery is applied to agriculture to such an extent that one day's labor of one man produces more than 15 bushels of wheat. All industries show a similar though a smaller increase. In short, the average amount of labor required in civilized countries to produce a given product is less to-day by at least 40 per cent than it was a score of years ago.

I might go further, and show how petroleum has destroyed the former manufacture of illuminating liquids, from whale oil up; how the former cultivation of madder has been killed by the production of an artificial substitute, and so on. But I have said enough to show what a stupendous rias of changes has taken place.

These changes have come suddenly, and all together. It is indeed a marvel that they have not produced greater disturbance. For the world is poor, as a whole. It has hitherto eaten and worn and used up nearly all that it annually produced. It could not, we might infer, afford to have its ships, buildings, machines and business arrangements swept away, and to be practically ordered to begin again.

Yet society has endured this revolution, and found it beneficial on the

whole. Nothing is more certain than this, that the wages of labor have increased, while the cost of living has decreased. Moreover, the rate of interest has fallen, a sure sign that the profits of capital are not greater than formerly.

The chief attendant hardships have been so-called over-production and consequent dullness of trade, and the presence of surplus labor, unemployed. Mr. Wells shows clearly that these and other evils, often cited as causes of depression, are in reality results of the overwhelming cause outlined above. They are incidental to the process of readjustment which must go on. No device of legislation or organization will evade this necessity—most of them simply enhance and prolong the trouble. For if capital must engage in new enterprises and men must find new employments, the imposition of fresh burdens upon capital and of fetters upon individual men must directly hinder the process. Legislative remedies are worse than useless. When the surface of water has been disturbed and is seeking its level again, you can not hurry or help it with a paddle.

We hear sometimes that the next step of progress will be the ownership by the laborer of the tools, machinery, and plant of manufactures and trade. This would be a good thing in many occupations, and a bad thing in others. But it is in any event not a thing to be forced upon the laborer against his will. If "labor" had owned the property destroyed within the past fifteen years by the progress of the arts, the world would be full of outcry about its wrongs. And if a laborer, fearing such changes and losses yet to come, prefers to make a bargain which gives him definite wages and relieves him from the risks of losses, he should be free to make it, and bound to keep it.

The best way in which a poor man can become an owner in a large business is through the principle of incorporation, with limited liability. This has been done to an immense extent. Stocks of our great corporations are held by hundreds of thousands of small owners who have invested in them their savings. But the fashionable philanthropy of the day denounces corporations as iniquitous, and no officer of a corporation, striving to discharge his duty to its stockholders, is exempt from fierce and slanderous attack.

The principle of association, whether of capital or of labor, is good and necessary; but it is a power in the state which needs to be closely watched. Associated capital we do watch, restraining it by law and by public opinion. But associated labor may also become a menace to liberty and justice. *All associations must be voluntary, open and responsible.* And no association, whether of capital or of labor, should be allowed for one moment to stand beyond the reach of law. The most pressing problem of the hour is to make the laborer's contract free and then to make it binding. Solve this; and time will solve the rest. Neglect this, and your social reform, founded upon iniquity, will topple into chaos.

SEMI-ANNUAL REVIEW OF THE NITRATE MARKET.

Mr. F. B. Nichols, in the *Oil, Paint and Drug Reporter*, reviews the nitrate of soda market covering the last six months of 1887. Concerning the movement of nitrate during that period, he says that the market was flat in July, and depressed by an increasing stock with sales at 1'75c., continuing without improvement until September, when, with the help of a good demand, the price was carried to 1'85c. A reaction from the heavy purchases of the previous winter and spring of stock to arrive on spread charters furnished another opportunity to control the spot market, and in October and November a speculative movement carried the price in store up to 2'4c. Later, however, offerings ex vessel induced a fall to 2'05c. The forward business revived in the summer and started at 1'85c., but owing to the European demand for low-grade to supply next spring's agricultural wants, Valparaiso was strong and orders for refined were filled with difficulty even at 2c.; but later shipments fell off in prices and buyers were cautious.

The European demand was stimulated in July by the small stock of 18,000 tons, against 75,000 in 1886 and 89,000 in 1885. The consequence of this demand, however, is a production now of fifteen millions of quintals per annum, an increase of fifty per cent on the syndicate agreement. It is a question whether the world can absorb this production, even though the best industry should equal expectations. There would not be so much doubt if the syndicate had used its available funds, as so many of the producers desired, for a propaganda to increase its use in agriculture in this country in the same manner as it made liberal appropriations in Europe with success.

The deliveries at Atlantic ports were 93,542 bags more in the last half of 1886 than in the first six months. In 1887, the deliveries in the last half were 245,584 bags, against 224,476 in the first, making an evident increase of more than 40 per cent in the consumption in 1887 over that of the year ending July, 1886. The shipments to the United States were 550,000 bags (of which 15,000 are distressed), against 522,750 in 1886, 270,323 in 1885, and 437,234 in 1884. The stock to arrive includes charters for March, which makes the visible supply, so far, to July. The quantity to arrive at Atlantic ports is 239,000 bags, against 238,500 at the same time in 1886, and 73,500 the year before. The total visible supply is 301,940 bags, against 311,266 at this time in 1887, 160,791 in 1886, 189,154 in 1885, 267,300 in 1884, and 240,450 in 1883.

The arrivals, deliveries and stocks at the Atlantic ports for the past ten years have been as follows:

| | 1887. | 1886. | 1885. | 1884. | 1883. |
|--------------------------|---------|---------|---------|---------|---------|
| Imports | 483,862 | 398,293 | 270,303 | 437,234 | 360,610 |
| Deliveries | 470,060 | 412,618 | 314,186 | 388,384 | 367,175 |
| Stocks December 31st.... | 62,940 | 72,766 | 87,911 | 121,154 | 72,304 |
| Average price..... | 2'07c. | 2'23c. | 2'20c. | 2'4c. | 2'6c. |
| | 1882. | 1881. | 1880. | 1879. | 1878. |
| Imports | 428,611 | 381,112 | 225,414 | 167,312 | 196,820 |
| Deliveries | 384,533 | 372,361 | 234,413 | 212,320 | 156,784 |
| Stocks December 31st.... | 78,869 | 34,761 | 26,040 | 35,039 | 80,047 |
| Average price..... | 2'4c. | 3'4c. | 3'6c. | 3'4c. | 3'4c. |

The quantity to arrive in Europe is 2,487,500 bags, making the visible supply there 2,927,500 bags, against 2,070,000 in 1887, 2,400,000 in 1886, 2,550,000 in 1885, 2,760,000 in 1884, and 1,968,000 in 1883.

The shipments from the West Coast to all ports were in 1887, 5,115,000 bags; 1886, 3,181,500 bags; 1885, 3,198,000 bags; 1884, 4,074,000 bags; 1883, 4,420,000 bags; 1882, 3,720,000 bags; 1881, 2,415,928 bags; 1880, 1,649,820 bags; 1879, 1,144,000 bags; and 1878, 2,340,767 bags.

THE GLACIERS OF ALASKA.*

The glaciers of Alaska discovered up to the present time are all of the Alpine type, except certain masses of buried ice of ancient date, which are probably remnants of accumulations that were formerly of great extent. All the true glaciers are confined to the Southern portion of the territory, and evidently depend on topographic conditions for their geographic distribution. The mountains of Alaska occur mostly along its southern border, attaining their greatest elevation in the St. Elias Alps, distant less than twenty miles from the ocean. The entire Pacific border of Alaska is described by all who have explored it as being extremely rugged and mountainous. The same bold topography characterizes the Alaskan Peninsula and is continued in the Aleutian Islands, which are in reality the peaks of a submerged mountain range. Northward of the imperfectly known Alaskan mountains which traverse the territory in an easterly and westerly direction. The country is mostly low and not occupied by permanent snow or ice, except in the case of certain buried ice-masses to be mentioned further on. The glaciers of Alaska occur in valleys and gorges amid the mountains, in the same manner as in similar localities in the Sierra Nevada, Rocky Mountains, etc.; but they are of vast dimensions, owing to the high latitude at which they occur and the abundant precipitation of the region.

The principal stream in the vicinity of Sitka is the Stikine (Stikine), which rises in the Blue Mountains, opposite the headquarters of the Mackenzie, and flows in a general southeasterly direction parallel with the coast until it breaks through the mountains east, and a little north, of Sitka. When the snows are melting the river becomes much swollen, and is then navigable with difficulty by small steamboats for about 125 miles above its mouth. The valley is generally narrow and the river is not bordered by a great breadth of alluvial land.

In descending this river one glacier after another comes into view. All of them are upon the right bank of the stream and descend from the inner slope of the mountain range. There are four large glaciers and several small ones visible within a distance of 60 or 70 miles from the mouth.

The accompanying pictures of the Bernardo and Orlebar glaciers, which we have introduced as illustrations of the wonderful glacier scenery of the Stikine River, are direct reproductions from photographs taken by Mr. E. Dossetter, under the direction of Lieut.-Col. J. W. Powell, Superintendent of Indian Affairs of British Columbia. The photographs were kindly placed at the service of the Geological Survey by the Director of the American Museum of Natural History.

Along the shore of the mainland north of the mouth of the Stikine River (approximate latitude 56° 40') glaciers are reported as occurring on the coast east of Admiralty Island, and will probably be discovered along the Taka River, which, like the Stikine, breaks through a mountainous region near the coast. A number of glaciers, some of which are of great size, occur along the precipitous shores of Glacier Bay and Lynn Canal.

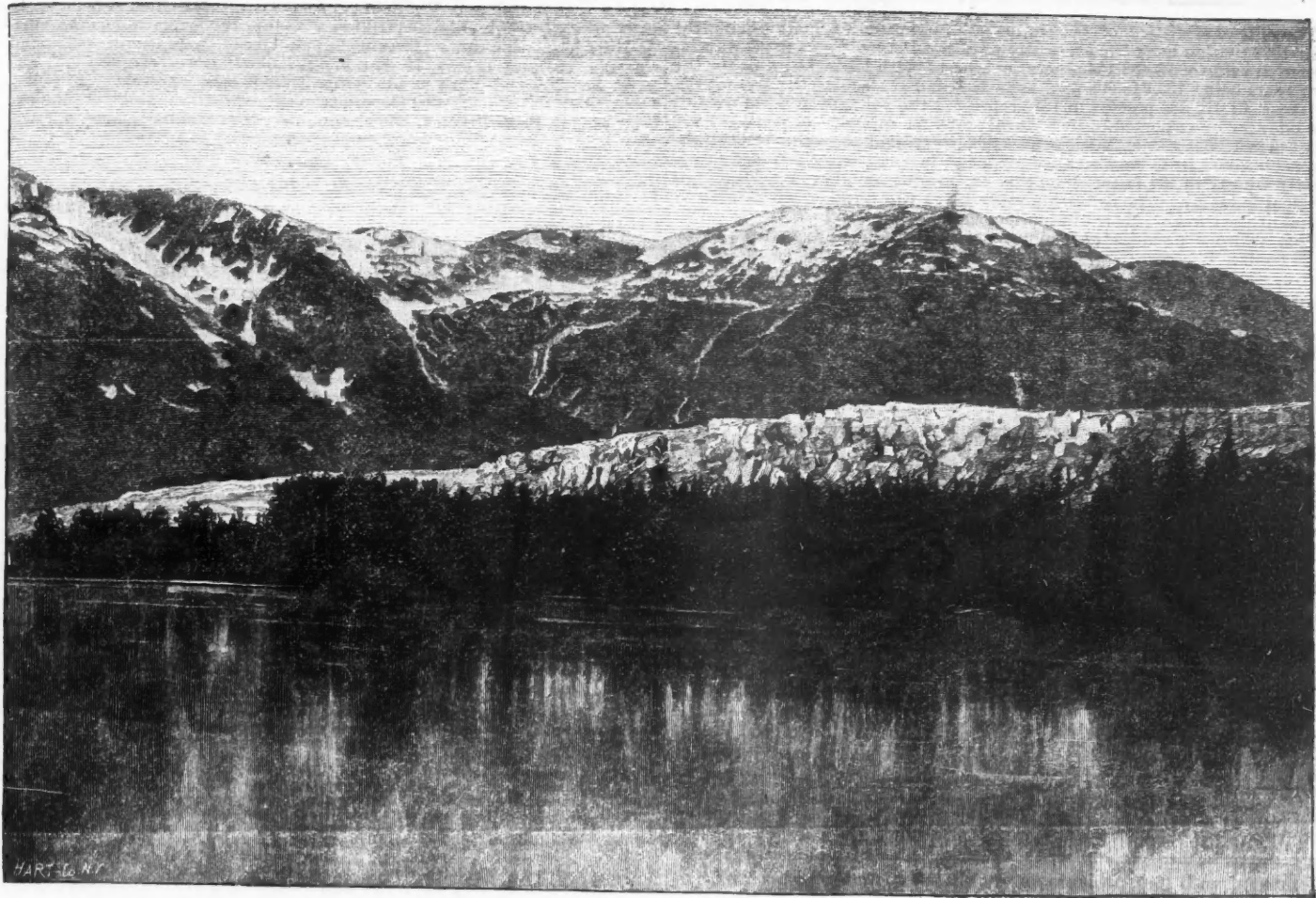
Nearly all the glaciers reported are near the coast; in fact, the greater part were discovered from the decks of vessels. When exploration is carried inland with the thoroughness and accuracy that characterize Dall's survey of the coast, it can not fail to extend greatly our knowledge of glacial phenomena. A thorough exploration of the St. Elias Alps is especially important in this connection, and this has been partially made by Lieutenant Schwatka for the *New York Times* in 1886.

In writing on present glaciation in Alaska, Dall has called attention to the great differences in the character of the ice masses observed by him during nine years of exploration. To use his own words: "These might be classed under several heads: As plateau ice, filling large areas of depression and without motion as a whole, but when sufficiently accumulated, overflowing the edges of its basin in various directions; as valley ice, filling wide valleys of gentle incline both as to their axes and their lateral slopes, producing masses of ice moving in a definite direction, but without lateral and sometimes without terminal moraines; as ice-cascades, formed in sharp, narrow ravines of very steep inclination, usually without well-defined surface moraines; as typical glaciers, showing *névé* and lateral and terminal moraines; and lastly, as *effete* and fossil glaciers, whose sources had become exhausted, whose motion had therefore ceased and whose lower portions had become smothered by the accumulations of non-conducting *débris*. The very existence of one of these last remained unknown for half a century, though the plateau under which it is buried had been described and mapped by explorers.

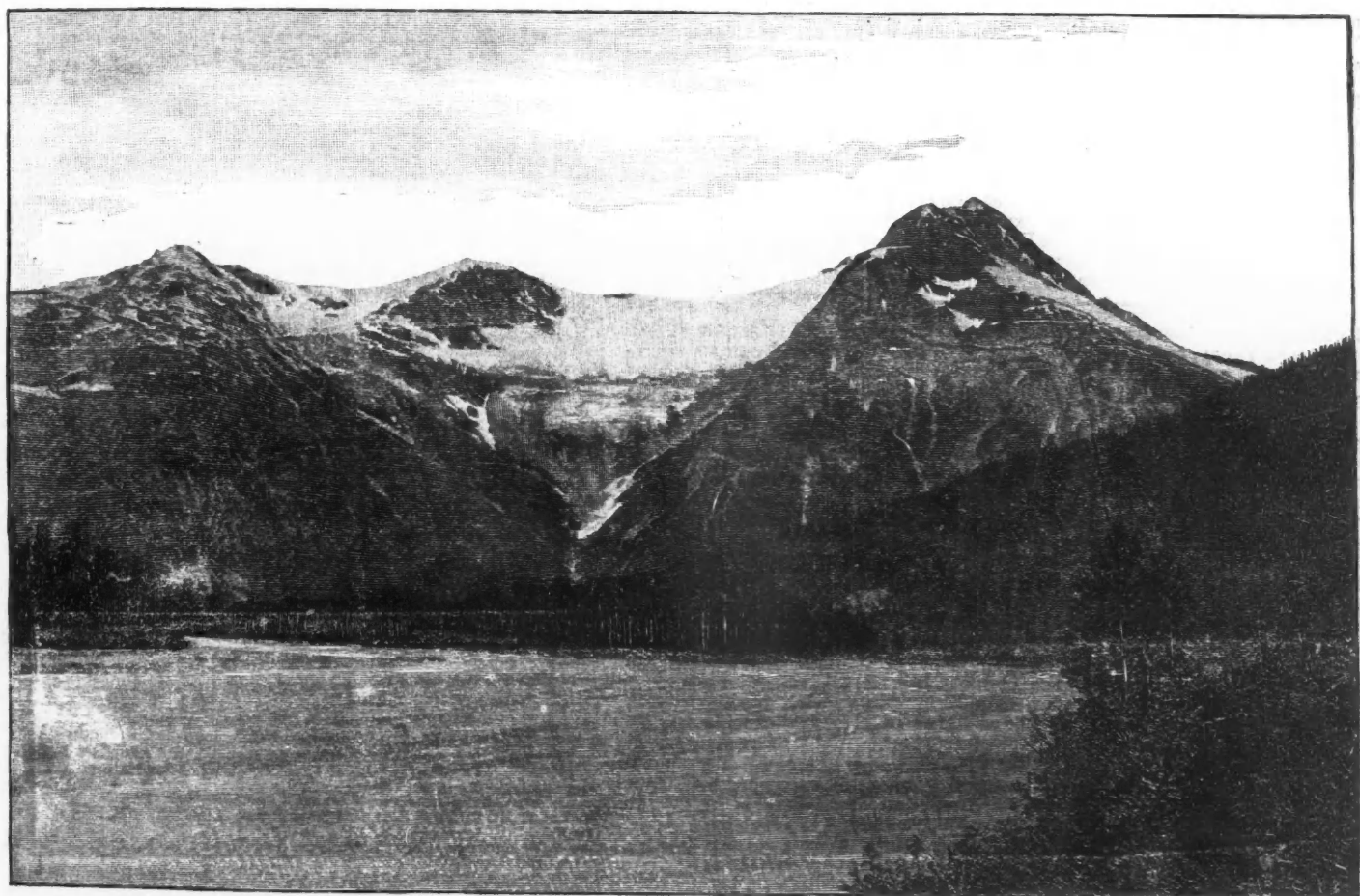
"Another form under which ice appears in Alaska is that of solid motionless layers, sometimes of great thickness, interstratified with sand, clay, etc. This formation, in which ice plays the part of a stratified rock, extends from Kotzebue Sound, on the west coast of Alaska, at the Arctic Circle, where the greatest known thickness of the ice lays, about three hundred feet, has been noted, round the Arctic coast, probably to the eastern boundary. In Kotzebue Sound the ice is surmounted by about forty feet of clay, containing the remains of fossil horses, buffaloes (*Bostatifrons*, etc.), mountain sheep, and other mammals. Farther north the ice is covered with a much thinner coat of mineral matter or soil, usually not exceeding two or three feet in thickness, and rarely rising more than 12 or 15 feet above high water mark on the sea coast. Its continuity is broken between the Kotzebue and Icy Cape by the rocky hills composed chiefly of carboniferous limestones, which bear no glaciers and do not seem to have been glaciated. The absence of boulders and erratics over all this area has been noted by Franklin, Beechy, and others who have explored it."

Report on the Mineral Resources of Burma.—It is reported that the Indian Government intends sending a number of mining engineers to Burma to report upon the mineral resources of the country, particularly iron and coal. A good addition to the staff would be some American engineers familiar with our gold and silver ores, and with natural gas and petroleum. Lord Dufferin is so exceptionally able and practical, such a suggestion made to him might receive attention.

* Abstract from the Fifth Annual Report of the United States Geological Survey.



ORLEBAR GLACIER, STICKINE RIVER, ALASKA.



BERNARD GLACIER, STICKINE RIVER, ALASKA.

MINERAL PRODUCTION OF SPAIN AND CUBA IN 1886.

The official statistics of the mineral production of Spain during the year 1886 which have been recently published show for that year an increase in value of 13,433,154 pesetas, compared with 1885, the totals for the two years being 135,642,808 pesetas in 1886 and 122,209,653 pesetas in 1885. Of these, 31,476,833 pesetas in 1886 represent the value of mineral used in the country or exported in its natural state as mined, while 104,167,974 pesetas in 1886, against 91,005,836 in 1885, represent the value of the products obtained from treatment of ores, the increase over 1885 being thus nearly wholly in the latter class; that is, mining combined with metallurgical industry. The following table gives the number of mines and metallurgical works, their production, value of product, etc.

Spot values are values at the mine or works. The peseta has a value of 20 cents:

MINERAL AND METAL PRODUCTION OF SPAIN IN 1886.

| MINERAL OR METAL. | Mines number. | Metal-works. | Men at mines. | Ores produced, metric tons. | Spot value of same, pesetas. | Ores treated, metric tons. | Metals, e. t. c., produced, metric tons. | Spot values of same, pesetas. |
|-----------------------|---------------|--------------|---------------|-----------------------------|------------------------------|----------------------------|--|-------------------------------|
| Iron | 526 | 33 | 13,682 | 4,166,946 | 14,247,509 | 392,030 | 57,728 | 12,436,583 |
| Steel | | 1 | | | | | 20,261 | 2,672,855 |
| Lead | 814 | 37 | 17,690 | 342,200 | 42,781,937 | 253,842 | 91,895 | 25,053,114 |
| Argentiferous lead | 86 | 14 | 2,258 | 25,246 | 4,685,786 | 73,837 | 11,047 | 4,128,140 |
| Antimonial lead | | | | | | | 280 | 70,240 |
| Silver, kilos | 15 | | 240 | 1,531 | 188,263 | 122 | 39,063 | 9,635,055 |
| Copper | 42 | 7 | 10,566 | 2,376,381 | 26,367,177 | 1,675,300 | 41,870 | 37,813,420 |
| Copper, argentiferous | 10 | | 37 | 51 | 320 | | | |
| Zinc | 84 | 5 | 1,785 | 39,810 | 1,145,929 | 9,787 | 4,327 | 2,377,020 |
| Quicksilver | 14 | 3 | 3,594 | 25,286 | 6,163,266 | 24,861 | 1,846 | 8,301,533 |
| Antimony | 2 | | 16 | 8 | 809 | | | |
| Cobalt | 3 | | 63 | 132 | 85,800 | | | |
| Manganese | 3 | | 49 | 400 | 7,275 | | | |
| Arsenic | | 1 | | | | 477 | 77 | 32,802 |
| Salt | 53 | | 569 | 124,851 | 1,674,120 | | | |
| Sulphate of soda | 6 | 2 | 19 | 3,155 | 18,275 | 1,605 | 325 | 32,500 |
| Barytes | 1 | 1 | 6 | 13 | 39 | 13 | 13 | 683 |
| Phosphorite | 8 | | 370 | 11,839 | 118,390 | | | |
| Soapstone | 1 | | 4 | 100 | 1,000 | | | |
| Fluor-spar | 1 | | 10 | 2,000 | 10,000 | | | |
| Alum | 6 | 4 | 92 | 7,000 | 17,500 | 7,000 | 560 | 70,000 |
| Sulphur | 28 | 12 | 935 | 45,669 | 1,866,590 | 45,231 | 9,041 | 1,135,567 |
| Coal | 502 | | 9,309 | 977,559 | 8,186,674 | | | |
| Lignite | 54 | | 497 | 23,873 | 395,119 | | | |
| Kaolin | 3 | | 31 | 946 | 28,940 | | | |
| Asphalt | 2 | 2 | 9 | 159 | 1,308 | 159 | 117 | 5,300 |
| Cement | | 9 | | | | | 31,945 | 405,222 |

Compared with 1885, an increase was shown in the output of the following ores: Iron ore, increase 233,648 tons; lead, 78,375 tons; argentiferous lead, 367 tons; copper, 177,256 tons; cobalt, 132; common salt, 7547; fluor-spar, 1980; sulphur, 7341; coal, 58,119, and kaolin, 66 tons.

The following showed decreases compared with 1885: Silver ores, 3326 tons; argentiferous copper, 3573 tons; zinc, 5699; quicksilver, 515 tons; antimony, 141 tons; manganese, 3645 tons; sulphate of soda, 35; sulphate of baryte, 137; soapstone steatite, 100; phosphorite, 7511; alum, 513; lignite, 2591, and asphalt, 125 tons.

The number of productive mines decreased by 6, while their area increased by 4179 hectares. The number of persons employed increased by 4293 men and 784 boys, and decreased by 90 women.

The number of accidents to the men employed showed a total of 2190, causing 112 deaths, an increase over 1885 of 311 accidents and 25 deaths. These

Mining on the Island of Cuba in 1886.—Accompanying the statistics for Spain are given those for the Island of Cuba. The island produced, in 1886, 2066 tons of asphalt, 112,755 tons of iron ore, 40 tons of manganese ore, and 45 tons of copper ore. The exports of mineral from Cuba were, in 1886: Iron ore, 112,755 tons to the United States; asphalt, 1403 tons to the United States and to England; copper ore, 45 tons to England; manganese, 40 tons to the United States.

Extensive gold-fields are said to exist on the Southern or Chinese side of the Amur Valley, and they only require a little American energy to increase the output considerably.

The Autographometer.—M. Floran de Villepigne has devised an instrument, the autographometer, which records automatically the topography and difference of level of all places over which it passes. It is carried about on a light vehicle; and those who wish to use it have nothing to do but to drag it, or have it dragged, over the ground of which they desire to obtain a plan.

Mining Operations in Chota-Nagpore, India.—*Indian Engineering* says: We glean from the Government Resolution on the Administration Report of the Southwest Frontier Division of Bengal for 1886-87 that the coal mines in Hazaribagh and Lohardugga continue to be extensively worked during the year, and operations for the extraction of copper and mica in Giridih were also extended.

Action of Alumina and Kaolin upon Calcium Chloride.—A. Gorgen. Calcium chloride, if mixed with alumina, kaolin or common clay, and melted at cherry-redness in presence of moist air, is gradually transformed into certain crystalline bodies soluble in dilute acids. For the present the author merely points out the existence of these bodies without entering into their composition.

The New Gas, Hydride of Nitrogen.—The discovery of a new gas is reported in Germany by Dr. Theodore Curtius, who has succeeded in preparing the long-sought hydride of nitrogen, amidogen, diamide, or hydrazine, as it is variously called. This remarkable body, which has hitherto baffled all attempts at isolation, is now shown to be a gas perfectly stable up to a very high temperature, of a peculiar odor—differing from that of ammonia—exceedingly soluble in water, and of basic properties. In composition it is nearly identical with ammonia, both being compounds of nitrogen and hydrogen.

A Big Meteoric Stone.—A huge stone, supposed to be of meteoric origin, was found near Middleburg, Fla., last week. It had been broken into several fragments by striking a stump, the larger one being buried out of sight. The other pieces were hot. One of them weighs 212 pounds, another 15, and others 10 and 5. It looks like iron ore, is dark, quite hard, and covered with small white transparent crystals. It will be forwarded to the Jacksonville sub-tropical exposition, and samples have been sent to Prof. Proctor, the astronomer, for examination.

BOOKS RECEIVED.

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

Tables for Calculating the Cubic Contents of Excavations and Embankments. Vol. II. By John R. Hudson, C. E. Published by John Wiley & Sons, New York, 1887. Pages 82; and Index. Price \$1.00.

PATENTS GRANTED BY THE UNITED STATES PATENT-OFFICE.

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

PATENTS GRANTED JANUARY 3D, 1888.

- 375,733. Amalgamator. Henry Cook, Philadelphia, Pa.
- 375,749. Permanent Magnet for Electrical Apparatus. Wm. Humans, Cambridge, Mass., Assignor to the American Magnetic Electric Company, Jersey City, N. J.
- 375,750. Armature for Magneto-Electric Machines. Wm. Humans, Cambridge, Mass., Assignor to the American Magnetic Electric Company, Jersey City, N. J.
- 375,751. Magneto-Electric Machine. William Humans, Cambridge, Mass., Assignor to the American Magnetic Electric Company, Jersey City, N. J.
- 375,760. Automatic Valve or Shut-off for Gas Mains. George W. McKenzie, Van Port, Pa.
- 375,761. Automatic Regulator for the Receivers of Air Compressors. David T. McKim, Cable City, Mont.
- 375,763. Device for Rolling Metallic Bodies to Spheroidal Forms. Chas. F. Tebbetts, Fitchburg, Mass.
- 375,784. Apparatus for Electric Welding. Elihu Thomson, Lynn, Mass.
- 375,791. Process of Casting Ordnance. John F. Allen, New York, N. Y.
- 375,808. Rock-Separating Apparatus for Mining Sluices. Lawrence A. Feuner, Virginia City, Mont.
- 375,815. Traction Engine. Martin E. Hershey, Harrisburg, Pa.
- 375,836. Welding Machine. Thos. T. Rowland, New York, N. Y.
- 375,837. Pressure-Regulator for Carbonic Acid Gas. Ethan A. Scott, San Francisco, Cal.; Elizabeth Adelaide Scott, Executrix of said Ethan A. Scott, deceased.
- 375,838. Brick-Kiln. Edmund Hair, Harrisonville, Mo.
- 375,874. Steam Engine Indicator. Albert L. Ide, Springfield, Ill.
- 375,889. Gunpowder-Mill Roll. Paul A. Oliver, Oliver's Mills, Pa.
- 375,896. 375,897. Lime-Kiln. Marcus Sayre, Montrose, N. J.
- 375,903. Apparatus for Distilling Wood. John Wilson, New York, N. Y., Assignor to the American Acetic Acid Company, Jersey City, N. J.
- 375,917. Composition of Metals. Halvor Berglin, Minneapolis, Minn.
- 375,920. Kiln for Drying Cement. Henry A. Bradley, New York, N. Y., Assignor of one half to John J. Gorman, same place.
- 375,927. Valve Gear. Henry R. Fay, Boston, Mass.
- 375,929. Air-Compressor. William I. Forster, Kansas City, Mo.
- 375,952. Covered or Insulated Wire or Conductor. Leonard F. Requa, New York, N. Y., Assignor by mesne assignments to the Safety Insulated Wire and Cable Company.
- 375,965. Apparatus for Lining Converters and Converter-Bottoms. Bruno Versen, Dortmund, Westphalia, Germany.
- 376,000. Process of Preparing Explosives. David Johnson, South Hempstead, County of Middlesex, England.
- 376,003. Hydrocarbon Furnace. Chas. H. Land, Detroit, Michigan.
- 376,010. Cover for Wells or Cisterns. Joseph S. Redline, Derris, Pa.

PATENTS GRANTED JANUARY 10TH, 1888.

- 376,071. Pipe Coupling. George H. Benjamin, New York, N. Y.
- 376,072. Electric Circuit Breaker. Wm. R. Cole, Detroit, Mich., Assignor to Parrish Bros. and the Peck Electrical Company, both of same place.
- 376,101. Pressure Regulating Valve. Franz Markgraf, New York, N. Y.
- 376,114. Nailing Machine. John P. Smith and Warren C. Evans, Exeter, N. H.
- 376,117. Lighting Gears by Electricity. Arthur D. Stevens, Minneapolis, Minn., Assignor of one half to Edgar B. Dillingham, same place.
- 376,120. Dynamo-Electric Machine. Elihu Thomson, Lynn, Mass.
- 376,130. Pipe Coupling. James Armstrong, Bridgewater, N. Y.
- 376,141. Air Compressor. George Chamberlin, Pittsburg, Pa., Assignor of one half to James Chamberlain and James J. Corcoran, both of same place.
- 376,145. Explosive derived from Phenol. Stephen H. Emmens, London, County of Middlesex, England.
- 376,167. Machine for Shaping Wrought Metal Cylinders. Frederick J. Seymour, Cleveland, Ohio, Assignor to the Brown's Seamless Metal Company, Jersey City, N. J.
- 376,168. Method of Making Guns and Ordnance. Frederick J. Seymour, Cleveland, Ohio, Assignor to the Brown's Seamless Metal Company, Jersey City, N. J.
- 376,172. Paving and Roofing Compound. Austin Walrath, Nevada City, Cal.
- 376,189. 376,190. Production of Sulphite Solutions. Adolph Frank, Charlottenburg, Prussia, Germany.
- 376,194. Process of Treating Low Steel. Haward A. Harvey, Orange, N. J., Assignor to the Harvey Steel Company, of New Jersey.
- 376,208. Nail-Making Machine. Freeborn F. Raymond, Newton, Mass.
- 376,222. Die and Die Holder for Drawing. Winslow Alderdice, Akron, Ohio, Assignor to the Akron Iron Company, same place.
- 376,224. Method of and Machine for Making Nut Blanks. Seward S. Babbitt, Union Town, Pa., Assignor to John B. Skinner, Chicago, Ill.
- 376,248. Battery Zinc. John Beattie, Jr., Fall River, Mass., Assignor to the Beattie Battery Zinc and Electric Company, same place.
- 376,275. Sectional Steam Boiler. Richard Ponnay, Chicago, Ill., Assignor of two thirds to Charles H. Smith and John Hewitt, both of same place.
- 376,280. Process of Making Artificial or Elastic Bitumen for Paving. Heinrich Busse, Linden, vor Hanover, Prussia, Germany.
- 376,290. Composition of Matter for Paving. Heinrich Busse, Linden, vor Hanover, Prussia, Germany.
- 376,296. Stone Dressing Machine. Uriah Cummings, Buffalo, N. Y.
- 376,313. Gas-Pressure Regulator. Moses W. Kidder, Lincoln, Assignor to Person Noyes, Lowell, Mass.
- 376,351. Apparatus for Making Ammonium Sulphate. William Simpkin, Richmond, Va.
- 376,357. Water-Wheel. James N. Weeks, Warren, N. Y.
- 376,391. Inermittent Grip for Fan-Blowers or Other Machines. Jacob F. Bender, Columbia, Assignor of one half to Potts & Weber, Lancaster, Pa.
- 376,366. Process of Obtaining Potassium Carbonate. Ferdinand Brütjes, Leopoldshalle, Prussia, Germany.
- 376,401. Flexible Piping. Francis M. Wilder and George H. Benjamin, New York, N. Y.
- 376,402. Rail Joint. George H. Williams, Nashville, Tenn.
- 376,408. Machine for Counter Boring and Tapping Nuts. John Gielow, Chicago, Ill.
- 376,409. Process of Making Alkaline Silicates and Carbonates. Adolf Kayser, Buffalo, N. Y., Assignor of two thirds to Horace Williams and Albert B. Young, both of same place.
- 376,410. Process of Making Alkaline Silicates. Adolf Kayser, Buffalo, N. Y., Assignor of two thirds to Horace Williams and Albert Young, both of same place.
- 376,417. Barb Wire Machine. Chas. D. Rogers, Providence, R. I., Assignor to the American Screw Company, same place.
- 376,418. Chas. D. Rogers, Providence, R. I., Assignor to the American Screw Company, same place.
- 376,421. Method of Treating Iron or Steel. Edwin D. Wassell, Pittsburg, Pa., Assignor to Ann Isabella Wassell, same place.

THE METALLURGY OF STEEL.*

By Henry M. Howe.

(Continued from page 489.)

Table 58 does not include almost incredible results such as Schafhäütl's, (he found from .18 to 1.20% nitrogen in iron) which are readily explained by the great difficulties in the determination of this element. The analytical results in lines 2 to 7, obtained by four distinguished observers, by five different methods, most of them with elaborate and effective precautions, agree as closely as do the quantities of other elements (e. g. phosphorus, manganese, etc.) found by unquestionable methods in different specimens of iron. Confirmed as they are by the discovery of similar quantities of nitrogen by the wholly independent methods of heating in vacuo and of boring under water, they leave little or no doubt that commercial irons ordinarily contain minute quantities of nitrogen, rarely exceeding say 0.04%.

Stuart and Baker^a thought they had proved that nitrogen was rarely present in iron. Seeking it in many specimens by attempting to convert it into ammonia through heating them to full redness in hydrogen, they found in

the great majority of cases absolutely no nitrogen, in only two cases over 0.0051% and in only one as much as 0.015%. (I here exclude their preliminary and distrusted results.) The evidence of its existence is, however, so powerful that the results obtained by these experimenters tend rather to disprove the value of their method than the presence of nitrogen, for it is by no means certain that, at so high a temperature as they employed, hydrogen would convert the minute quantity of nitrogen present into ammonia. Bouis' observation that this method acts only superficially, and cannot be employed quantitatively unless the metal be very finely divided or the process very long continued, accords with this view.

§ 173. NITROGENIZED IRON.—Berthollet and after him several others, notably Depretz and Frémy, observed that iron was altered in appearance by being heated in a stream of ammonia. It absorbs nitrogen, but not hydrogen as proved by Frémy, becomes white, brittle to friable, much lighter (its specific gravity occasionally falls to 5), less readily attacked by air or moisture, easily and permanently magnetizable, and acquires a brilliant fracture; the nitride of iron thus formed, which is reported to be of definite composition, is not decomposed by a red heat, nor attacked by oxygen except at high temperatures, but is readily decomposed at a gentle heat by dry hydrogen with formation of ammonia and pure iron.^b

* Copyright by the Scientific Publishing Company, 1887.
 ^a Journ. Chem. Soc., XVII., p. 390, 1864.

^b Frémy, Comptes Rendus, LII., p. 323, 1861; Percy, Iron and Steel, p. 53.

TABLE 56.—GASES EVOLVED FROM IRON WHILE HEATED IN VACUO.

| Number. | Observer. | Description of metal. | Treatment previous to heating in vacuo. | | Evolution of gases in vacuo. | | | | | | | | | | | | | |
|---------|-----------|---|---|-------------------------|---------------------------------|----------------------|-----------------------------|--------|-------|-------|-------------------|--|--------|-------|------|-------------------|----|---------|
| | | | Heated. | | Conditions of heating in vacuo. | | Composition of gas evolved. | | | | | Volume of gas evolved per volume of metal. | | | | | | |
| | | | No. of hours. | In atmosphere of | At temperature of | Hours. | Temperature. | CO. | H. | N. | CO ₂ . | O. | CO. | H. | N. | CO ₂ . | O. | Total. |
| 1 | T.A.H. | Spiegeleisen..... | | Not previously treated. | | 800° | 0 | 91.5 | 8.5 | 0 | 0 | 0 | 0.38 | 0.055 | 0 | 0 | 0 | 0.42 |
| 2 | P. | White cast-iron..... | 3 | " | " | Low red. | 17.87 | 81.10 | 0± | .94 | 0 | .35 | 1.62 | 0± | .018 | 0 | 0 | 2.00 |
| 3 | " | Gray "..... | 6.5 | " | " | " | 2.32 | 84 | 6.88 | 6.80 | 0 | .04 | .68 | .13 | .136 | 0 | 0 | 2 |
| 4 | " | " | 2 | " | " | " | 5.20 | 89.7 | 3.25 | 1.60 | 0 | 1.09 | 18.8 | 0.68 | 0.34 | 0 | 0 | 21 |
| 5 | " | " | 24 | " | " | Good red. | 7.70 | 91.2 | 0± | 1 | 0 | 1.46 | 17.38 | 0± | 0.19 | 0 | 0 | 19 |
| 6 | " | " | 76 | " | " | Red to white. | 42.97 | 57.02 | | | 0 | 54.84 | 72.76 | | | | | 127.6 |
| 7 | " | " | 52.75 | " | " | White. | 52.75 | 47.21 | | | 0 | 65.19 | 58.31 | | | | | 123.5 |
| 8 | " | " | 36 | " | " | Rising to high. | 17.56 | 82.54 | | | 0 | 15.95 | 74.95 | | | | | 90.80 |
| 9 | " | " | 59 | " | " | Rising to full heat. | 24.44 | 75.55 | | | 0 | 47.50 | 146.30 | | | | | 194.3 |
| 10 | " | " | 165 | " | " | " | 39.70 | 60.29 | | | 0 | 135 | 205 | | | | | 340 |
| 11 | T.A.H. | Charcoal..... | 190 | Hydrogen. | White. | 800° | 16.76 | 74.07 | 5.58 | 3.59 | 0 | .04 | .18 | .014 | .009 | 0 | 0 | .24 |
| 12 | P. | Gray "..... | 24 | " | Bright red | 800° C. | 9.09 | 90.90 | | | 0 | .30 | 13.4 | | | | | 22 |
| 13 | " | " | 2 | " | " | " | 2 | 89 | | | 0 | .02 | .63 | | | | | .67 |
| 14 | T.A.H. | Charcoal..... | 48 | Carbonic oxide | 800° C. | 800° C. | 2.36 | 94.42 | 3.22 | 0 | 0 | .016 | .02 | .01 | 0 | 0 | 0 | .24 |
| 15 | " | Cast steel..... | 48 | " | " | " | 56.98 | 8.87 | 4.15 | 0 | 0 | .02 | .02 | .007 | .003 | .001 | 0 | .031 |
| 16 | " | " | 48 | " | " | " | 63.65 | 22.72 | 11.36 | 2.27 | 0 | .013 | .002 | .007 | 0 | 0 | 0 | .112 |
| 17 | " | " | 48 | " | " | " | 11.53 | 82.05 | 6.42 | 0 | 0 | .029 | .012 | .006 | 0 | 0 | 0 | .047 |
| 18 | P. | Soft steel..... | 2 | Not previously treated. | " | 800° | 24.35 | 52.61 | 6.49 | 16.55 | 0 | 3.16 | 6.83 | .84 | 2.15 | 0 | 0 | 13 |
| 19 | " | Bessemer steel..... | 60 | " | " | 1000± C. | 52.8 | 45.6 | 1.6 | 0 | 0 | 37.22 | 32.15 | | 1.12 | 0 | 0 | 70.5 |
| 20 | Z. | Soft open-hearth steel..... | | " | " | " | 7.9 | 57.3 | 34.7 | 0 | 0 | .43 | 3.12 | 1.89 | | | | 5.45 |
| 21 | " | Puddled iron..... | | " | " | " | 44.07 | 24.5 | 31.42 | 0 | 0 | 2.18 | 1.21 | 1.55 | | | | 4.95 |
| 22 | P. | Wrought-iron..... | 2 | " | " | " | 34.26 | 54.1 | 1.72 | 9.92 | 0 | .68 | 1.08 | .08 | .19 | 0 | 0 | 2 |
| 23 | G. | " wire..... | 2 | " | " | " | 67± | | | | 0 | 5.29 | | | | | | 7.94 |
| 24 | " | " | 1 | " | " | " | | | | | 0 | | | | | | | 7.27 |
| 25 | " | " | 7 | " | " | " | | | | | 0 | | | | | | | 12.55 |
| 26 | " | " | 4 | " | " | " | 52.7 | 30.4 | 11.5 | 5.2 | 0 | 1.39 | .80 | .30 | .13 | 0 | 0 | 2.66 |
| 27 | " | Horse-shoe nails..... | 4.5 | " | " | " | 4.46± | 85.68± | 9.86± | 0 | 0 | 0.12 | 2.44 | 0.28 | | | | 2.85 |
| 28 | " | Meteoric iron..... | 2.5 | " | " | " | | | | | 0 | | | | | | | |
| 29 | C. | Electrolytic iron (0.26% hydrogen)..... | | " | " | " | | | | | 0 | | | | | | | 236@248 |
| 30 | T.A.H. | Wrought-iron..... | 190 | Hydrogen. | 800° C. | 800° C. | 58.88 | 23.78 | 5.95 | 11.89 | 0 | .167 | .068 | .017 | .084 | 0 | 0 | .286 |
| 31 | " | same as No. 30. | 48 | " | " | " | 4.31 | 71.94 | 13.75 | 0 | 0 | .009 | .154 | .051 | 0 | 0 | 0 | .214 |
| 32 | P. | " | 34.5 | " | " | " | | | | | 0 | | 10.5 | | | | | 10.5 |
| 33 | G. | " Wire, same piece as No. 26..... | 1 | " | " | " | 8 | 92 | | | 0 | 0.04 | 0.46 | | | | | 0.50 |
| 34 | " | " | 2 | Carbonic oxide | " | " | 89.9 | | | | 0 | 4.15 | | | | | | 4.59 |
| 35 | P. | " | 68 | " | " | " | 100 | | | | 0 | 3.2 | | | | | | 3.2 |
| 36 | T.A.H. | same as No. 31. | 48 | " | " | 800° C. | 97.85 | 1.48 | 0.72 | 0 | 0 | .21 | .008 | .002 | 0 | 0 | 0 | .22 |
| 37 | R. | " | | " | " | " | 100 | | | | 0 | 10 | | | | | | 10 |

The iron from which gas was extracted was sometimes in its natural state, and had sometimes been previously heated in hydrogen or carbonic oxide. In no case is there evidence that, even after being heated in vacuo for many days, the escape of gas had wholly ceased; further heating would probably have extracted still more gas.

Troost and Hautefeuille thrice heated in vacuo cylinders of cast-iron, cast-steel and wrought-iron, each weighing 500 grammes, during 190 hours at 800° C., first in its natural state, next after heating during 48 hours in hydrogen at 800° C., and then after similar heating in carbonic oxide, examining the gas evolved at each heating. A similar cylinder of spiegeleisen was similarly heated in vacuo, but only in its natural state.

Graham similarly heated meteoric iron, horse-shoe nails and fine wrought-iron wire, 21 to 23 gauge, in vacuo in its natural state. Wire number 26, 33 and 34, which all refer to the same specimen, was heated in vacuo thrice, as in the experiments of Troost and Hautefeuille, i. e. first in its natural state till it seemed "nearly exhausted," then after heating and gradual cooling in hydrogen and free exposure to air "to get rid of any loosely attached hydrogen," and then after similar heating in carbonic oxide.

Parry performed similar experiments on iron sometimes in clean lumps, sometimes in borings.

1. Troost and Hautefeuille, Comptes Rendus, LXXX., 1875, p. 909. 2, 3 and 4. Parry, Journal Iron and St. Inst., 1872, II., p. 240. 5. Idem, 1873, I., p. 480. 6. Idem, 1874, I., p. 93. Temperature rose from red to white; iron unchanged in appearance. 7. Idem. 8. Idem, wrapped in platinum; temperature rose from dull red to "high heat." 9. Idem, wrapped in platinum. Temperature rose from red through full red to "full heat of furnace." 10. Idem, 1881, I., p. 189; during first 128 hours ratio carbonic oxide: hydrogen = 0.9, during last 36 hours = 0.213. 11. Troost and H., op. cit., LXXXVI., 1878, p. 568. Most of the carbonic oxide comes off in the first few hours; the hydrogen is retained more tenaciously. 12. Parry, op. cit., 1873, I., p. 480. 13. Idem, 1874, I., p. 93. 14. Troost and H., op. cit., p. 564. This specimen before saturation with hydrogen had been exhausted, with results as described in No. 11. 15. Idem: this specimen, before saturation with carbonic oxide, had been exhausted with results as described in No. 11. 16, 17, and 18. Idem. These results obtained with one specimen which, before saturation for Nos. 17 and 18 had been exhausted with results as described in No. 16. 19. Parry, op. cit., 1871, II., p. 240. 20. Idem, 1881, I., p. 189. Contains .08% silicon, .35 carbon, .72 manganese, 1.02 magnetic oxide (?) = 0.28% oxygen. 21. Zyromski, Stahl und Eisen, 1884, p. 536. Journ. Iron and St. Inst., 1884, II., p. 625. Contains .05% carbon, trace silicon, trace sulphur, .024% phosphorus, .25% manganese. 22. Idem. Puddled iron from same materials as No. 20. Contains .08 carbon, .046 silicon, trace sulphur, .078 phosphorus, .20 manganese. 23. Parry, op. cit., 1872, II., p. 240. 24, 25, 26. Graham, Journ. Chem. Soc., 1867, XX., p. 285. 27 and 28. Graham, Chem. News, XV., 1867, p. 273. 29. Iron deposited by electrolysis from ferrous chloride. Cailetet, Comptes Rendus, LXXX., 1875, p. 819. 30 and 31. Troost and H., loc. cit. Before saturation with hydrogen for No. 31 it had been exhausted with results given in No. 30. 32. Parry, op. cit., 1878, I., p. 430. Before being saturated with hydrogen it had been exhausted in vacuo for 7 days. 33. Graham, Journ. Chem. Soc., loc. cit. Before being saturated with hydrogen the wire had been exhausted in vacuo with results given in No. 26. After saturation with hydrogen the wire became white, like galvanized iron. A repeat experiment gave similar results. 34. Idem. Before exposure to carbonic oxide it had been saturated with hydrogen, and subsequently exhausted with results given in No. 33. 35. Parry, op. cit., 1873, I., p. 480. 36. Troost and H., loc. cit. Before exposure to carbonic oxide it had been exhausted with results given in No. 31. 37. W. Chandler Roberts.

TABLE 57.—ABSORPTION OF GASES BY IRON.

| Number. | Observer. | No. in Table 56. | Description of metal. | Treatment before exposure to the gas absorbed. | | | Absorption of gases. | | | | | |
|---------|-----------|------------------|---------------------------------|--|-------|-----------------------|-------------------------------|-------|--------------|-------------------------|----|--|
| | | | | Heated. | | | Conditions during absorption. | | | Gas absorbed. | | Measured directly or inferred from volume subsequently evolved in vacuo. |
| | | | | Hours. | In. | Temperature. | Hours. | In. | Temperature. | Vol. gas per vol. iron. | H. | |
| 41. | P | ... | Gray cast-iron | Apparently | vacuo | previously, heated in | Hydrogen | 22.4 | | Direct. | | |
| 42. | " | " | " | " | " | " | " | 13.2 | | " | | |
| 43. | " | 12 | " | " | " | " | White | 20 | | " | | |
| 44. | " | " | " | " | " | " | " | 22 | | " | | |
| 45. | " | 13 | " | " | " | " | Bright red | 13.2 | | " | | |
| 46. | " | 10 | " | " | " | " | " | 20 | | " | | |
| 47. | T and H | 14 | Cast-iron | 190 | " | 800°C | " | 0.63 | 0.016 | Indirect. | | |
| 50. | " | 17 | Cast-steel | 190 | " | 800°C | " | 0.09 | 0.013 | " | | |
| 51. | P | 20 | Bessemer steel | 168 | " | " | " | 10.54 | | Direct. | | |
| 52. | " | 82 | Wrought-iron | 190 | " | " | Red + | 13 | | " | | |
| 53. | T and H | 31 | " | 190 | " | 800°C | Red | 0.15 | 0.009 | Indirect. | | |
| 54. | G | 33 | " wire | 7 | " | Red | " | .46 | | " | | |
| 60. | P | 10 | Gray cast-iron (see No. 46) | 165 | " | " | Carbonic oxide | | 0 | Direct. | | |
| 61. | T and H | 11 | Charcoal cast-iron (see No. 47) | 190 | " | 800°C | " | 0.02 | 0.21 | Indirect. | | |
| 63. | " | 16 | Cast-steel (see No. 50) | 190 | " | 800°C | " | 0.01 | .03 | " | | |
| 65. | " | 30 | Wrought-iron (see No. 53) | 190 | " | 800°C | " | 0.003 | .21 | " | | |
| 66. | P | 35 | " | 1 | " | Low red | " | 4.50 | | Direct. | | |
| 67. | G | 26 | " wire (see No. 54) | 1 | " | " | Red | 4.15 | | Indirect. | | |

Parry measured the absorption of hydrogen and carbonic oxide by iron, by heating the metal, which at least in certain cases had been previously heated or even fused in vacuo, in a closed tube in contact with a known volume of gas. The diminution of volume could then be read. In case of hydrogen this is supposed to be due to absorption. In case of carbonic oxide it is assumed in this table that this gas was absorbed as such; but, as will be shown later, its disappearance may be due to its decomposition, with the absorption of its oxygen and carbon separately. The indirect determinations were made by first heating the metal in vacuo, in some cases till it appeared to be nearly exhausted, then heating it in an atmosphere of hydrogen or carbonic oxide, and then later again heating it in a vacuo. The gas now evolved is analyzed, and is supposed to have been absorbed from the atmosphere of gas in which the metal had just been heated. Its composition in general supports this view. The conditions of these indirect determinations are described in the reference to Table 56, some of whose data are reproduced here, to bring all the cases of absorption together. 41, 42, 43, Parry, Journ. Iron and St. Inst., 1873, II., p. 431. 44, 45, idem, 1873, I., p. 94. Temperature above the melting point of the iron. 46, idem, 1881, I., p. 190. 47, Troost and Hautefeuille, Comptes Rendus, LXXVI., 1873, p. 562. 50, idem, p. 564. 51, Parry, op. cit., 1881, I., p. 190. 52, idem, 1873, I., p. 431. 53, Troost and Haut., loc. cit. 54, Graham, Journ. Chem. Soc., XX., 1867, p. 285. The wire became white like galvanized iron. 60, Parry, op. cit., 1881, I., p. 190. This iron had previously been saturated with hydrogen, with results as in No. 46. 61, 63 and 65, Troost and Haut., loc. cit. These pieces had been previously saturated with hydrogen, and then exhausted, with results as given in numbers 47, 50 and 53 respectively. 66, Parry, op. cit., 1873, I., 431. 67, Graham, loc. cit. This wire had previously been saturated with hydrogen and then exhausted, as per No. 54.

TABLE 58.—NITROGEN IN COMMERCIAL IRON.

| Observer. | Mode of extracting nitrogen. | Cast-iron. | | Steel. | | Wrought iron. | |
|----------------------------|---|------------|--------|--------|---------|---------------|---------|
| | | %. | Vols. | %. | Vols. | %. | Vols. |
| 1. Stuart and Baker | Expulsion and Conversion into ammonia. Measurement. | 0.015 | 0.98 | 0.01 | 0.65 | | |
| 2. Bouis | | 0.001 | 0.65 | 0.002 | 0.654 | 0.005 | |
| 3. Allen | | 0.004 | 0.698 | 0.005 | 0.172 | 0.41 | 0.12 |
| 4. Boussingault | | | 26 | 0.22 | 0.42 | 1.44 | 0.74 |
| 5. Marchand | | | 59 | 0.14 | | 0.91 | |
| 6. | | | 0.159 | 1.24 | 0.189 | 1.24 | |
| 7. Boussingault | | | | | 0.57 | 3.72 | |
| 8. Graham | | | | | | | 0.0459 |
| 9. Troost and Hautefeuille | | | 0.0021 | 0.0061 | 0.00046 | 0.003 | 0.0026 |
| 10. Parry | | | 0.010 | 0.68 | 0.0129 | 0.84 | 0.00459 |
| 11. Zyromski | | | | 2.73 | 0.29 | 1.89 | 0.24 |
| 12. Stead | | | 0.042 | | 0.173 | 1.13 | |
| 13. Müller | | | | | 0.019? | 1.25? | |
| 14. | | | 0.002 | 0.007 | 0.002 | 0.0016 | 0.01 |

1, Pure hydrogen passed over the metal at full redness: the ammonia formed was absorbed in sulphuric acid. Their results average 0.0033% nitrogen. Journ. Chem. Soc., XVII., 1864, p. 390. 2, Comptes Rendus, LII., p. 1, 195, 1861. Percy, Iron and Steel, p. 53. Two streams of the same perfectly dried hydrogen are passed independently through two red-hot porcelain tubes in the same furnace, one containing the iron, the other empty and serving as a check. The removal of nitrogen appears to be only superficial: on filing the iron after exposure to hydrogen the fresh surfaces again give off nitrogen. Bouis results appear to be incorrectly given in at least one standard text-book, the weights of nitrogen which he gives being mistaken for percentages: this magnifies some of his numbers 200 times. Yet his text leaves no doubt that the high figures ordinarily quoted are incorrectly attributed to him. 3, Journ. Iron and St. Inst., 1879, II., p. 489 and 1880, I., p. 191. Iron is dissolved in hydrochloric acid with complete exclusion of air: the solution is distilled after adding excess of lime: ammonia is determined in the distillate by Nessler's test. The nitrogen recovered must have come from the iron, for analyses of zinc and of iron freshly reduced by hydrogen gave absolutely no ammonia whether in presence or absence of air: blank analyses gave minute quantities of ammonia, which were deducted. 4, Comptes Rendus, LIII., p. 77. Percy, Iron and Steel, p. 56. Method same as the last, except that the ammonia is determined by sulphuric acid. This method gave 2.65% nitrogen in nitrogenized iron, in which the cinnabar method found 2.66%. 5 and 6, Percy, Iron and Steel, p. 52. 7, Idem, p. 56. 8, 9, 10, See Table 56. 11, Stahl und Eisen, IV., p. 594, 1884. 12, Iron, 1888, p. 115. 13, Idem, 1884, p. 138. Müller found from 1 to 1.5 volumes of gas escaping from Bessemer steel during solidification, whose composition was not determined. The percentage of nitrogen in gas escaping under similar conditions varied from 2.2 to 4% (see Table 55): assuming it at 10% merely to get a rough idea of the quantity of nitrogen thus escaping, we have 0.125 volumes per volume of steel. 14, See Table 54.

The percentages of nitrogen found by several investigators in iron thus nitrogenized are here given.

TABLE 59.—NITROGENIZED IRON OBTAINED BY HEATING IN AMMONIACAL GAS.

| No. | Observer. | Substance heated. | Nitrogen absorbed. | | How determined. |
|-----|--------------|------------------------------------|--------------------|--------|---------------------------------|
| | | | Vol. | %. | |
| 1. | Despretz | Iron | 754-585 | 11.538 | By gain of weight. |
| 2. | Frémy | Ferrous chloride at bright redness | 608-22 | 9.3 | By loss on heating in hydrogen. |
| 3. | " | Iron at redness, 20 hrs | 640-92 | 9.8 | |
| 4. | Boussingault | Thin iron wire, 90 mins | 173-964 | 2.66 | As ammonia. |
| 5. | Percy | Thin iron wire, 90 mins | 28-776 | 0.44 | By gain of weight. |
| 6. | H. N. Warren | Puddled iron | 00-2616 | 0.004 | By Nessler's test. |
| | | | 32-70 | to .5 | |

1 Percy, Iron and Steel, p. 51. 2. Idem, p. 53. 2 and 3, Comptes Rendus, LII., 1861, p. 325; Percy, op. cit., p. 54. 4. Comptes Rendus, LIII., p. 10, 1861, Percy, op. cit., p. 57. 5. Percy, op. cit., p. 55. 6. Chem. News, LV., p. 155, 1887.

Percy's wire, number 5, though it apparently had taken up but 0.44% of nitrogen, had turned white, was remarkably brittle, and had a very brilliant fracture. Bars of the finest puddled iron nitrogenized by Warren (included in number 6, Table 59), after taking up 0.5% nitrogen became so brittle that they broke transversely on falling from a height of 6 feet. A bar of the same iron which had absorbed but 0.004% nitrogen is reported as breaking with a decidedly crystalline structure: one with 0.01% nitrogen is reported as still more crystalline and apparently somewhat more brittle. Unfortunately Warren reports no numerically comparable tests of strength and ductility.

§ 174. INFLUENCE OF NITROGEN IN COMMERCIAL IRON.—As 3% of nitrogen suffices to render iron friable, and as even 0.44% appears to render it "remarkably brittle," it is by no means unlikely that the 0.04% occasionally found in commercial iron may materially affect it. Metcalf^a ascribes the lustrous fracture of Bessemer steel, and its reported relatively low ductility compared with crucible steel of otherwise identical composition, to the presence of nitrogen absorbed from the enormous volumes of air blown through the metal at high pressure during manufacture. If merely a coincidence, it is a striking one that Allen (Table 58) finds twice as much nitrogen in pneumatic as in crucible steel^b: but his results are too few to decide the question. The nascent iron, which alone absorbs nitrogen from the atmosphere, may be furnished by the reduction of iron-oxide by carbon, etc., in the Bessemer process.

^a Trans. Am. Inst. Mining Engrs., IX., p. 548, 1881.

^b Journ. Iron and St. Inst., 1880, I., p. 188. He obtained the following percentages of nitrogen in several specimens of steel: acid Bessemer, 0.164; basic Bessemer, 0.115; open hearth, 0.107, 0.098; blister, 0.148, 0.156; double shear, 0.139; crucible, 0.082.

(TO BE CONTINUED.)

NOTE.—The publishers of the ENGINEERING AND MINING JOURNAL will thank the readers of this article if they will promptly call attention to any inaccuracies they may observe in it.

PERSONALS.

Mr. John M. Crawford, a retired coal and iron merchant, died suddenly on the 7th inst. at his residence in Philadelphia.

Mr. Edward Bates Dorsey, civil and mining engineer, has returned from England and is now visiting the Southern States on professional business.

Mr. H. K. Nichols has resigned as Superintendent of the Jumbo Mining and Milling Company, Colo., and Mr. Yeatman has been appointed his successor.

Mr. David K. Tuttle, of New Jersey, has been appointed Melter and Refiner, and Henry Loffmann, of Pennsylvania, Coiner at the Mint, at Philadelphia, Pa.

Mr. Joseph J. Albright, for more than twenty years general sales agent of the Delaware & Hudson Canal Company in Scranton, died on the 12th inst., aged 77 years.

Mr. John B. Wright, of Tennessee, Chief of the Mineral Division in the General Land Office at Washington, D. C., has been appointed Chief Law Clerk of the General Land Office, vice John Le Barnes, removed.

Mr. Charles Knapp, the well-known manufacturer of Pittsburg, Pa., being the head of the firm of McIntosh, Hemphill & Co., founders, died on the 9th inst., aged 72 years. During the war Mr. Knapp did a very large business casting heavy guns for the government.

The following gentlemen have been appointed members of the Assay Commission of 1888, to meet in Philadelphia, Pa., February 8th: Senator Z. B. Vance, North Carolina; Representative Thomas M. Norwood, Georgia; George F. Becker, San Francisco, Cal.; Celton Buck, Wilmington, Del.; Charles B. Dudley, Altoona, Pa.; W. P. Lawyer, Bureau of the Mint, Washington; J. W. Mallet, University of Virginia, Va.; Alfred M. Mayer, Hoboken, N. J.; Frank Nicholson, St. Louis, Mo.; John H. Ordway, New Orleans, La.; Charles S. Peirce, Milford, Pa.; Charles E. Pellew, New York; Raphael Pumpelly, Newport, R. I.; David K. Tuttle, Carson City, Nebraska; Henry F. Wild, Boise City, Idaho. The ex-officio members are: Wm. Butler, Judge of the United States District Court for the Eastern District of Pennsylvania; Wm. L. Trenholm, Comptroller of the Currency, and Herbert G. Torrey, Assayer of the United States Assay Office at New York.

FURNACE, MILL, AND FACTORY.

Three furnaces of the Pottsville Iron and Steel Company, Pottsville, Pa., were blown out on the 9th inst. for want of coal.

A charter has been granted to the Edge Hill Furnace Company, of Edge Hill, Montgomery County, Pa. The capital is \$200,000.

It is reported that the Tennessee Iron and Manufacturing Company, of Memphis, Tenn., will erect an iron furnace at Puck Hill, Miss.

The rolling mill and nail works of the Oxford Iron Company, at Oxford, N. J., have shut down for an indefinite period. The furnaces and mines are still running.

The Columbia Iron and Steel Company, Uniontown, Pa., contemplates erecting a blast-furnace to make its own Bessemer iron. The works are running full on beams, ingots, etc.

The annual meeting of the American Society of Civil Engineers will be held on January 18th, at the house of the society, No. 127 East Twenty-third street, New York City.

The furnace of the Elliott Iron-Works, at Round Mountain, Ala., which is new being relined, will be completed in March and will then blow in again on cold-blast charcoal for car-wheel iron.

Batteries 9 and 10, occupying the entire north end of the rolling mill at Brazil, Ind., exploded on the 9th inst. with terrific force, demolishing two smoke-stacks and tearing down the north end of the mill, piling the debris several feet deep. Under this it is feared several men are buried.

The furnace of William F. Kaufman & Co., at Tipton, on the East Pennsylvania Railway, has gone out of blast for the purpose of making some necessary repairs. The furnace will not resume operations until the strike has been settled and coal is again furnished at reasonable prices.

The Blandon Rolling Mill Company, Limited, whose works are at Blandon, Pa., have been reorganized as a limited liability company with H. Y. Kaufman, of Reading, as Chairman; Frank L. Froment, of New York, as Treasurer, and Wm. P. Tilton, as Secretary. The works are running on full time.

The Haselton Furnace, at Haselton, Ohio, which has just been completely overhauled and extensively improved, has been blown in and is estimated to have a daily capacity of 150 tons. This will make the eighteenth year in which the Haselton Furnace has made a specialty of Haselton-Scotch metal.

A 20-ton Lash steel melting furnace is being built by Messrs. Lean & Blair for the Standard Steel Casting Company, at Thurlow, Pa. It is the intention to use producer gas in the furnace when completed, and as this is largely in the nature of an experiment the re-

sults will be watched for with considerable interest. Until now the furnace has only been used when natural gas was available.

Messrs. Oliver Brothers & Phillips, the iron manufacturers of Pittsburg, Pa., are said to have already in bank the money to pay off the third installment of their indebtedness on February 1st. The sum is upward of \$800,000. The last payment was made on February 1st, 1887. Two more remain to be paid before the indebtedness is entirely liquidated. This payment will make about \$1,000,000 paid since the extension was granted.

At a special meeting of the Westinghouse Air-Brake Company, held at Pittsburg, Pa., last week, the capital stock was increased \$2,000,000, making it \$5,000,000. The reason given for the increase is that it was made to properly represent the real value of the assets and air-brake patents. It has not yet been decided to increase the size of the plant, although such a move is in contemplation. The company has recently received heavy orders for its new freight brake, and is running many departments in its works time and a half. A little over a year ago the capital stock of the company was only \$600,000. A year ago it was increased to \$3,000,000, on which a year's dividends have since been 21 per cent of the par value of the stock. It is understood that the increase in capital means a large increase in capacity.

In the suit of the Washburn-Moen Manufacturing Company against the Beat-Em-All Barb Wire Company, of Waterloo, Iowa, to which we referred in our issue of December 31st, for infringement of a patent issued in 1874 to Joseph F. Glidden, in which Glidden claimed as his invention the original barb wire used in fences, Judge Shiras, of the United States District Court, at Dubuque, Iowa, rendered his decision on the 5th inst. He held that the second wire, twisted about the fence strand for the purpose of holding the barb in place, was an old device, being clearly shown in a patent issued to Michael Kelley in 1868, and that the mode of constructing the barb as shown in the Glidden combination had been brought into use by Alvin Morley, of Delaware County, Iowa, as early as 1859. Consequently the patent issued to Glidden was void for want of novelty. The case will undoubtedly be appealed to the United States Supreme Court, but the decision of Judge Shiras is thought to foreshadow the final defeat and overthrow of this giant monopoly.

The great steel gun being made for government approval by the Pittsburg Steel-Casting Company, Pittsburg, Pa., was cast on the 11th inst. The cast was a most successful one. Since the awarding of the contract last autumn the company has been engaged in experiments and tests preparatory to this cast.

The gun will remain in the mold until it has cooled, which will be probably a week. As soon as it can be annealed after it is taken from the mold the boring will begin. The gun when completed will be 5½ tons; its total length 193 53 inches; the velocity of projectile 2000 feet per second, and the pressure in chamber 15 tons. The great importance of this experiment is demonstrated by the fact that a gun of this kind can be made for about \$3300, while a built-up gun of the same size would cost at least \$22,000. By this plan a gun of 125 tons, which now would cost about \$300,000, can be made for \$200,000.

The company is having a special lathe constructed for the boring of the gun. A 6-inch bore will be made from end to end. This part of the work is under the supervision of Mr. J. J. McGill, who was Superintendent of the Reading Gun Foundry during the late war.

The production and consumption of materials at the five works of the North Chicago Rolling Mill Company, the Union Steel Company, and the Joliet Steel Company during 1887 were:

| Production. | Net tons. |
|---|-----------|
| Pig-iron | 695,000 |
| Steel rails | 710,000 |
| Steel ingots | 823,000 |
| Angle bars | 50,100 |
| Bar-iron and steel | 44,400 |
| 72,000 kegs of nails | 3,600 |
| Principal materials consumed: | |
| Iron ore | 921,000 |
| Coke | 690,000 |
| Coal | 563,000 |
| Spiegel and ferro-manganese | 52,000 |
| Pig-iron | 826,000 |
| Old iron rails, scrap, etc. | 113,000 |
| Limestone | 197,000 |
| Railroad and lake freights paid | 4,020,200 |
| Amount paid out for labor | 5,951,000 |
| Amount paid out for merchandise and supplies consumed | 1,270,000 |
| Total average number of men employed | 9050. |

The North Chicago Rolling Mill Company states that their production in 1887 shows about 8 per cent increase over 1886, and an increase in price of finished product of about 10 per cent over 1886.

The Joliet Steel Company report an increase of product of 23 per cent in 1887 over 1886.

CONTRACTING NOTES.

Contracts open will be found on page xix. New contracts this week: No. 710, Water-Works; No. 711, Steel Rails; No. 712, Iron Viaduct; No. 713, Howe Truss Bridge; No. 714, Iron Bridge; No. 715, Sewers; No. 716, Water-Works.

The Galveston City Railway Company, Galveston, Tex., is about making contracts for machinery to run its cars by electricity.

The Director of Public Works at Philadelphia, Pa., has awarded the contract to furnish a gas holder at the Fifteenth Ward station to the Camden Iron-Works for \$13,740, and the contract for excavating and walling a tank for the holder to E. D. Smith for \$17,700.

The Hoaring Fork Electric Light Company, of Aspen, Col., have contracted with the Sprague Electric Railway and Motor Company, of New York, for two of their improved electric hoisting machines to be ready for use early in the spring, the intention being to supplement their light business with that of furnishing electric power for the mines, etc., about Aspen. The water-power in the neighborhood is very fine, and by means of the machines in question it can be put to use cheaply in every mine in that neighborhood.

LABOR AND WAGES.

The employés of the Crane Iron Works, at Catsaunqua, Pa., have reconsidered their former action, and will not strike on the 16th inst.

The Cambria Iron Company, Johnstown, Pa., have decided to make a reduction in wages of 10 per cent on February 1st unless business improves within a few weeks. The reduction was to have dated from January 15th, but was postponed.

The employés of eighteen blast-furnaces in the Pittsburg district met at Pittsburg, Pa., on the 12th inst., and decided to prepare a new scale of wages to be submitted to the manufacturers. The scale will make wages uniform and regulate the hours of labor. It will be completed at a meeting to be held on the 16th inst.

The nucleus for cementing the scattered forces of the old nailers and feeders of the Ohio Valley and the West was formed at Wheeling, W. Va., on the 8th inst. A mass meeting was held at that place and the utmost unanimity prevailed. A motion to organize under the banner of the Amalgamated Association of Iron and Steel Workers was carried by a unanimous vote, and those present were at once taken into the organization.

THE SCHUYLKILL (PA.) BASIS OF WAGES.—The following collieries drawn to return prices of coal sold in month of December, 1887, to determine the rate of wages to be paid, make the following returns: Tunnel colliery (P. & R. C. & I. Co.), \$2.65; Gilberton colliery (P. & R. C. & I. Co.), \$2.84; Elmwood colliery (P. & R. C. & I. Co.) \$2.64; Mahanoy city colliery (P. & R. C. & I. Co.), \$2.73; Gitard Mammoth colliery (P. & R. C. & I. Co.), \$2.70. The average of these rates is \$2.71, and the rate of wages to be paid is seven (7) per cent above the \$2.50 basis.

From present indications the Amalgamated Association's Steel Workers' wages scale, which has been under discussion by the manufacturers at Pittsburg, Pa., and vicinity, will be adopted without any serious trouble. After a number of consultations had by the Linden Steel Company, Limited, of that city, and the representatives of the Amalgamated Association, the scale has been signed by that company and also by Messrs. Jones & Laughlins of the American Iron Works. The Amalgamated officials are now satisfied that all their scales will be signed before the end of this week. There are no indications of a settlement at the Edgar Thomson and Homestead works, which are controlled by the Knights of Labor.

The strike of the coal miners in the Schuylkill and Lehigh regions, Pa., continues, and investigation shows that all the Philadelphia & Reading Company's collieries are practically idle. The only work being done any where is what is known as "dead work." The strikers are as firm as ever. The result of the visit of a committee of Schuylkill business men to President Corbin has convinced every one throughout the coal regions that the company will not even attempt to settle the strike as it now stands. President Corbin declared that the non-union railroaders who took the places of the discharged Knights of Labor shall not be put off to please the leaders, and that he will meet the miners if they agree to throw the railroaders overboard. This the miners have refused to do so far, and every thing possible is now being done to bring about this result.

The engineers, firemen and yardmasters on all the lines of the Pennsylvania Railroad west of Pittsburg have petitioned for an increase of pay, and they threaten to strike if their demands are not complied with. They say they have given the company until next Wednesday to make the increase. Most of the engineers have been getting 29 cents an hour. They want 30, with compensation for men who are paid by the trip when they are delayed or kept idle. The yardmasters have been getting \$125 a month. They want \$150. Their assistants ask for an increase of from \$75 to \$100 a month. The railroad company has paid no attention to the demand so far, and it is said that it certainly will not be granted. The lines of the Pennsylvania which are concerned are the Pittsburg, Fort Wayne & Chicago, Pittsburg, Cincinnati & St. Louis, Cleveland & Pittsburg and Erie & Pittsburg.

GENERAL MINING NEWS.

A meeting of all the natural gas companies of the Ohio Valley, as far west as Wheeling, W. Va., and Youngstown, Ohio, was to be held at Pittsburg, Pa., on the 12th inst. The object of the meeting is to form a natural gas association which will lead to the adoption of uniform prices.

TENNESSEE COAL, IRON AND RAILROAD COMPANY.—A suit for damages amounting to \$30,000 was brought last week against this company by Mrs. Mary

J. De Arman, at Birmingham, Ala., in the Circuit Court. She wants the damages for the death of her husband, Abram De Arman, who was killed on the company's road, at Pratt Mines, last October. De Arman was working for the road in the capacity of a track cleaner, and it was his duty to keep the track clear of the coal which accumulated upon it in the loading of the cars. He was engaged in this work one day, and was standing between the cribbing, from which coal is dumped into the cars, and a string of empty flats, when, through the negligence of another employe, the train was started, and the space in which De Arman was standing being very narrow, he was crushed to death before he could extricate himself.

ARIZONA.

COCHISE COUNTY.

TOMBSTONE MILL AND MINING COMPANY.—Official reports to us show what has been done at the mines since the production of ore ceased in September last. On the 5th of September sinking a new vertical double compartment shaft was begun on the Lucky Cuss mine, and since hoisting works have been erected, competent for a depth of 1000 feet. The object of this shaft is, primarily, to enable the company to get under or into and work more readily and economically a good ore-body which had been followed from the surface to a depth of 160 feet, through old and tortuous workings. Secondly, the continued exploration of the Lucky Cuss vein; also the Owl's Nest vein on the west, and the East Side vein on the east. The new shaft is now down 270 feet, and a cross-cut was started at 250 feet which has already entered the ore-body above named, and drifting has commenced both north and south.

GRAHAM COUNTY.

ARIZONA COPPER COMPANY.—On the 4th inst. another furnace was blown in, and there are now three 60-ton stacks in full blast. It is stated that plenty of coke is assured for some time to come.

PIMA COUNTY.

At the annual meetings of the Peer, Peerless, Weldon and Combination mining companies, the following officers were elected for the ensuing year: W. S. Lyle, President; Charles H. Fish, Vice-President; A. W. Havens, J. B. Low and George Frier, Trustees. August Waterman was re-elected Secretary and William Pickett, Superintendent.

ARKANSAS.

SILVER LEAF MINING AND SMELTING COMPANY.—This company has been organized, with a capital stock of \$1,000,000, for prospecting and mining in this State. The incorporators are: Lee Worthington, H. G. Gonzales and Antonio Maestre.

CALIFORNIA.

MONO COUNTY.

BULWER CONSOLIDATED MINING COMPANY.—The official weekly letter of the Superintendent, dated December 30th, says: "We again ran into the Standard Company's workings on our ledge on the 200-foot level, and made a survey, finding the Standard Company working on a vein belonging to the Bulwer Company. The ledge is about 3½ feet wide, in the face of the stope, and one as-y from it went \$29.63 per ton. Our assays from the 200-foot level during the week are as follows: \$16.88, \$93, \$51.65, \$9.67, \$71.98, \$41.76, \$11.86, \$26.53, \$35.29 and \$60.92. We came to an agreement with the Standard Company by which we stopped work on our north drift on the 200 level, and they discontinued all work on what we claim to be Bulwer ground until their surveyor arrives. We find that they have stoped from 55 to 60 feet in length on their 300-foot level, up to the 200 of the Bulwer, on the vein that without any doubt belongs to the Bulwer. This stope is filled in, so we can not tell what the width was. I can not say how much more ore belonging to us the Standard Company has worked until I make a more thorough examination. The north drift, 1000-foot level, is in hard porphyry."

COLORADO.

Dr. Munson, assayer in charge of the United States mint in Denver, predicts a greater output at the mines this year than ever. He says he found while gathering statistics this fall that in a great many districts mine owners and operators had devoted a great deal of time to "cleaning things up," removing debris, etc., work which prevented the prosecution of other business. By the opening of the spring season all will be in readiness for very active operations.

The following statement relating to the production of coal in this State has been furnished by the Hon. John McNeil, State Inspector of Coal Mines. During 1887 there were produced 1,791,735 tons of coal, as against 1,436,211 tons in 1886, showing an increase in 1887 of 355,524 tons. The average thickness of the coal seams now being worked throughout the State is five feet seven inches; the thickest is fourteen feet, and the thinnest is three feet. The average price paid to miners for digging and loading the coal and timbering their working places is 89½ cents per ton, of 2000 pounds of screened coal. The average cost of producing the coal on the cars at the mines (including royalty) is \$1.73 per ton.

CHAFFEE COUNTY.

MARY MURPHY MINING COMPANY.—This mine is shipping about 50 tons daily. This is not half what it shipped previous to last September, and is not one third of the mine's capacity. The increase of shipment depends almost entirely on the market for the ore. If the new process at the Holden Smelting Company of treating zinc ore is the success that it is

claimed, there is no question but this will be an immense shipper. The new process saves the zinc as well as the other metals, while heretofore the zinc has been wasted.

DAKOTA.

CUSTER COUNTY.

TIN MOUNTAIN MINING CO.—The mill is practically completed, and the machinery has been tested in detail, with the most satisfactory results. Experimental runs will now be made in the reduction of ore, and, if satisfactory, will be followed by regular and continued operation of the mill.

LAWRENCE COUNTY.

IRON HILL MINING COMPANY.—The smelter was blown in on the 6th inst.

ROYAL ARCH MINING COMPANY.—This company, which owns several claims at Bald Mountain, started a force to work upon its property. Developments will be pushed vigorously.

PENNINGTON COUNTY.

AMERICAN TIN MINING COMPANY.—This company has 7000 pounds of stream tin averaging 65 per cent, that will shortly be shipped to New York.

GEORGIA.

HALL COUNTY.

The discovery of a large deposit of black lead ore near Gainesville is reported.

IDAHO.

ALTURAS COUNTY.

ALBA MINING COMPANY.—All claims against this company have been paid and work has commenced on the Rising Sun, which is situated south of Bullion, and preliminary steps for obtaining a United States patent have been taken. Nothing has been done on the company's property for several years; in fact, very little work has ever been done besides sinking a shaft about 35 feet, and driving a tunnel about 20 feet. The Rising Sun claim was sold by George D. Mackey in 1884, to the Alba Mining Company for \$25,000 and a large block of stock.

KOOTENAI COUNTY.

SILVER TIP.—Joseph K. Clark, Harry A. D'Acheul, and William A. Clark have purchased a three quarter interest in this silver lead mine, in the Cœur d'Alene District, for \$15,000. The Silver Tip is an extension of the Sunset, which is located on Sunset Peak. The property was under bond to J. E. Boss, who surrendered his bond for a quarter interest in the property.

ILLINOIS.

It is said that Messrs. George Westinghouse, Jr., and Lemuel Bannister, of the Fuel, Gas and Electric Engineering Company, of Pittsburg, Pa., have about concluded the preliminary arrangements with Chicago capitalists for the establishment in that city of a company for the manufacture of fuel gas under the patents owned and controlled by the first-named corporation. Illinois coal will be used as the basis, and the gas will be furnished at a cost below that of any other form of fuel now used in Chicago.

COCK COUNTY.

Natural gas has been discovered at the Leland Hotel, Chicago, flowing freely from an artesian well sunk under the hotel fifteen months ago. Like Cooke's brewery, where natural gas was first discovered in Chicago recently, the Leland Hotel is close to the lake shore, but it is two miles distant from the brewery.

A comparison between the Cooke and Leland gases has been made. The analysis is as follows:

| | Cooke's. | Lelands. |
|-------------------|----------|----------|
| Carbonic acid gas | 0.8 | 1.0 |
| Carbonic oxide | 1.5 | 0.5 |
| Marsh gas | 22.6 | 11.0 |
| Hydrogen gas | 10.0 | 11.5 |
| Air | 65.4 | 76.0 |

It will be seen that the Cooke gas contains about 50 per cent more marsh gas than the Leland product, while, on the other hand, the latter contains more free hydrogen. The difference, however, is so slight that both may be regarded as from the same source. The large quantity of air which is present in the samples secured is owing to the manner in which it is pumped to the surface and not to the quality of the gas in its original state.

MARYLAND.

ALLEGANY COUNTY.

BARTON & GEORGE'S CREEK MINING COMPANY.—The company has just shipped its first lot of coal, consisting of ten car loads, from the mine, near Frostburg. The capacity of the mine will be 200 tons per day.

MICHIGAN.

CANADIAN MINING COMPANY.—Work is about to be resumed and unpaid labor accounts settled.

LAKE SUPERIOR IRON COMPANY.—It is stated that this company has given an option to Mr. E. D. Nelson, of Janesville, Wis., for the purchase of a lease of the lands embracing the gold bearing quartz vein, from which many rich samples of rock carrying free gold were taken last summer, and to the strike of which we referred in our issue of July 16th. The stock of the company has just been listed at the Boston Stock Exchange.

MICHIGAN GOLD COMPANY.—Active development work continues on this company's property.

ROPES GOLD AND SILVER MINING COMPANY.—The stock of delinquent shareholders who had failed to pay the assessment was sold last week. Bids were made

for the stock as high as \$1.87 per share. The Ishpeming *Iron Ore* states that rich rock has been encountered in the new shaft being sunk east of the one from which work is now prosecuted, at a depth of about 20 feet.

COPPER MINES.

There are now seven furnaces in operation at the Calumet & Hecla Smelting-Works, and nine at the Hancock Smelting-Works.

CALUMET & HECLA MINING COMPANY.—Another cave in the surface was reported this week and further injection of steam and gas. Reports state that the mine has not yet been opened. An opening was contemplated, but an accidental derangement of the covering of No. 2 shaft demonstrated that it was not yet time to open. Advice received by the Boston *Herald* express the opinion that water has reached some of the levels where the company was stopping when the fire broke out, and that the pumping facilities of the company, hardly adequate for the ordinary requirements of the mine, will be insufficient to unwater it. By the time pumping facilities could be added the breaking up of winter, always troublesome, would cause a further inflow of water. This authority is of opinion that the Calumet Company will have to rush development at the Black Hills end of the mine if it hopes to accomplish much as a copper producer in the early future.

COPPER FALLS MINING COMPANY.—It is reported that while drifting south on the Owl Creek vein lately, a rich belt of ground was struck. In cutting across it about seventy-five tons of very rich stamp rock was taken out, and quite a quantity of good barrel copper. More miners have been put on, and it is the intention to open sufficient ground to enable them, when prepared to begin stamping, to keep all four heads going. The exploratory work has been going on very satisfactorily.

MONTANA.

According to press reports, mining men of Montana have become alarmed over the fact that a vast majority of the public land in that territory is being classed by United States surveyors as agricultural, thus allowing it to be claimed by the Northern Pacific Railroad under its grant.

LEWIS & CLARKE COUNTY.

JAY GOULD MINING COMPANY.—The production for December amounted to \$42,500.

NEVADA.

ELKO COUNTY.

COMMONWEALTH MINING COMPANY.—It is stated that this company is about to segregate parts of its large ground into two separate mines, and two new companies are to be formed and their shares divided pro rata among the stockholders of the Commonwealth.

LANDER COUNTY.

LANDER MINING COMPANY.—The lienholders who purchased the Manhattan Silver Mining Company's property at Austin, to the sale of which we referred in our last issue, have incorporated under the above name and intend to work the mines on their own account.

STOREY COUNTY—COMSTOCK LODE.

We take the following from the Virginia City *Chronicle*:

The pay rolls of the different Comstock mining companies for December amounted to \$249,029. The footing shows an increase of \$15,704 above the total sum disbursed to employes during November. There are a number of mines being developed along the Comstock not included in the above list, the pay rolls of which will swell the total sum disbursed last month to \$260,000.

BULLION MINING COMPANY.—The shaft at this mine has been reopened to the 400 level and will be opened down to the 500 by February 1st. The 400 level will not be explored until the shaft is reopened down to the 500 level, when both levels will be prospected simultaneously.

CHOLLAR MINING COMPANY.—The new mill is shut down for a clean-up after a month's uninterrupted run. The value of the bullion product of the run will be about \$25,000. The mill is to be named the Logan mill, in honor of Bob Logan, its superintendent, who has introduced a new and successful process for working the ore.

NEW YORK.

SENECA COUNTY.

Natural gas was struck at a depth of 1450 feet in the well at Seneca Falls on the 9th inst.

PENNSYLVANIA.

Along the East Penn Railroad, between Reading and Allentown, are located numerous ore mines. Each of these mines employs a small force of men who get very small wages. Several furnaces which received their supply of iron from these mines having shut down, and others having reduced the customary amount of their orders, about a dozen of the ore mines on the 12th inst. suspended operations. The operatives of these mines are mostly men of small means and can not afford to stock the ore.

COAL.

An old coal pit on the Dilworth property, Mount Washington, is burning, it having been set on fire last week by some boys. The fire causes considerable apprehension among the residents of the Mount, as it is honeycombed throughout with old galleries, giving every chance for the subterranean conflagration to spread. Another element of danger is the number of holes drilled from dwellings to the mines for draining

purposes which supply drafts in numerous places not calculated on by the mining engineers.

NATURAL GAS.

It is reported that the Natural Gas Company of West Virginia and the Wheeling Natural Gas Company have arrived at an arrangement similar to that between the Philadelphia and the Chartiers Valley Natural Gas Companies, and will hereafter be operated practically as one company. The terms of the agreement are pretty much the same as those between the larger companies, and only need the signatures of the higher officials of both corporations to put it into effect. This, it is said, will do away with all competition between them, and guarantee larger earnings and regular dividends for both corporations.

BADEN GAS COMPANY.—The company is declared to be insolvent. W. B. Rodgers, receiver of the company, has made an application in court for the sale of the franchises and effects of the company. The receiver says that he has found the company insolvent and unable to pay its outstanding debts and obligations to the amount of \$100,000, which are now overdue and unpaid; that the receiver, after careful consideration of the matter and consultation with persons familiar with the gas business, is of the opinion that he can not operate the company so as to pay the indebtedness within a reasonable time, and that if the debts are to be paid it will be necessary to convert the property of the company into cash for the payment of the same.

HOME NATURAL GAS COMPANY.—The company struck a big flow of gas in its third well at Brownsville last week.

PHILADELPHIA COMPANY.—The Philadelphia-Chartiers natural gas consolidation, to which we referred in our last issue, was ratified at a meeting of the Philadelphia Company's stockholders held at Pittsburgh on the 9th inst. By the agreement a joint concern is formed with an aggregate capital of \$13,333,333.33. The Chartiers receives monthly 30 per cent of the net earnings, subject, however, to certain changes when the Philadelphia Company shall have made further investments in the way of pipe lines already designated. These improvements will cost \$666,666.66, and with their completion the earnings will be divided into 110 parts, of which the Chartiers Company will receive 30, and the Philadelphia Company 80.

Further capital which may be expected will be furnished by the two companies in the proportion upon which they are from time to time to receive net earnings, but should the Chartiers Company fail to supply its proportion of money, each expenditure of \$133,333.33 by the Philadelphia Company will entitle it to an additional part in the division of the net earnings.

The Philadelphia Company cedes a share in the benefits which may be derived from the use of fuel gas to the Chartiers Company on payment by the latter company of three tenths of the cost of the rights to the Philadelphia Company.

The Supreme Court at Philadelphia, in the case of Carruthers against the Philadelphia Company, affirmed the judgment. The Court discussed at length the power of the company under its act of incorporation and the general act of 1885 for the incorporation and regulation of natural gas companies. Judge Williams concluded his opinion with the following summary: "Our conclusions are that the special law incorporating the defendant company, while it may be impropriet in some of its provisions, is nevertheless valid. The grant of power therein is sufficiently comprehensive to authorize the company to engage in the production, distribution and supply of natural gas as fuel. It possessed the right of eminent domain under its charter. If this is doubtful it acquired it beyond all doubt under the act of 1887. The general system for the assessment of damages provided by the act of 1885 is applicable to companies engaged in the transportation of natural gas at or before its passage, as well as to those organized for that purpose under its provisions."

OIL.

Exports of refined, crude, and naphtha from the following ports, from January 1st to January 7th:

| | 1888 | 1887. |
|-------------------|-----------|-----------|
| | Gallons | Gallons. |
| From Boston..... | 5,686 | 1,670 |
| Philadelphia..... | 1,677,106 | 1,520,563 |
| Baltimore..... | | |
| Perth Amboy..... | 435,700 | 703,311 |
| New York..... | 6,588,781 | 4,847,444 |
| Total exports .. | 8,656,773 | 7,134,988 |

The Chief of the Bureau of Statistics reports the total values of the exports of mineral oils from the United States for the month of December, 1887, and during the twelve months ended December 31st, 1887, as compared with similar exports during the corresponding periods of the preceding year, as follows: December, 1887, \$3,985,702; December, 1886, \$3,591,881; twelve months ended December 31st, 1887, \$45,231,988; twelve months ended December 31st, 1876, \$47,016,695. The exports from the above-named ports comprise about 99 per cent of the total exports of mineral oils. It is stated on good authority that the distillation of 100 gallons of crude petroleum will yield 75 gallons of illuminating oil, 12 gallons of gasoline, benzine, or naphtha; 3 gallons of lubricating oil, and 9 gallons of residuum.

Press dispatches state that the drillers and tool dressers, belonging to the auxiliary branch of the Producers' Protective Association, numbering 1000, received, on the 10th inst., \$1 a day each from November 1st, when the shut-down took effect. None of the profits of the 2,000,000 barrels set apart for the workmen at 62 cents a barrel can be realized until February, and this is to relieve their immediate wants.

The money, amounting to about \$60,000, has been provided by leading members of the Producers' Protective Association.

COLUMBIA OIL COMPANY.—The annual meeting of this company was held in Pittsburg on the 12th inst. This is the oldest oil company in existence. The report showed the daily production of the entire oil region was but 40,000 barrels, while the consumption was absorbing 1,000,000 barrels per month of the surplus stock. The Columbia's production averaged 23 1/2 barrels per day during 1887. It cost them 45 cents per barrel, and was sold at an average of 74 cents, the lowest since the organization, twenty-six years ago.

TEXAS.

BEXAR COUNTY.

The discovery of a deposit of bituminous coal some distance northwest of San Antonio, is reported.

VERMONT.

We are advised by telegram that Mr. F. M. F. Cazin has purchased the copper mines at Ely, Vt., which were sold at auction by order of the Court in Chancery. The property purchased by Mr. Cazin includes the mines, mill and furnaces, including the waste dumps and three adjoining farms required for future underground elbow room. The price paid was \$80,000, the property covering over two thousand acres of land in fee simple. The first payment has been made. These copper mines produced and sold to the Ansonia Brass Company 30 million pounds of copper, and accumulated on their waste dumps, as the result of hand dressing, 10 million pounds of copper which now become available by machine dressing, all as the result of twelve years operation, having succumbed in 1883 to obsolete management and protracted litigation.

COAL TRADE REVIEW.

NEW YORK, Friday Evening, Jan. 13.

Anthracite.

The coal market is in a condition of indifferent equilibrium, waiting for the solution of the Reading strike question. If the Reading men go to work the Lehigh men will also, and prices of coal will probably quickly feel the effect of the heavier output. If the men stand out, actual prices are likely to advance, though nominal prices may remain as they are.

No one can form any opinion of value as to the prospects of the strike. We publish on another page a very interesting statement from the books of the company of the earnings of the men when they struck, and they are such as should have kept them at work.

The whole question now is as to the "backbone" of the Reading President, and this appears to be in a very healthy condition.

Our own impression, based on what the real interests of the men demand, rather than on what their leaders may order them to do, is that the men will go to work securing some kind of arbitration in name to "let them down easy" to the old basis, and the Lehigh men will of course go in at the same time. Then the question of the amount of production will come up later on. For some time after the Lehigh and the Schuylkill have gone to work the increase in production will not be very greatly increased, for as soon as prices decline the companies which have been forcing output with every available man will have a good deal of deadwork to do, and the Lehigh strikers have been working in the other regions, so that when they return home the other districts will produce that much less.

Prices are nominally unchanged as follows: Prices for coal continue without change and are firmer than a week ago. For free burning coals we quote net prices f.o.o.: Broken, \$3 85@4; Egg, \$4 10@4.25; Stove and Chestnut, \$4.75. Lehigh coal sells at \$4.50 for Broken and Egg; \$5 for Stove and Chestnut \$2.85@2.90 Backwheat.

But some of the companies meet the inquiries for coal at these prices that they have none to sell or can not make prompt delivery; so they have to go to middle men, who make a good round addition to the nominal prices.

The demand is not nearly as active or pressing as might have been expected. The mild weather relieves the pressure and there appears to be no anxiety about the future in this market.

Another week will probably bring about something more definite in the strike question.

Bituminous.

This market moves along in the even manner which has characterized it for months. Prices are \$3.50 to \$3.70, according to quality of coal and urgency for delivery. Cars are more abundant on the main line of the Pennsylvania Railroad, but even harder than they were to get for delivery on other lines.

Buffalo.

Jan. 12.

[From our Special Correspondent.]

No changes in the condition of the coal market or prices. Good weather for the consumption of fuel is now prevalent.

The annual meeting of our Merchants' Exchange was held yesterday. The coal committee, through Messrs. T. Guilford Smith, and J. J. McWilliams, made the following report, which has not appeared in print, and as it contains very valuable matter, suggest that you publish it in place of any jottings of mine:

The course of the coal trade during the year 1887 has not called for very much action on the part of your committee.

In the early part of the year the buyers were some-

what uncertain as to the effects the Inter-State Commerce bill might have upon prices, and held aloof. Their action was emphasized to some extent by rather high rates, which were made by the various railroad companies, and which materially affected the delivered price of coal west of Buffalo.

The bill itself took effect April 7th, and there was still some little hesitation after it went into effect to see exactly how prices would be maintained. Now that the bill has been in effect since that date, we feel that we can look back upon its operations with very considerable satisfaction.

The pitfalls which were feared early in the year have not yet appeared; the friction which was anticipated has not materialized, and we think the coal trade, as a rule, has been more stable and more satisfactory, both at Buffalo and at points west of here, than before the passage of the bill.

Shippers have entire confidence that there is no one favored with rates lower than themselves. There may be incongruities in the rates of freight, which will develop from time to time, but the Coal Committee of your Exchange do not find, at this writing, any serious cause of complaint. The prevailing rates of 1887 have been actually a little higher than those hitherto received by the roads east of Buffalo, and to that extent the Inter-State bill has been an advantage to the railroads, although by the stability which it has given prices, and the confidence that the shippers have had in the rates made by the railroads, we think this small advance has been counterbalanced.

The statistics of the port of arrivals at this point, both of hard and soft coal, show increased receipts over previous years, and the shipments from here, both by lake and rail, are correspondingly increased. In fact, the future of the coal trade of Buffalo seems so thoroughly assured that the largest railroads reaching here are constantly enlarging their facilities for handling the tonnage.

During the past year notably one of the largest coal transfers that has ever been built has been erected here for the purpose of transferring coal into line cars, and for storing large tonnage before the opening of navigation in the spring. The shipping wharves of the various companies in the harbor have been more or less enlarged, and the opening of the season of navigation of 1888 will see the daily storage capacity in the trestles very materially increased, as well as the shipping facilities for the dispatch of vessels very much improved. In fact, the efforts of all the railroads reaching here and owning docks has been to give dispatch to all vessels applying for tonnage, and in the erection of their shipping wharves special attention has been paid to the newer vessels just launched, so that the largest tonnage can be loaded in the least possible time. During the past season, many vessels that have been depended upon by the coal trade for lake shipments in previous years have been wrecked, but the new ships that are being built, both here and at Cleveland, are designed particularly for the shipment of large amounts of coal up the Lakes, and with a draught of water that will ultimately permit deep lading to Lake Superior points, and thus increase the yearly tonnage to Duluth and Superior City. In fact, those ports are likely soon to rival Chicago in the amount of coal received, not only from Buffalo, but from other Lake Erie points.

The local consumption of coal, so far, has not been materially affected by the use of natural gas, as early in the autumn the Natural Gas Company notified consumers that they could receive no more applications, the daily consumption having equalled the capacity of their pipes. There is no question at all but that additional pipes will be laid, and that sooner or later more gas will be consumed in Buffalo, especially for domestic use.

Thus far, however, no attempt has been made to use it in a large way for manufacturing.

The shipments of coal by the Erie Canal during the season of 1887 have been smaller than in 1886, and the probabilities are that little coal will be received via this route in the future. Unfortunately no systematic effort has been made during the past year by the shippers of coal to protect themselves from the petty stealing from the cars while on the tracks at East Buffalo and elsewhere, and the committee hope that before 1888 shall have expired, some definite plan will have been arrived at by which this can be prevented. It requires, however, the hearty co-operation of all shippers and all railroads, and until that can be accomplished it is useless for any one to attempt to protect any individual interests.

The railroad surprise of the coal and other trades, during the year 1887 was the Inter-State Commerce bill, which, as we have noted above, has been generally accepted in good faith, and we believe it to be to the interests of the coal men. That for 1888 will be the new mileage system and demurrage charge for delay of cars, which went into effect the first of the year.

It has been adopted by twenty-two of the principal roads, of which the following enter Buffalo direct: Buffalo, Rochester & Pittsburg, Lehigh Valley, Chicago & Atlantic, New York Central & Hudson River R. R., New York, Lake Erie & Western, New York, Philadelphia & Ohio, Pennsylvania R. R., Philadelphia & Reading, West Shore and Delaware, Lackawanna & Western. Before another year goes by, it may be confidently expected that the old mileage system will be entirely abolished, and the use of foreign cars settled for on the combined per diem and mileage basis. We think, as the result of this reform that the inconvenience resulting from scarcity of cars every fall, just prior to the close of navigation, will be materially lessened if not entirely avoided.

The fall of 1887 was no exception to past years, and

WEEKLY REGISTER OF CURRENT QUOTATIONS.

This list is the result of careful compilation and is destined to meet the demands of all classes of subscribers. The prices quoted are those actually ruling in our own and foreign markets. Manufacturers and exporters will please give notice of all modifications not later than Friday noon each week.

CHEMICALS.

Table of chemical prices including Acid-Acetic, Muriatic, Nitric, Oxalic, Sulphuric, Alkali, Alum, Aqua Ammonia, Ammonia, Antimony, Arsenic, Asbestos, Asphaltum, Barium, Barytes, Borax, Bricks, Bromine, Building Stone, Calcium, Cerium, Cement, Chalk, China Clay, Chrome Yellow, Chromium, Cobalt, Copper, Gypsum, Iodine, Iridium, Kaolin, Lead, Litharge, Lithium, Magnesia, Manganese, Mercury, Molybdenum, Nickel, Niobium, Osmium, Palladium, Platinum, Phosphate Rock, Phosphorus, Plumbago, Potassium, Potash, Pyrites, Quartz, Quicklime, Rotten Stone, Rhodium, Rubidium, Sals, Salt Cake, Salt Peter, Selenium, Strontium, Sulphur, Sulphuric Acid, Soda Ash, Soda Caustic, Sal, Saltpeter, Spelter, Spongy Iron, Sulfur, Talc, Tantalum, Tellurium, Thallium, Thorium, Tungsten, Vanadium, Vermilion, Vitriol, Yttrium, Zinc Oxide, Zinc, Zirconium.

Table of metal prices including Steel Plates, Iron Plates, Bar Iron, Merchant Steel, Cast-Iron Pipe, Wrought Iron Pipe, Boiler Tubes, Nail Fastenings, Wrought Scrap, Cast Scrap, Old Car Wheels, Old Rails, Nails, Pig-Iron, Philadelphia Prices, Pittsburgh Prices, Coke or Bituminous Pig, Charcoal Pig, Bessemer Pig, Spiegeleisen, Steel Blooms, Steel Slabs, Steel Wire Rods, Steel Rails, Structural Iron and Steel.

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Table of metal prices including Lead, Tin, Zinc.

STOCK MARKET QUOTATIONS

Table of stock market quotations including Baltimore Stock Quotations, Birmingham, Ala., Stock Quot., and Pittsburgh Stock Quotations.

Bonds. Highest and lowest prices bid and asked during the week ending January 7th. The trustees of the Central Trust Company, of New York, offer to pay 105 and accrued interest for bonds of the Pratt Coal and Iron Company of Alabama, not exceeding in the aggregate \$50,000 (if presented on or before January 28th, 1888), in accordance with the terms of the mortgage of said company, dated November 1st, 1883.

Table of gas prices including Allegheny Gas, Bridgewater Gas, Chartiers Val. Gas, Columbia Oil, Forest Oil, La. Noria Mining, M'Intire's Gas, Nat. Gas Co. of W. Va., N. Y. & C. Gas Coal, Ohio Valley Gas, Pennsylvania Gas, Philadelphia Gas, Pittsburgh Gas Co., Silvertown Mining, Tuna Oil Co., W'h'se Air-Brake, W'h'house Brake, Westmoreland & Cambria Gas, Wheeling Nat. Gas.

Highest and lowest prices bid and asked during the week ending January 12th.

Table of gold and silver prices including London Quotations, Alturas Gold, Arizona Copper, Birdseye Creek, California Gold, Carlisle, N. Mex., Centennial, Cal., Charles Dickens, Id., Colorado United, Colo., Denver Gold, Eberhardt, Nev., Empire, Mont., Flagstaff, Utah, Garfield, Nev., Gold Hill, N. C., Robinson, Colo., Montana L., Mont., New California, Colo., New Consolidated, Colo., New Emma, S. Utah, New Hoover Hill, N. C., New La Plata, Colo., Pittsburg Cons., Nev., Plumas Eureka, Cal., Richmond Con., Nev., Ruby & Dunderberg, Nev., Russell Gold, N. C., Sierra Buttes, Cal., Stanly, N. C., Union Gold, Colo., U. S. Placer, Colo., Viola L., Idaho.

DIVIDEND-PAYING MINES.

NON-DIVIDEND-PAYING MINES.

Main table containing two columns: 'DIVIDEND-PAYING MINES' and 'NON-DIVIDEND-PAYING MINES'. Each column lists company names, locations, capital stock, shares, and dividend/assessment details.

G. Gold, S. Silver, L. Lead, C. Copper. * Non-assessable. + This company, as the Western, up to Dec. 10th, 1881, paid \$1,400,000. Non-assessable for three years. † The Deadwood pro...

NEW YORK MINING STOCK QUOTATIONS. DIVIDEND-PAYING MINES. NON-DIVIDEND-PAYING MINES.

Main table of New York Mining Stock Quotations, listing various mining companies and their stock prices from Jan. 7 to Jan. 13, 1888. Includes columns for Name and Location of Company, Date, and Sales.

*Assessment unpaid. *Dealt in at the New York Stock Exchange. Unlisted Securities

BOSTON MINING STOCK QUOTATIONS.

Table of Boston Mining Stock Quotations, listing various mining companies and their stock prices from Jan. 6 to Jan. 12, 1888. Includes columns for Name of Company, Date, and Sales.

New York: Dividend shares sold, 76,415. Non-dividend shares sold, 157,960. Boston: Dividend shares sold, 11,845. Non-dividend shares sold, 12,653. Total New York, 234,375. Total Boston, 24,498.

COAL STOCKS.

Table of Coal Stocks, listing various coal companies and their stock prices from Jan. 7 to Jan. 13, 1888. Includes columns for Name of Company, Par value of shares, Date, and Sales.

San Francisco Mining Stock Quotations.

Table of San Francisco Mining Stock Quotations, listing various mining companies and their closing stock prices from Jan. 6 to Jan. 12, 1888. Includes columns for Company, Date, and Closing Quotations.

*Of the sales of this stock, 49,253 were in Philadelphia, and 303,670 in New York. The quotations for these stocks are not percentage, but actual price. Dealt in at the New York Stock Exchange Unlisted Securities. Total sales, 486,710. See note under large table of coal stocks in our last issue.

IRON MARKET REVIEW.

NEW YORK, Friday Evening, Jan. 13.

There are very few new items of interest in the iron market since our last writing. The situation of American pig-iron is unchanged and quotations remain the same. The strikes among the anthracite coal miners are still unsettled, and the furnaces of the Lehigh and Schuylkill regions have to look forward to no coal or inferior coal unless an adjustment of the difficulties can speedily be reached. Under these circumstances it is hard to tell what can prevent a general stiffening of prices, which, up to the present time, show no tendency in that direction. This is partly accounted for by the entrance of the Southern makers into this market, already an established fact. Southern irons, also, are freely offered here at prices lower than those which Northern makers will accept.

The Western pig-iron manufacturers held a meeting at Pittsburg on Thursday to consider the best course to pursue "in view of the demoralized condition of the trade caused by the cutting of rates, high price of coke, and the exorbitant freight rates." The conclusion reached appears to have been that "the Carnegies" had them all at a disadvantage, being able to sell pig-iron, and placing orders, at \$1.50@2 per ton less than others could afford to sell it; not making profit on their iron, but realizing on the ores and coke which they control. The meeting appointed a committee to demand reductions in freights and in coke.

Scotch pig-iron has been more active, with lower quotations here, and in Glasgow.

Bessemer pig, steel blooms and billets, and wire rods are very dull, with quotations unchanged and nominal.

The steel rail market is unchanged, Eastern mills still quoting \$32@33 at mill for heavy sections. Orders aggregating 24,000 tons have been placed this week at these figures. The mills, however, are mostly idle, only three being now running, namely, the Bethlehem, Pennsylvania, and Scranton steel companies.

The Lackawanna mill is closed only for repairs, and will probably start again soon, as their sales to date will cover several months work.

It is the prevailing impression among steel rail makers that the present state of affairs can not last long, and that the next thirty days will show more activity. Orders for rails for renewals can not be much longer delayed. The English market is strong, and it is believed that the large American buyers will soon be in the market.

The Bulletin of the American Iron and Steel Association publishes the following complete returns of the production of Bessemer steel rails in this country in 1887, not including a few tons which were rolled by iron rolling-mills from imported blooms, but including all rails rolled by Bessemer steel-works. We give below in net tons the details for the first half and second half of 1887, compared with the production of the Bessemer steel-works in the corresponding divisions of 1886:

| Periods. | Net tons of 2000 pounds. | | | |
|-------------------------|--------------------------|-----------|---------------|-----------|
| | Pennsylvania. | Illinois. | Other states. | Total. |
| First half of 1886..... | 489,790 | 163,978 | 53,679 | 707,447 |
| Second half of 1886... | 608,153 | 266,997 | 167,302 | 1,042,452 |
| Total 1886..... | 1,097,943 | 430,975 | 220,981 | 1,749,899 |
| First half of 1887 | 660,145 | 323,993 | 170,055 | 1,154,193 |
| Second half of 1887.. | 578,970 | 398,658 | 163,773 | 1,141,401 |
| Total 1887..... | 1,239,115 | 722,651 | 333,828 | 2,295,594 |

Structural iron is lower, although the makers have still plenty of work ahead.

Old rails continue in their usual anomalous condition; it is hard to sell and harder to buy at current quotations. The stocks in hand January 1st amounted to about 16,000 tons. Efforts have doubtless been made to break the market, but without success, and strong holders continue to refuse to sell at current prices. Some sales of small lots are reported, and some inquiries.

Nothing of importance was done at the meeting of the Atlantic States Nail Association yesterday.

The Western Nail Association held its regular session in Wheeling, West Virginia, on the 11th inst., and changed the price of nails to \$2 per keg, card rate

Louisville.

Jan. 12

[Reported by GEO. H. HULL & Co.]

The market is very peculiar. There is a difference of views of \$2.50 between various makers of irons. There has been very heavy buying on all sides, owing largely to contracts that are being made at the beginning of the new year, and to the fact that the prices at which some furnaces were willing to sell have seemed very low to iron buyers. There has been no cause for cutting the market in the way it has been done save a general feeling of distrust, which does not seem to be borne out by the business prospects of the coming year. Off-colored irons like silver gray and brights, that are being held by some furnaces at \$18, have been sold by others at \$16. The same is true of foundry irons. Car-wheel grades are looking up a little. Quotations will be found in the weekly register of prices.

Philadelphia.

Jan. 13.

[From our Special Correspondent.]

Every thing is coal this week and no one talks of anything else. To-day's calculations are that by Saturday four furnaces will bank up, not, however, for want of coke. With all the excitement in the coal

trade there is nothing of special importance in the iron trade. The coal scarcity, if it keeps up, may work both ways. It may lessen the pig-iron demand by pushing up prices, and this possibility was spoken of to-day by several. Consumers generally are not in a position to pay more money. The duration of the strike is uncertain. Even if Mr. Corbin did overcome his unwillingness to arbitrate with labor, organized or unorganized, there is no assurance that he would include the railroad hands. The re-action which set in this morning when the public learned that arbitration was improbable has not yet had time to assert itself. Coal is dangerously scarce. Pig-iron quotations have nominally advanced on several brands. The mill-men are watching things closely; some few large forge orders have been placed at \$17. Muck-bars are under inquiry. Merchant iron is quiet, but a fair business is doing. Nails are weak and dull. Iron and steel plates have begun to move, and there are excellent trade prospects for a good winter and spring consumption.

The rolling-mills throughout the State are fairly busy, but there is nothing like a rush. The Wyoming and Clearfield coal regions may come out, and thus bring matters to a crisis. Wages are being reduced at blast-furnaces all around, and the 10 per cent drop has been accepted in all rail mills, except one or two.

Skepp iron has dropped back to its old level, and the pipe mills will be a little slack of business next month, unless some hanging orders come in. Steel rails and structural iron are attracting but little attention, and quotations remain where they have been. Old rails are held for higher prices than they are likely to bring. Plenty of scrap has been moving all week at quoted rates.

Pittsburg.

Jan. 12.

[From our Special Correspondent.]

The iron market, although not active, shows a better state of feeling, the inquiries being larger and more general. Last week's prices were fully maintained. This may be in a measure due to the fact that a number of furnaces have been banked and blown out, and will not be started up again until there is a better understanding about the prices, labor, and cost of material. Messrs. Jones & Laughlin, of the American Works, have signed the scale for another year. This was brought about by concessions on both sides. As usual, there is considerable difference of opinion in regard to the present and future of the iron trade; for instance, the first broker visited spoke cheerfully. He said trade was improving, things looked brighter than last week, while the sales made proved all he said. He further remarked that we were going to have a good business year. The next broker took a different view. Although he had added several transactions to the report, he did not like the appearance of trade generally, but would hope for the best. The next one reported several transactions being under negotiation, that, when closed, would show that at least certain buyers had come to the sensible conclusion that raw iron was being sold at remarkable low figures, and the present was a good time to invest. The next party we encountered was a furnace owner, who remarked, I have no sales to report; we have withdrawn all our metal and will not accept present prices. The above gives the views of various dealers; you can take your choice. Makers of pig-iron find the cost of production a serious item; either prices must advance or cost of making be reduced, neither of which seems possible at this moment. Here is the difficulty: If prices advance the market will be open to competition from other sources, and if any considerable number of furnaces blow out the result will be pretty much the same.

On the 1st of February Messrs. Oliver Bros. & Phillips, that failed three years ago, will pay their third installment, amounting to \$300,000.

FINANCIAL.

NEW YORK, Friday Evening, Jan. 13.

Mining Stocks.

Since our last the developments in mining speculation have not been of an exciting character, but there has been a continued good demand and the second week of the New Year closes with a very buoyant feeling in all directions. A glance at the table will show a fair degree of activity all along the line.

In the case of the Tortilita Gold and Silver Mining Company, it is stated that the committee of the Consolidated Exchange has within the past few weeks held sessions, with the view of ascertaining the status of affairs at the company's mines. President Reall has failed to come forward and explain the true inwardness of affairs, as the official head is naturally expected to do, but has appeared by proxy. While the committee are naturally reticent as to the result of the proceedings thus far, we understand that the light so far thrown upon Tortilita affairs, so far as regards those not in the deal, is of a very obscure character; in other words, the investigators know no more than when they first undertook to lay bare the actual facts concerning the great Arizona bubbles.

The principal feature of the week has been the advance in Robinson Consolidated and Leadville Consolidated shares. For a long time past these stocks have attracted little or no attention whatever, but during the present week a demand has sprung up resulting in a good advance. Inquiry on the Mining Exchange throws but little light upon the cause of the movement. We understand, however, that important developments at both the Robinson and Leadville mines are assigned as the cause

for the upward movement. Without vouching for the accuracy of the reports circulated, and which in the majority of instances are pure fabrications, it may be stated that Leadville's strength is said to be due to the removal of the water heretofore remaining in the mine. A statement, issued by the company, shows a cash balance in the treasury of \$39,547, being a decrease of \$21,053 since 30th September. There is, however, also a balance of \$12,536.46 at Leadville, held "to pay for certain machinery now being put" in the mine; while at the Robinson mine good ore-bodies are alleged to have been encountered.

The stocks of the former company advanced from 33c. to 51c., and that of the latter from 45c. to 81c. Little Chief has also shown considerable activity at prices ranging from 20c. to 26c. Little Pittsburg shows a sale at 30c.; Iron Silver at from \$3 to \$3.10; Colorado Central at \$2; Chrysolite at 45c.; Silver Cliff at 7c.; Security advanced from 90c. to \$1.25; Lacrosse sold at 11c. to 12c. Cashier is still below the "teens," selling at from 8c. to 11c.

Sutro Tunnel as usual records the largest business—the transactions amounting to 54,500 shares—the price was firm and advanced from 11 to 15c. Consolidated California & Virginia shows no signs of the boom that is predicted for this stock; the price in the beginning of the week advanced to \$23.60, but to-day declined to \$19. Hale & Norcross was active, going from \$11.75 to \$13.25 on Tuesday, but during the week declined to \$9.25, at which price it was selling to-day. Savage went from \$7.38 to \$8, and then again to \$7. Sierra Nevada changed hands at from \$4.60 to \$4.95, closing at \$4.60. Yellow Jacket ruled at from \$7 to \$7.38. Ophir was largely dealt in at from \$8.75 to \$9.75. Belcher went from \$7 to \$6.50.

Navajo shows transactions at prices which went from \$1.10 to 90c., North Belle Isle ranged from \$8.63 to \$9. Belle Isle advanced from 48 to 65c. Tornado sold at \$1 and Found Treasure at \$2.

The boom in the quicksilver stocks continues. Quicksilver Preferred was actively dealt in at prices ranging from \$37 to \$38.75, some 5030 shares changing hands. Common was more active, the transactions amounted to 12,635 shares; the price advanced from \$10.37 to \$13.75.

Brunswick is firm, and went from \$1.65 to \$1.70. Plymouth Consolidated shows a small business at from \$19 to \$20.

Considerable attention has again been demanded by Bodie Consolidated, which shows a large business at declining figures, going from \$2.90 to \$2.40. Bulwer was firm at \$1. Standard at from \$2.25 to \$2.35. Mono shows a downward tendency, going from \$2.35 to \$1.70.

Amador shows sales ranging from \$1.55 to \$1.50. Middle Bar advanced; from \$32 to 39c.

Taylor Plumas was quoted at 2@3c. Green Mountain at 5@7c.

Proustite was dealt in to the extent of 33,400 shares. The price declined from \$2.40 to \$2.10. We hear unfavorable reports of the property.

Carupano shows one sale at \$2.10.

Sales of 400 shares of Ontario were made at \$27 per share.

Iron Hill, which has been neglected during the past few weeks, sold at 85c. Only one sale of Homestake is recorded at \$11. Deadwood-Terra advanced from \$1.85 to \$2. Father de Smet shows a sale of twenty shares at 35c. per share—the lowest figure ever reached.

San Sebastian remains unchanged at \$3.25.

Rappahannock is quiet and sales were made at prices ranging from 18 to 20c.

Meetings.

Annual and special meetings of the following companies will be held at the dates given:

Chartiers Valley Gas Company, Garrison Building, Wood street, corner Third avenue, Pittsburg, Pa., January 20th, at two o'clock P. M.

Consolidated Kansas City Smelting and Refining Company, office of Edw. M. Shepard, No. 31 Nassau street, New York City, January 21st, at three o'clock P. M.

Lehigh Valley Prospecting, Mining and Smelting Company, No. 145 Broadway, Room 26, New York City, January 26th, at twelve o'clock M.

Lehigh Valley Railroad Company, No. 228 South Third street, Philadelphia, Pa., January 17th, at twelve o'clock noon.

Manmoth Mining Company, No. 163 S. East Temple street, Salt Lake City, Utah, February 7th, at two o'clock P. M.

Minas Prietas Mining Company, No. 18 Wall street, New York City, January 19th, at twelve o'clock noon.

New England Gold and Silver Company, No. 470 Broadway, New York City, February 8th, at twelve o'clock noon.

Pewabic Mining Company, Howard Bank Building, No. 19 Congress Street, Boston, Mass., February 4th, at twelve o'clock noon. Special meeting to have the stockholders act as authorized by the laws of Michigan upon a proposition to extend and direct a continuance of the corporate existence of said Pewabic Mining Company for a period of not exceeding thirty years from April 4, 1883.

Rio Chiquito Mining Company, No. 11 Wall street, New York City, February 1st, at two o'clock P. M.

Santa Lucia Mining and Milling Company, No. 11 Wall street, New York City, February 1st, at one o'clock P. M.

Vermont Marble Company, office of Fisher A. Baker, No. 2 Wall street, January 26th, at twelve o'clock noon.