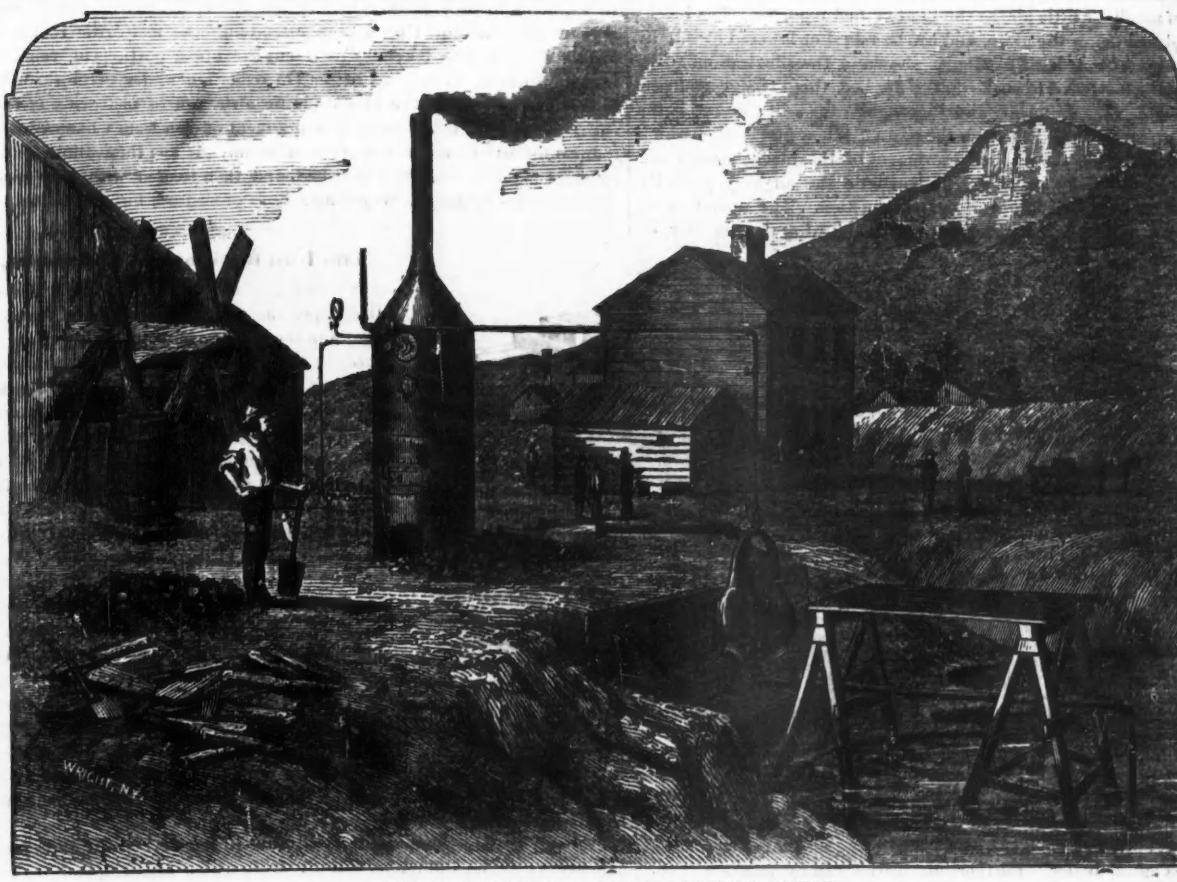
THE ENGINEERING AND MINING JOURNAL,

VOL. XVI.—No. 20.—FOURTH SERIES. NEW YORK, TUESDAY, NOVEMBER 11, 1873. PRICE 10 CENTS PER COPY.



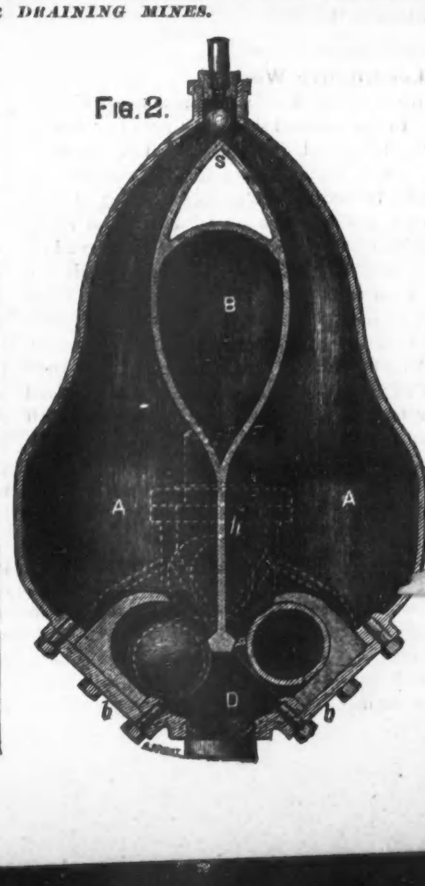
THE PULSOMETER FOR DRAINING MINES.

The Pulsometer for Draining Mines.

WE described in our issue for July 29th of the current year, the construction and working of a new direct pressure steam pump which is well named the "Pulsometer," and we now print an illustration showing the mode of placing the machine in quarries or other excavations. For convenience we will recall the several parts of the Pulsometer. It consists of two pear-shaped water chambers, so placed that their apices meet at the top, where the steam pipe enters. Immediately below the mouth of this pipe is a small ball valve marked *S* in Fig. 2, which closes the entrance to one of the water chambers. The steam has access to the other chamber and presses down the water there, which escapes by raising a second and large ball *h*, at the bottom, made of metal and hollow, and passes to the outlet pipe, Fig. 2. But contact with the water soon condenses the steam which leaves a vacuum, and the ball valve at the top falls over and closes the entrance to the half-empty chamber, leaving open the inlet to the other water chamber. The steam accordingly immediately commences to act in the second chamber, while at the same time water rushes into chamber number one, to fill the vacuum, being forced by atmospheric pressure through the suction pipe which projects from the bottom of the two chambers. This suction pipe is closed by hollow ball valves, similar to those that work in the outlet pipe. So long as the pressure within either chamber is below that of the atmosphere the inlet steam valve and the water outlet valves are closed, while the water inlet valve is open. The moment the vacuum is filled and the pressure of the atmosphere balanced, these valves reverse and the steam begins to act. These alterations are very rapid, and the result is a steady and powerful stream of water. The chambers, together with an air chamber, are cast in one piece. The top valve is dropped through the steam port, and the bottom valves are put in through holes left for the purpose and which are afterwards closed by plates bolted on. Nothing could be more simple than the construction nor easier than replacing the valves.

The mode of setting the pump is plain from Fig. 1. It requires nothing more than to be placed within the usual drawing distance of the water, and to be connected with the steam boiler by means of a pipe screwed in its upper end—the small end of the water chambers. It is very light compared to other machinery for handling water, requires no nice adjustment, and, for these reasons, is a convenient means of drying quarries, or open cuts where the bottom is uneven and cannot be drained from one spot. Steam can be brought by means of a rubber tube, and the utmost handiness given to the whole apparatus. The Pulsometer is, by the very nature of its construction, a steam condenser, and therefore [illegible]es no return pipe, and is not compelled to allow any part of the water it raises to run back for the sake of using it to condense steam. It can be used to raise water to any height, and is constant and steady in its action. Engi-

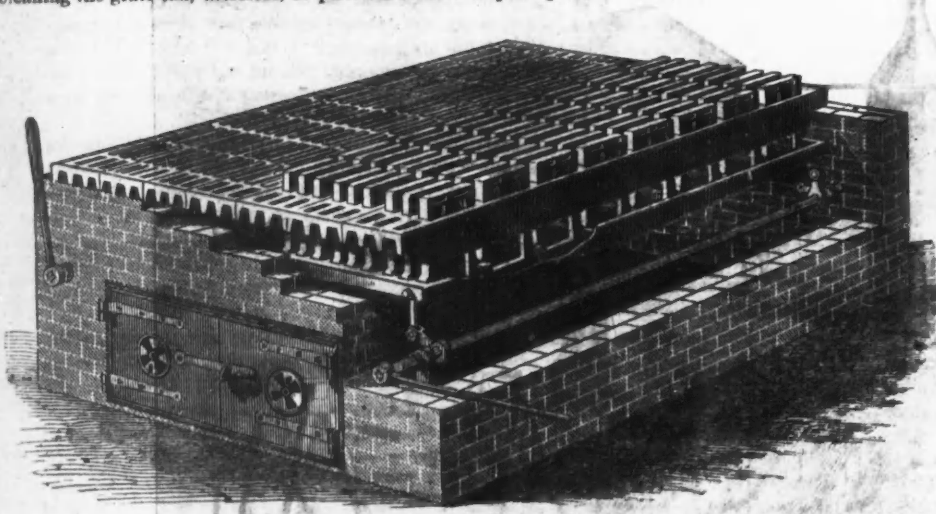
FIG. 2.



neers who have had it in use for several months say that is a durable, trustworthy pump, and not expensive in steam. The inventor has taken care to reduce the surface of contact between steam and water to a minimum, by drawing out the small end of what we have called the "pear," so that its upper part forms a kind of cylinder. This construction gives a considerable path to the steam, before condensation sets in to any great degree, while the increased surface in the lower part of the water chamber makes condensation rapid when it does begin, and thereby brings about the rapid pulsations. Messrs. C. HENRY HALL & Co., 20 Courtlandt street, are the proprietors of the Pulsometer, and have it in constant operation there.

Pratt's Patent Renovating Grate.

AT the Fair of the American Institute, Mr. P. W. PRATT, of Abington Centre, Mass., exhibits a fine grate of which the accompanying cut gives a good idea. The grate itself is formed of castings, which contain rectangular perforations, and in these perforations work blocks, which may have any form calculated to allow the passage of much or little air, as the kind of fuel requires. The blocks rest upon a frame placed below the grate, and can be raised or lowered at will by a rocker shaft supplied with a lever handle, as shown in the illustration. It is easy to see that when it is desired to shake up the fire-bed, this arrangement permits the work to be done very uniformly and thoroughly, the ashes being, at the same time, ground up and dropped through the grate. When fuel is used which becomes pasty by combustion, the upward movement of the blocks makes and leaves perforations in the pasty mass which distribute the air very perfectly through it, and assists in producing uniform combustion. The operation of cleaning the grate can, therefore, be performed without opening the fire door, or



PRATT'S PATENT RENOVATING GRATE.

the ash door, and this is sometimes a decided advantage. Fine coal can also be burned freely without sifting through the bars. The grate shown in our illustration is intended for a steam boiler. Further information can be obtained at the address given above, or of the Exhibitor at the Fair.

English Locomotive Work.

PROF. R. H. THURSTON sends to the *Scientific American* some notes of observations made in English workshops. In the railroad shops at Crewe he "noticed that eccentrics were all bushed with white metal, and was particularly interested in the style of connecting rod ends. They are all made solid, without strap, gib or key, and bushed with white metal. No provision is made for taking up wear. When worn and beginning to shake, the bushings are taken out and recast. This is only found necessary at long intervals. Dome tops are struck up, and the seats of all boiler mountings are of wrought iron. The boilers are usually four feet in diameter and three eighths of an inch thick. Steam is carried at 120 to 130 pounds. Engine frames are of 1½ inch plate, cut out, as in all European shops, straightened and then ground smooth by a grindstone revolving horizontally in a tank containing water. All wheels are of wrought iron. Piston rings are of the Ramsbottom style, small rings sprung into grooves in the piston, and seem to give full satisfaction. Our forward trucks are never used, their small wheels being looked upon with great distrust. English and continental builders prefer a single pair of larger wheels. The solid bar Stephenson link is used, a decided improvement upon the strap link universally used in the United States.

Both injectors and feed pumps are fitted to all engines. The express engines of this road are driven at higher speed and are claimed to make better time than those of any other road in the kingdom. They are remarkable for the great size of their, usually, single pair of drivers. Six and a half feet is the usual size, seven and a half is not uncommon, and eight feet diameter has been reached, in the one example of the engine "Cornwall," which is still kept at work. This engine shakes badly and has large bills for repairs. The favorite design is now, as with us, two pairs of coupled wheels for express engines, but with drivers six and a half feet in diameter. Freight engines are given five feet six inches wheels. This whole establishment, with its fine buildings, excellent plant, and peculiar designs of machinery, and its excellent work, should be carefully inspected by every American engineer visiting Great Britain.

In iron making the growth in size of blast furnaces seems to have ceased; the temperature of blast has not been elevated; the same forms of hot blast stoves are still used; and the yield of metal per ton of fuel consumed still remains as three years ago, about ton per ton, for the best known results. In the Cleveland district the most generally approved size of furnace seems to be about 75 to 78 feet high, and 26 to 27 feet diameter of bosh. The temperature of blast is about 1,000° or 1,100° Fah., with cast iron stoves, and two or three hundred degrees higher with brick ovens.

The Earth a Great Meteorite.

A FRENCH *savan* has been studying meteorites to ascertain whether the earth cannot be considered as a huge meteorite. According to his view the terrestrial rocks, taken in their totality, behave like the epidermis of a globe whose lower regions are constituted by masses resembling the meteoritic rocks. Veins of ferrous oxide may be taken to represent the upper portions of veins of massive iron comparable to the siderites. On oxidation under certain conditions the nickel is eliminated. The characteristic structure of meteorites is found to be entirely destroyed by oxidation. A fragment of iron from Charcas was heated to redness for five hours in a current of steam. It was then allowed to cool, the coherent mass of oxide was polished, and then treated with very weak hydrochloric acid according to Widmanstætten's procedure, but no figure appeared.

The Iron Business in Columbus, Ohio.

A CORRESPONDENT of the New York *Times* sends to that paper the following notes upon the condition of affairs in the iron works of that city: The new blast furnace of the Franklin Iron Company was fired up yesterday, October 28, for the first time. ISAAC EBERLY is President. The commencing of operations at present was not a matter of choice by this furnace company. They purchased a very large supply of iron ore some two months or more ago, before the price of iron tumbled, and they could not avoid losing money at first, whatever they did—whether they went into blast or not. They have received pledges of assistance from Columbus banking-houses for the next three or four months, at the end of which time they calculate that their returns will be sufficient to enable them to go forward unaided. The intention is to run the furnace very moderately for a time. It is a large fifty-ton furnace, but will be run as low as twenty-five tons per day, if possible.

The Columbus Iron Company's furnace, of which R. E. NEIL is President, is running under full headway, and does not seem to give any evidence that it feels the money pressure keenly.

Probably the most flourishing institution in the city, under all depressing circumstances, is the Columbus Rolling Mill, which began operations only about six months ago. R. S. BROWN is President. It has some very big contracts, made before the panic, and is working up pig-iron purchased at the present low prices. I understand it is realizing a profit of eight hundred dollars a day now. It has been a grand success from the first. Last week it turned out six hundred and eight tons of railroad iron—the largest run ever made in one week.

The American Institute Fair.

MR. E. G. SPILSBURY exhibits a working model of a wire rope "tramway," so called. It is composed of a wire rope strained over two horizontal balancing wheels and set in motion by any suitable means. This forms a continuous traveller, on which buckets or cars of any kind may be hung by means of a peculiar pulley. This pulley is composed of a solid block with grooved under surface, which is the bearing point by which it rests upon the rope. There are no wheels in this groove, and the block therefore partakes of the motion of the rope, and is transported from one end to the other of the system. Inasmuch as the rope is supported at distances of 300 or 500 feet by posts, some means must be provided for surmounting these obstacles, in which the pulley block would infallibly catch, were it not assisted over them. This is managed by placing on the inside of each post a raised rail, and on the inside of the pulley block two grooved wheels made to fit the rail. The edge of the latter is higher than the rope lying in its groove on the post, and when the block reaches the point of support its momentum is sufficient to carry the wheels over the rail, when, the obstacle having been passed, the block falls again upon the rope and the motion is continued. This means of transportation has, within a few years, received great attention from engineers, and it is undoubtedly one of the most practical methods in countries where the price of labor and materials, or the nature of the ground forbid the construction of a railroad, or heavy snows prevent its use during several months of the year. Our readers well know that these conditions apply in the greatest force to the Western mining regions of this country. This rope road has been set up there with great success, as it has also been in other countries. STEPHENS BROS. & Co., 187 Broadway, New York, are, we believe, the agents here.

Mr. L GEO. SUITTERLIN, 60 Duane street, New York, exhibits a poly-chromatic printing press, in which three colors are printed in one operation, from the same type and consequently without danger of false register. This is done by inking the type roller from rollers which are longer or shorter, according to the width of the color to be laid on. The type roller is accordingly banded in three colors and the type receive ink of one or another color, according to their position. The press is at work, printing circulars in green, red and black, and the result is undeniably excellent. The letters forming the words "Chromatic Press" have a red center and green top and bottom, while all through the page green, red and black are dispensed in a way that shows perfect command of the results. The union of the two colors in one type is quite perfect, and there does not appear to be any spreading of one color into another.

Two exhibits designed to lighten the task of making buildings fire proof are shown. One is the artificial stone of the Fire-proof Building Co., room 126, Trinity Building, New York. This is concrete, manufactured from the hydraulic lime of Teil, France, and is made into shapes adapted to the exterior and interior walls of houses, roofs, floors, walks and similar uses. The hollow blocks make very serviceable inner walls. It is to be hoped that something of this kind may come into common use. We have hoped to see those modes of building which have been adopted in other countries, as the most servicable on the whole, copied here, or at least made the foundation of an American practice, whatever might be the form it took. Architects say that the cost would be but little more, and safety could be obtained without increased expense of money and only at the cost of some of that tawdriness which is too commonly found in our city houses. But it is pretty evident that the mode of building houses goes by fashion like other things, and it is not yet the American fashion to build them safely.

The Kreischer Hollow Tile, made by HEMMELMAN & HAVEN, 77 and 83 Liberty street, is a brick, pierced with holes in the direction of its length, and designed to make a light floor or interior wall. Various shapes are made, among which is a flat arch, designed to spring between iron floor beams. The bricks are well made, and one of them stood a test of 19,570 lb. in the School of Mines Testing Machine, or about 2,000 lb. per square inch.

BOOMER & DUNHAM, 55 Dey street, exhibit a series of presses intended for lard and tallow, but which can be adapted to any work. Pressure is obtained by bringing together a pair of knuckle pointed levers, by means of a right and left handed screw. This is therefore a combination of two well known mechanical powers. The workmanship is excellent and the exhibitors say that one man can exert in their presses a force of 100 to 600 tons.

Refrigerators seem to be one of the specialties of the fair this year, and they show plainly enough how great an improvement has taken place in this kind of house apparatus. Allegretti's Iceberg Refrigerator has broken ice disposed all around the chamber where articles are kept, and the exhibitors (ALLEGRETTI, BADGER & Co., 842 Broadway), say that with ice alone a temperature of 38 F, can be maintained. With ice and salt zero can be reached. A magnificent 7-lb. brook trout is hanging stack and stiff in a small refrigerator of this kind at the fair, and the thermometer shows a temperature of about zero.

The Diamond Refrigerator, manufactured by E. GALLIN, 309 West 41st street, is equally worthy of praise. A low temperature is obtained by means of air circulating through pipes packed with ice. These pipes are in the top of the refrigerator and the method is applicable to large rooms, or to railroad cars with equal facility as to small chests for preserving food. The circulation of air is a well known means of keeping meat sweet, and the position of the ice immediately under the ceiling leaves the largest amount of space available.

Mr. C. W. HUNT exhibits a model of his automatic railway, illustrated by us August 6, 1872, and which has been received with great favor. The patentee says that with it one man can move sixty tons per hour, or 600 tons a day, and as it is a gravity road it works very cheaply.

We have before noticed the fact that there are but few exhibits of iron and steel manufactures *per se*. In the agricultural department we found nothing of this kind but some steel cultivator teeth and samples of other agricultural steel work, made by Messrs. A. J. NELLIS & Co., Pittsburgh, Pa. They are plainly finished and evidently have received no particular brushing-up for exhibition.

The Award Against the English Ironmasters.

THE North of England ironmasters have failed in an effort to obtain a reduction of 12½ per cent. in wages. Their claim was referred to Mr. RUPERT KETTLE, after the workmen had put in counter evidence, and the award was against the masters. This seems to be a somewhat extraordinary conclusion considering the condition of trade in England, and we accordingly print all that part of the award which deals with the claim in question, premising that the whole affair belongs to the month of September and not of October.

As the claim for a change is on the part of the masters, it is their duty to satisfy me that such change is required. Three arguments were relied upon at the arbitration board to establish the masters' proposition :—

I.—That in consequence of the high prices of coals, and of pig iron (the price of which depends so much upon that of coal), they are unable to sell iron with a profit with the present rate of wages.

II.—(Though this argument is not so much insisted upon as the first.) That the rise of wages in the finished iron trade has been greater than in any analogous industries, except the coal trade.

III.—That it is expedient to lower wages, as an inducement to coal owners to reduce coal, and so bring iron down to a price that will induce purchasers to deal.

I.—Upon the first of these arguments, I could only repeat what I said at Saltburn, when the arguments founded upon the price of coal were properly urged against the continuance of the sliding scale, and also in relation to the rate of wages. I there expressed my opinion—and gave my reasons for it—that the purchase of raw materials is part of the mercantile business of ironmaking, the risk of which must be taken by the employer as a capitalist. If by his forethought and the proper estimate of commercial risks, the employer makes a good investment of his capital in raw materials, the workman has no right to share his gains. On the other hand, if he makes bad purchases, or omits to purchase at the right time, not forseeing the coming market, he cannot call upon the workmen to participate in his losses. From the first establishment of the iron trade up to the present date, the employer has taken upon himself the whole of this risk. In the old ironmaking district, with very few well-marked individual exceptions, the course of trade was for the iron manufacturers to purchase quantities of mines, both of coal and iron, in the block, to hold and use as part of his stock-in-trade. The holding of mines was not at all times, and by all firms, coextensive with their requirements; but as the prices of coal, pig iron, and merchant bars were officially fixed at the commencement of each quarterly meeting, their relative values were publicly known. In the Middlesbrough district it was the practice to purchase large quantities of materials for the blast-furnace for forward delivery, some of the contracts extending over several years; whilst for mills and forges coal was purchased for consumption for periods of at least a year. As iron furnaces, and mills and forges, have been increased in number faster than mines could be bought, or pits could be opened, to supply them with fuel, some of the newly-established finished ironworks have to depend upon the purchase of coal, as well as pig iron, under very disadvantageous conditions.

This circumstance does not alter my opinion that this is a commercial risk which belongs to capital; and that the workmen should not suffer directly for the consequences of that part of their employers' trading over which they have not the slightest control.

I find from authentic returns made to me on behalf of the employers in the Ironstone Mining Arbitration, that when the make of iron was at what I believe to have been the lowest ebb in the year, out of 2101 furnaces belonging to thirty-nine firms there were 592 puddling furnaces "laid off," and that of these five-ninths belonged to only four of the thirty-nine firms. So that, in fact, the depression of trade was not distributed generally over the district, but was, I found, for the most part centered in those houses who were buyers, for immediate consumption, of pig iron and fuel.

Now, suppose the effect of lowering wages was to enable firms, situated as the four I have referred to, to make finished iron at present prices, would it not also add so much profit in another department of the business of iron-making to those firms who had been so fortunate as to buy coal and pig iron forward, or who had bought in block for future consumption, and held coal mines as part of their stock-in-trade? It would be as inconsistent to raise the wages in one case, as to lower them in the other; and yet if I entertained the argument, I see no way in which I could act upon it equitably, without having different rates of wages.

II.—As to the second argument, that the rise in ironworkers' wages has been greater than in other similar industries; that depends upon the point from which you start. Wages in different trades, as we all know, have not risen simultaneously; it has been now one trade, and then another, which has obtained a rise. I feel quite sure that if comparisons with other trades are carried back as far as they ought to be—to institute a fair comparison with the finished iron trade—it would be found that ironworkers are not paid comparatively higher now than they were before the modern rise in the price of labor commenced. Their rise began earlier than it did in most other industries; but this was owing to the accident that the railways take their special manufacture, and that so many modern improvements are carried out by the use of iron. I do not go into details, because, as I said, this point was not insisted upon, and is, after all, of much less importance than the first or the third.

III.—Let me now deal candidly with the third proposition. Although the price of fuel ought not directly to affect the rate of wages, I know full well it must indirectly affect it, from the inevitable tendency of high prices to check consumption, and therefore lessen the demand for labor. The iron trade is peculiarly and extensively liable to this check in consumption. The great bulk of iron now produced is used in carrying out new and great enterprises—railways, ships, bridges, and permanent constructions of all kinds, Great works are not projected, or, if projected, their execution is delayed, when it is believed that the price of iron is unnaturally high. This checks trade, orders fall off, and some works must be stopped; and, of course, the weakest (in coal) first go to the wall. At such a time puddling furnaces are laid off, and the workmen are thrown out of employment. It may be that, to a greater or less extent, these bad times are coming, as the masters fear. Our iron exports are already falling off in quantity, although they are keeping up in value; and the use of iron is already very much checked at home. I learn, however, from the tables before me, that if this dreaded downward course in the iron trade is to be run, it has not begun at present; and when it has begun, I am quite sure that the mere reduction of wages to an extent that will bring the cost of producing finished iron down 5s. a ton will not stop it. I remember that the masters contend that it is not the 5s. a ton of itself that will make the difference; but that the reduction of wages will have a tendency to induce coalowners to reduce the price of coal. The men, on the other hand, say that it will have the opposite effect, and that what is taken off wages will be put on coal. I need not go into this, because it is a speculation upon tendencies urged by both sides. As a general rule, I may say, you do not reduce prices by efforts to keep up demand. The employers who appeared before me were not unanimous in this branch of their argument. There was another, upon the probable immediate effect of lowering wages, apart from its supposed influence upon the coalowners. It was urged very deliberately and forcibly, for reasons based certainly upon long experience, and perhaps also upon sound judgment, that the contemplated reduction in wages would be regarded by the buyer—and particularly the speculative buyer of iron—as an indication that prices were giving way, and that the buyer might think his better discretion would be to wait and see how low prices would go before making purchases. I do not think it necessary I should decide on which side of the reasoning the balance of probability lies.

I have said that the downward course has not yet commenced. I assure both employers and workmen that if I conscientiously believed it had commenced, or was immediately about to commence, I would award that the men should take the consequences, whatever they may be, of submitting at once to a reduction of wages. I am bound to declare that, upon a close examination of Mr. WATERHOUSE'S returns, I find, at the present time, no indication of a real, substantial, giving-way of either production or price.

I am told that I cannot rely upon the figures before March, 1873, because Mr. WATERHOUSE'S tables are made up from the returns of members who composed the Arbitration Board for the time being, and, therefore, may not relate to precisely the same number of puddling furnaces. The facts since that date, I am informed, are drawn from the same firms. I may state that if I could use the previous returns, they would greatly strengthen my position. What, then, are the facts before me? The sales for March, April, and May, were 57,000 tons per month. For the months of June, July, and August, the average was only 42,000 tons a month; but it came to my knowledge for other purposes, as I have before mentioned, that at the end of June the make of finished iron was reduced 2-7ths; but the diminution of sales for the three months is only a fraction over 1-7th. Large stocks of finished iron are not kept by manufacturers; so that the make and the sale practically describe the same quantity with sufficient accuracy for my purpose. Between the end of June and the end of August, therefore, it is quite clear the trade must have revived, otherwise the deficiency would have been two-sevenths instead of one-seventh. If I take Mr. WATERHOUSE'S figures for the last month (September), I find the sales are further increased; for, by adding the two omitted firms to these returns, it brings the month's sales up to 52,000, as against the average of 47,000 per month in the preceding three months. Nor is there any great variation in price. For I find that the average of the quarter (March, April, and May), was 11*l.* 8*s.*: for the next three months (June, July, and August), it was 11*l.* 19*s.*; and for the last month, adding the two omitted returns which have now been given to me, it was 11*l.* 12*s.* 6*d.*, or a little higher than the first period, and a little lower than the second. All the employers say there is a lull in the trade now. Some of them say they have only a few weeks' orders on their books. I should have wondered if this state of things had not arisen. When—by whatever means produced—there is a general impression that an attempt will be made to reduce wages, it is a matter of common knowledge that buyers of iron will, and do, withhold their orders when a fall of wages is claimed by the manufacturer, because he believes he must reduce the price of his iron to meet the market. I am told that the present trade is what is called "a spurt"—that it has come on in consequence of the closing of the shipping season to Russia, and the North of Europe generally. It may be so, but what does that mean commercially? It means that the buyers have stayed out of the market as long as they possibly can, in the hope that prices would fall. Prices have not fallen as much as buyers expected; they must have iron, and now they issue their orders for prompt delivery. In fact, the same quantity of iron is taken by the customer; but the manufacture of it is not distributed over the usual period. It must be borne in mind that I am acting judicially in this matter. I must rely, so far, as they will lead me, upon the actual facts before me. What I have to find out is the condition of the iron trade. For this purpose I can refer to authentic figures; and I should stand upon very unsafe ground if I so far disregarded these to allow them to be explained away by expressions of opinion. There are Mr. WATERHOUSE'S tables, showing the fact that for the past seven months, and particularly for the last month—September—there has been a good, fair average business done in the North of England iron trade; and I feel bound to act upon those facts. The masters frankly offered me an inspection of their books, for the purpose of satisfying my mind as to the state of their profit and loss account. I could not have more convincing evidence than that which was afforded me by the closing of some of the most perfect finished iron-works in the Middlesbrough district. I know if they could have been worked to a profit they would not have been closed; and I know this is true of every puddling furnace which is laid off. Upon a very slight turn of the trade these works have begun again, and I also know that they would not have been begun again unless their proprietors believed that they could be worked to a profit. If the books of firms using their own coal and pig-iron, or who had made prudent contracts forward, were so kept as to show the current value of the material used they would show upon the profit and loss balance sheet of finished iron, making the same results which had closed some of the neighboring works. If I had accepted this offer to go over the books for the purpose of ascertaining profit and loss, I should, by implication, have admitted the right of the employer to ask his workmen to participate, directly or indirectly, in their employers' losses; and I do not see how the employers could, with logical consistency, have refused the workmen at any future time the examining of the same accounts, that they might participate in profits.

The last point I have to consider is whether at the present time, having regard to the price of pig-iron and coal and the sale price of iron, the masters are as well off as they were at the time when my Saltburn decision was given. If not, of course I am bound to re-open that settlement. There is some dispute as to the extent of the reduction in pig-iron and in coal since the present rate of wages was fixed. The workmen say 19*s.* in the former and 4*s.* in the latter. The employers say that those of them who are buyers are, from the state of their contracts, now paying about as much upon these two articles as was paid when I gave my last award. It is enough for me to say that I am satisfied that there has been lately a substantial reduction in the price of pig-iron, and that the price today for mill and forge coals is less than the highest prices quoted over the period to which Mr. WATERHOUSE'S returns relate. Here, again, let me say, that I have reason to believe, from statements made at the board, that some of the firms of finished iron makers are not in a position to avail themselves of these advantages, and I very much regret that they may be under pecuniary disadvantages in consequence; but I repeat, it is part of the ordinary risk of the employer as a capitalist.

Before I conclude, I beg to say that I have not used the tables of Mr. WATERHOUSE as the only basis of my award. I have taken the information they contained, with other facts and estimates, so far as they bear upon my conclusions. I have not revived, nor attempted to revive, what is called the sliding scale. The workmen well know that if that scale was still in existence their wages would be higher than those they are now receiving; but I feel confident that, all things considered, their wages are as high as they are entitled to, or as it is prudent of them to require. And I feel sure that under the most favorable circumstances, for reasons which are easily gathered from my foregoing observations, that there are some finished iron makers who can barely afford to pay the present rates. It is the duty, under such trying circumstances, of the workmen, more than ever to strive to give fair value in good steady work for the wages they receive, and to consider that by promoting the employers' interest in the course of their labor they are taking the most effectual and most direct means of saving themselves from a drop in wages. My desire has always been, and is now, to promote steadiness of trade. The masters have not satisfied me that it is either economically right or commercially expedient to reduce wages at present, and, therefore, my award is, that present prices be continued over the current quarter.

Testing Steam Boilers.

THE United States Commissioners, appointed last Winter, to conduct experimental tests of the cause of boiler explosions, and to ascertain the best means of prevention, proceeded to Sandy Hook on Friday morning on the steamer Alexis, to begin the first series of experiments. Two marine boilers were designated for the experiment; one of them a small, upright tubular boiler, and the other a large low-pressure boiler, such as is in general use on steamers in New York Harbor, and known among engineers as a "lobster-back." Some time elapsed before the small boiler, which weighs about 2,000 pounds, could be fairly tested, owing to leakage in the supply pump, and the spectators spent nearly two hours in a bomb proof casemate, 200 yards away, anxiously awaiting the expected explosion. It was not, indeed, until a cold, cutting wind, and a sharp rain driving directly into the casemate, drove them out of their refuge, and they cautiously advanced toward the boiler. Suddenly a violent noise was heard, a thick cloud of steam burst forth, and the impatient spectators, engineers, commissioners, and all, turned in dismay, and scrambled for shelter under the shrubs and behind the sand hills on the beach. It was discovered on inspection, when the danger was over, that a tube had collapsed at a steam pressure of 54 pounds. The aim of the experiment was to test the theory that with low water in the boilers the iron plates became heated so as to decrease their strength of resistance, and it was shown by the pyrometer, which was stationed below the boiler, near the fire-box, that the steam in the upper part of the boiler was superheated to 750 degrees when the tube collapsed. The scientists among the Commission were of the opinion that the experiment fully proved the truth of the theory.

The large low-pressure lobster-back boiler was next tested by being heated to a steam pressure of 70 pounds, at which point it ruptured a seam on the upper side of the shell, without doing further damage. The split occurred in a soft patch and was about 18 inches long. It was shown by the gauges that even after the rupture took place the steam pressure continued to increase and the rupture did not extend, experts concluding from these results that over-pressure of steam will rupture a boiler if it has a weak spot, whereas it would be likely to explode it violently, and consequently with danger, if the boiler is uniformly strong at all points. The Commissioners intend to strengthen these boilers at the weak points thus exposed and renew their operations for an explosion upon them on Tuesday or Wednesday of next week, to which time the tests are postponed. The various safety-valves that have been tendered them by makers and patentees will also be tested at that time. The experiments in Pittsburgh have been postponed until about the 18th inst.—Extract from *N. Y. Tribune.*

THE COAL TRADE

NEW YORK, Nov. 5, 1873.

Although the coal dealers seem to have suffered less actual loss by the panic than most other trades there is no doubt that the effects of the general stagnation in manufacturing circles are becoming increasingly felt, and business falls off more and more rather than improves. Retailers hesitate to buy coal, partly because they are not certain of having the cash to pay for it when the bills fall due and partly because, when there is the least chance of lower prices, no one who can avoid it lays in coal. The freedom from actual failure or suspension, which we have before noticed as one of the characteristics of the trade, continues, but the mining companies are asked to take a good deal of paper.

Of course every one is anxious to know whether prices will be maintained or not. On one hand we hear that the "combination" is steady in its old determination and means to follow out the line it laid out for itself; on the other hand, there is the still more certain fact that no combination whatever can possibly make head against the radical changes in business affairs, which are now affecting the whole country. It is hopeless to suppose that production will be cut down below a certain point, or that all the companies will store coal to keep it out of the market. There are quite enough independents in the business to set a price for coal if the combination undertakes to war against sound business principles. We do not say that coal will be lower, but we do say that if a fall in prices will bring business, the fall will take place.

In the Bituminous trade, affairs are reported by some to be in a very good condition, with the mines worked on full time, stocks in New York low, and prospects for the winter anything but bad. On the other hand there is the undoubted fact that the largest takers of soft coal are cancelling their orders. Everybody who can do it is "cutting under" the regulation prices, and the market is by no means in an orderly condition.

Anthracite Coal Trade for 1872 and 1873.

The following table exhibits the quantity of Anthracite Coal passing over the following routes of transportation for the week ending Nov. 1, 1873, compared with the week ending Nov. 2, 1872.

COMPANIES.	1872. WEEK.	1872. TOTAL.	1873. WEEK.	1873. TOTAL.
Phila & Reading R.R†	86,259	3,963,731	96,565	4,368,662
†Schuylkill Canal	27,220	749,957	20,793	662,946
‡Lehigh Valley R. R.	79,118	2,794,703	61,763	2,939,360
Lehigh & Sus. R. R.	39,651	1,430,444	40,747	1,719,436
" " Canal	25,823	763,577	15,513	656,214
Scranton North	26,470	677,313	19,631	812,870
" South	40,023	1,769,905	48,495	1,815,316
Penn. Coal Co., rail	28,449	1,021,666	24,809	1,056,917
" " " canal	119	5,758	505	7,424
Del. Hud C Co. Canal	41,693	1,296,910	41,727	1,278,139
" " East	5,775	455,457	6,138	359,489
" " West	13,031	55 ,198	14,528	490,035
" " South	6,584	328 919	1,317	164,486
Shamokin	15,631	482,403	16,581	554,587
Trevorton	....	....	....	....
Lykens Valley Coal Co.	....	....	....	....
Wyoming North	....	....	....	....
Wyoming South	....	....	....	....
P. N. Y. C. & R. R. Co.	12,760	630,291	9,240	640,248
Williamstown Col'y	....	......	....	....
Big Lick Col	....	......	....	....
Total	428,841	16,595,382	408,354	17,515,621
1872	408,354			16,595,382
Increase				920,239
Decrease	19,487			

These figures are for the week and fiscal period commencing Nov. 30.

†‡ Incl. coal transported for Company's use and Bituminous coal.

Bituminous Coal Trade, 1872 and 1873.

The following table exhibits the quantity of Bituminous Coal passing over the following routes of Transportation for the week ending Nov. 1, 1873, compared with week ending Nov. 2, 1872.

COMPANIES.	1872. Week.	1872. Year.	1873. Week.	1873. Year.
C. & O. Canal	15,561	570,837	17,324	569,830
B. & O. R. R.	28,714	1,059,608	35,210	1,260,350
Penn. S. Line	....	.....	2,964	89,233
H. & B. T. R. R.	7,883	251,506	10,046	386,722
*Harrisburg & D.	9,386	412,070	7,274	287,792
*L. V. R. R.	808	25,239	744	26,420
P. & N.Y.C. & R. Co.	6,038	315,622	6,737	269,836
Cumberl'd Branch Canal	4,762	188,809	4,241	120,105
" Railroad	1,284	19,410	1,647	75,092
Total	74,436	2,843,101	86,187	3,285,257
	....		74,436	2,843,101
Decrease	....			
Increase	....		11,751	442,156

Northern Central Railway, Shamokin Division

Below is the return of Coal sent over the Shamokin Division of the N. C. R. W., for the 7 days ending Nov. 1, 1873.

	Tons. Cwt.	
East	3,510 12	
West	13,072 16	
		16,583 08
Same time last year		15,624 01
Increase		944 07
Decrease		
Total amount shipped to date		554,586 19
Same time last year		482,402 16
Increase		72,184 03
Decrease		

Philadelphia & Reading Railroad and Branches.

COAL TONNAGE

For the Week ending Saturday, Nov. 1, 1873.

BY RAILROAD.—ANTHRACITE.

PASSING OVER MAIN LINE AND LEB. VAL. BRANCH.

	Tons. Cwt.
From St. Clair.	33,599 06
" Port Carbon.	3,551 07
" Pottsville.	3,835 06
" Schuylkill Haven.	31,236 19
" Pine Grove.	6,269 14
" Tamaqua.	13 268 00
" Harrisburg.	....
" Dauphin.	4,804 01
Total	96,564 13
FOR SHIPMENT BY CANAL.	
Passing Frackville Scales	8,586 19
" Mill Creek "	1,074 13
" Schuylkill Valley Scales	503 06
" Mt. Carbon	1,182 06
Cressona "	6,759 16
" Pine Grove "	....
" Tamaqua "	1,674 01
Total	19,781 00
SHIPPED WESTWARD VIA CATAWISSA AND WILLIAMSPORT BRANCH AND NORTHERN CENTRAL RAILROAD.	
Via Catawissa & Williamsport Br.	298 19
" N. C. R. R. passing Locust Gap.	504 03
" " " Shamokin.	4,606 08
" Herndon.	....
Total	5,409 10
SHIPPED WEST OR SOUTH FROM PINE GROVE	
Via Schuylkill & Susquehanna R. R.	1,989 01
" Lebanon & Pine Grove Branch	893 03
Total	2,672 04
CONSUMED ON LATERALS.	
From Frackville Scales.	1,696 14
" Mill Creek "	321 18
" Schuylkill Valley Scales.	646 11
" Mt. Carbon "	1,012 17
" Cressona "	812 08
" Pine Grove "	186 06
" Tamaqua "	739 13
Total	5,315 02
LEHIGH AND WYOMING COAL.	
Received via Silverbrook Junction, Sent East	6,128 02
Cat. & Wpt. Br. Sent West	....
" " Rupert, Cat. & Wpt. Br.	
" " Allentown E. Penn'a Br.	288 06
" " Alburtis, " "	....
" " Oreland, G. & N. Br.	1,123 14
" " Willow Street R. R.	435 00
Total	7,274 13
BITUMINOUS.	
From Harrisburg.	7,264 03
" Connecting R. R., G. & N. Br.	
" Junction R. R.	10 00
Total	7,274 03
COAL FOR COMPANY'S USE.	
Anthracite	6,700 02
Bituminous	253 14
Total	6 953 16

RECAPITULATION.

	Total for Week.	Corres-p'g week last year.		Increase and Decrease.
Passing over Main Line and Leb. Val. Branch	96,564 13	86,258 14	i	10,305 19
For Shipment by Canal	19,781 00	21,491 18	d	1,710 18
Shipped Westward via Northern Central R. R.	5,409 10	6,968 19	d	1,559 09
Shipped West or South from Pine Grove	2,872 04	1,835 15	i	1,036 09
Consumed on Laterals	5 315 02	4,522 19	i	792 03
Lehigh and Wyoming Coal	7,974 18	2,059 08	i	5,915 10
Total Anthracite paying freig't	137,917 07	124,135 13	i	14,781 14
Bituminous	7,274 03	9,386 00	d	2,111 17
Total of all kinds paying freig't	145,191 10	132,521 13	i	12,669 17
Coal for Company's use	6,953 16	6,406 16	i	547 00
Total Tonnage for Week	152,145 06	138 928 09	i	13,216 17
Previously this year	5785155 16	5505966 06	i	279,189 10
Total to date	5937301 02	5644894 15	i	292,406 07
SHIPPED BY CANAL.				
From Schuylkill Haven	18,600 18	18,600 18	d	6,277 02
" Port Clinton	2 192 00	2,192 00	i	403 00
Total Tonnage per Week	20,792 18	20,792 18	d	5,874 02
Previously this year	642,153 09	642,153 09	d	85,306 01
Total to date	662,946 07	662,153 09	d	91,180 03

Report of Coal Transported over Central R.R. of N.J. (Lehigh and Susq. Div.)

Week ending Nov 1—Compared with same time last year.

REGION SHIPPED FROM.	TIDE. tons ct.	LOCAL. tons ct.	CANAL. tons ct.	TL WEEK tons cwt.	TL. DATE tons.cwt.
Wyoming	27419 03	6701 03	5936 14	40059 00	1519776 10
Upper Lehigh	..	3186 02	768 14	3954 16	165845 15
Beaver Meadow	2898 12	2373 09	1590 07	7062 08	277728 15
Hazleton		127 18	3597 10	3725 08	1033291 16
Mauch Chunk	39 12	1813 08	571 19	2421 19	466014 10
Total	30357 07	14404 00	12465 04	57227 11	2610727 06
Prev'ly reported	1214986 11	590093 01	548421 03	2553500 15	
Total to date	1245343 18	604497 01	560886 07	2610727 06	
Same time 1872	1000553 04	728115 00	452479 08	2181147 12	
Increase	244970 14	75382 01	108406 19	429589 14	
Decrease					

DISTRIBUTION.	WEEK 1873.	WEEK 1872.	YEAR 1873	YEAR 1872.
Forwarded East by Rail to Tidal points	30357 07	27950 01	1245343 18	1000553 04
Forwarded East by Rail to Local points	8053 03	9915 10	378731 17	356319 12
Forwarded East by Rail use Central Division	2079 13	1765 01	75271 02	66210 07
Forwarded East by Rail use L. & S.	257 00	213 15	9989 12	7360 17
Delivered at and above Mauch Chunk	1684 02	1768 03	69482 13	50493 19
Delivered at Coalport & Hazard for Canal	12465 04	17326 19	584973 10	491352 07
Delivered to L. V. R. R. at Packerton	198 12	411 19	19845 16	12594 16
Delivered to L. V. R. Rd at Sugar Notch	1413 08		81890 07	
Delivered to L. & B. R. R. at Plymouth Bridge	518 02	5454 17	136296 11	193261 10
Total	57227 11	64795 06	2610727 06	2181147 12

Report of Coal Transported over the Lehigh Canal

For the week ending Oct, 31, 1873.

REGIONS SHIPPED FROM.	TIDE. tons, ct.	LOCAL. tons, ct.	TL. WEEK tons cwt	TL. DATE tons, cwt.
Mauch Chunk Region.	600 14	1,464 09	2,064 13	196,173 12
Mauch Chunk Region Hazardville	693 02	165 05	858 07	23,165 15
Beaver Meadow Region	400 02	2,348 02	2,748 04	117,315 02
Mahanoy Region				18,299 18
Hazleton Region	196 16	3,597 03	3,793 19	175,811 12
Upper Lehigh Region	798 05	173 19	972 04	25,583 18
Wyoming Region	3,290 02	1,778 16	5,068 18	95,581 17
Wyoming Region, Hazardville				4,282 09
Total.	5,478 11	10,033 14	15,512 04	656,214 04
Previously reported	228994 08	411707 11	640701 19	
Total to date	234472 19	421741 05	656,214 04	
Corresponding week last year	269175 08	434409 11	703574 19	
Increase				
Decrease	34 702 09	12,668 06	47,362 15	

DISTRIBUTION.	WEEK 1873.	WEEK 1872.	YEAR. 1873.	YEAR. 1872.
Consumed on line of Lehigh Canal	2,898 18	3,214 17	69,642 09	70,117 03
Passed into Morris Canal to Tidal Points		138 13	2,410 12	4,349 15
Passed into Morris Canal to Local Points	550 19	611 02	27,195 06	22,404 11
Passed into Del. & Rar. Canal to Tidal Points	5,478 11	8,533 17	232,142 07	264,225 13
Passed into Del & Rar. Canal to Local Points	201 00	267 05	11,471 09	13,162 13
Consumed on line Delaware Div. Canal	96 10	2,061 05	36,934 09	43,510 19
Passed through to Bristol	6,286 07	10,661 00	276,397 12	285,206 07
	15,512 05	25,822 17	656,214 04	703,576 19

Report of Coal Transported over Lehigh Valley Railroad

Report of coal tonnage for the week ending Nov. 1, 1873, with Totals to date, compared with same time last year.

WHERE SHIPPED FROM.	WEEK. Tons. Cwt.	TOTAL Tons. Cwt.
Total Wyoming	13,658 08	800,527 01
" Hazleton	37,709 05	1,991,022 14
" Upper Lehigh	87 11	2,589 02
" Beaver Meadow	8,147 16	593,795 12
" Mahanoy	5,375 02	461,911 19
" Mauch Chunk		3,018 09
Total	67,948 02	3,852,861 16
Same time last year	81,140 02	3,578,378 06
Increase		274,486 10
Decrease	13,192 00	
Forwarded East from Mauch Chunk by rail	51,762 18	2,939,359 11
Same time last year	59,117 17	2,794,702 17
Increase		144,656 14
Decrease	7,354 19	

DISTRIBUTED AS FOLLOWS.

	WEEK. Tons. Cwt.	TOTAL Tons. Cwt.
Local East of Mauch Chunk	1,457 09	71,821 14
Forwarded East for use L. V. R.	506 03	47,580 18
Delivered to Furnaces and Manufacturing Companies	6,664 14	422,941 14
Delivered to Cat & Fog. R. R	84 17	6 642 07
" " East Penn R. R.	196 12	6,421 01
" " North Pennsylvania Railroad	5,011 12	249,589 00
" " Port Del	5,326 03	192,742 16
" " East Amboy Railroad		
" " Morris and Essex Railroad	3,709 06	251,209 01
" " Bel Del Railroad	21,788 09	962,583 06
" " Central Railroad	5,513 14	486,947 14
Delivered at and above Mauch Chunk for use of L. V. R.R.	1,181 03	62 493 14
To P. & N. Y. R. R.	8,196 14	444,311 13
To Northern Central R. R.		22,488 05
To D. H. & W. R. R.	849 16	20,131 18
To L. & S. R. R. at Packerton for rail	217 06	13,318 02
To Individuals at Mauch Chunk	43 04	2,275 07
To Individuals above Mauch Chunk	659 02	14,628 17
To L. &S. R. R., at Penn Hav., for railroad		1 541 10
Do. for canal	3,793 19	172,526 15
To Lehigh Canal Mauch Chunk	1,244 04	70,137 04
To Catawissa Railroad		75 00
To L. & B. R.R. at Lack. Junc.		79,776 15
Total	67,948 02	3,852,864 15

Statement of Coal Transported over Cumberland and Pennsylvania Railroad

During the week ending Saturday Nov. 1. and during the year 1873, compared with the corresponding period of 1872.

WEEK.

	C. & O. C'l Tons. Cwt	B. &O. R R. Tons. Cwt.	Pa. S. Line Tons. Cwt	Total. Tons. Cwt
1873	17,324 00	35,209 15	2,964 01	55,497 16
1872	15,560 17	28,714 03	....	44,275 00
Increase	1,763 03	6,495 12	2,964 01	11,222 16
Decrease	....	......	....	

YEAR.

	C. & O. C'l Tons. Cwt	B. &O. R R. Tons. Cwt.	Pa. S. Line Tons. Cwt	Total. Tons. Cwt
1873	569,830 15	1260350 08	89,233 01	1,919,414 04
1872	570,837 04	1059607 19	....	1,630,445 03
Increase	....	200,742 09	89,233 01	288,969 01
Decrease	1,006 09	....	....	....

Cumberland Branch R. R.

WEEK.

	To C. & O. Canal. Tons. Cwt.	To B. &O. R. R. Co. Tons. Cwt.	Total. Tons. Cwt.
1873	4.241 06	1,646 19	5,888 05
1872	4,761 17	1,283 14	6,045 11
Increase		363 05	157 06
Decrease	520 11	.....	......

YEAR.

	To C. & O. Canal. Tons. Cwt.	To B. &O. R. R. Co. Tons. Cwt.	Total. Tons. Cwt.
1873	120,104 13	75,028 18	195,133 06
1872	188,809 10	19,409 18	208,219 08
Increase		55,618 17	
Decrease	68,704 17		13,086 00

Lykens Valley Coal Company.

Shipments of coal from Lykens Valley Coal Co., for week ending Oct. 18, 1873.

For week ending Oct, 18, 1873 .... 2,370 16

Total shipment to date ....

Delaware and Hudson Canal Company.

Coal mined and forwarded by the Delaware and Hudson Canal Company for the week ending Saturday, Nov. 1, 1873.

	WEEK.	SEASON.
By Delaware and Hudson Canal	41,727	1,278,132
By Railroad, East	6,136	359,489
" West	14,528	490,035
" South	1,317	164, 86
Total 1873	63,710	2,291,849
Corresponding time in 1872 :		
By Delaware and Hudson Canal	41,693	1,396,910
By Railroad, East	5,775	455,457
" West	13,061	355,178
" South	6,584	328,979
Total	67,113	2,436,544
Decrease	144,695	

Penn. and N. Y. R. R.—Coxton, Pa.

Coal tonnage for week ending Nov. 1, 1873.

	Week. Tons. Cwt.	Total. Tons. Cwt.
Anthracite received :		
From Lehigh Valley R. R.	8,196 14	444 311 13
" Lack. & B. R. R.	68 03	36,075 05
" Pleasant Valley R. R.		127,057 00
" Sul. & Erie R. R.	975 06	32,804 12
Total	9,240 03	640,248 10
Same time last year	12,760 10	539,291 00
Increase		100,957 10
Decrease	3,540 07	
Distributed :		
To Lehigh Valley R. R.		24,004 13
To Lack. & B. R. R.		1,443 0
To S. Central R. R.	1,942 13	143,928 15
To Ithaca & A. R. R.	2,405 16	132,702 11
To Erie R. W. Pockets for shipm't.	2,904 10	252,619 19
To Erie Railway, Watkins direct.	294 17	11,261 14
To individuals on line of road	426 06	26,616 08
To points at & above Coxton for use of Co	174 12	24,124 12
To points between Waverley and Elmira	1,091 10	43,546 13
Total	9,240 03	640,248 10

Bituminous received from BARCLAY R. R.

	Week. Tons. Cwt.	Total. Tons. Cwt.
Shipped north from Towanda	6,730 10	267,536 16
Shipped south from Towanda	6 09	1,914 18
Northern Central R. R.	....	384 09
Total	6,736 19	269,836 03
Same time last year	6,038 00	315 622 00
Increase	698 19	
Decrease		45,785 17
Distributed :		
To Erie Railway	6,515 05	245,579 10
To So. Central R. R.	209 05	21,346 00
To Ithaca Valley R. R.	6 00	542 01
Lehigh Valley, R. R.		1,034 13
To individuals on line of Railroad.	6 09	1,215 15
To points on line of road for use of Company	....	118 04
Total	6,736 19	269,836 03
Grand totals transported		
Anthracite	9,240 03	640,248 10
Bituminous	6,736 19	269,836 03
Total	15,977 02	910,084 13
Same time last year	18,798 10	854,913 00
Increase	......	55,171 13
Decrease	2,821 08	

Delaware Lackawanna & Western Rail Road Company.

Coal transported on the Delaware, Lackawanna, & Western Railroad for the week ending Saturday, Nov. 1, 1873.

	WEEK. Tons. Cwt.	YEAR. Tons. Cwt.
Shipped North	19,630 15	812,870 09
Shipped South	48,494 16	1,815,306 07
	68,125 11	
Total		2,628,176 16
For the Corresponding time last Year :		
Shipped North	26,470 05	677,313 10
Shipped South	40,023 00	1,769,984 16
Total	66,493 05	2,447,298 06
Increase	1,632 06	180,878 10
Decrease		

Delaware and Hudson Canal Company.

Coal mined and forwarded by the Delaware and Hudson Canal Company for the week ending Saturday, Nov. 1, 1873.

	WEEK.	SEASON
North	63,393 16	2,283,466 19
South	1,316 13	164,185 14
Total 1873	64,715 09	2,447,652 13
Corresponding time in 1872 :		
North	59,852 11	2,187,180 08
South	6,584 00	328,979 06
Total, 1872	66,436 11	2,516,159 14
Increase North	3,545 05	96,286 11
Decrease North		
Increase South		
Decrease South	5,267 07	164,793 12
Increase	1,721 02	68,507 01
Decrease	......	....

*Pennsylvania Coal Company.

Shipments of Pittston Coal for the week ending Nov. 1, 1873.

	1873. WEEK.	1873. YEAR.	1872. WEEK.	1872. YEAR.
By Railway	24,808 16	1,056,917 16	28,449 07	1,021,666 07
" Canal	504 10	7,424 18	119 06	5,758 02
	25,313 77	1,064,342 03	28,568 13	1,027,424 09
Increase, 1873	36,917 14			

Prices of Coal by the Cargo.

[CORRECTED WEEKLY.]

Company Coals.

Nov. 1873.

	L.	Str.	Gra.	Eg.	Sto.	Chest
*Pittston at Newburgh	5 00	5 00	5 10	5 20	5 50	4 80
*Lackawana at Rondout	5 05	5 15	5 25	5 40	5 70	5 05
Wilk'b're at Pt. John'n	5 05	5 15	5 25	5 40	5 70	5 05
Old Co. Lehigh at Pt. John's	6 00	5 85	5 85	5 85	5 20	—
New York Coal Exchange	5 85	5 70	5 70	5 85	5 15	—
AT PHILADELPHIA.						
Hard White Ash	4 60	4 60	4 70	4 70	5 00	3 95
Free B'rni'g White Ash Coal.	4 60	4 60	4 70	4 70	5 00	3 65
Schuilkill Red Ash	— —	— —	4 70	4 85	5 15	3 95
Alaska Red Ash	— —	— —	4 70	4 70	5 05	3 95
Shamokin White Ash	— —	— —	4 80	5 00	5 20	4 10
North Franklin	— —	— —	5 20	5 20	5 10	4 00
Lorberry	— —	— —	5 50	5 50	5 50	4 35
Lykens Valley	— —	— —	— —	6 10	6 10	4 75
SHIPPED FROM ELIZABETHPORT, HOBOKEN AND TRENTON.						
L. C. and N. Co., Newport	— —	— —	5 35	5 50	5 70	5 10
" " Plymouth Red Ash	— —	— —	5 35	5 60	5 80	5 10
" " Room Run	5 85	— —	5 70	5 70	5 95	5 15
Honeybrook Lehigh	5 90	— —	5 80	5 85	5 90	5 20
Fulton, "	6 00	— —	5 85	5 85	5 95	5 20
Scranton	4 85	5 10	5 20	5 55	5 65	5 00

For freights to different points see "Freights."

*To contractors only.

Prices at Baltimore—Nov. 1873.

Wholesale Prices to Trade.

Wilkesbarre, by cargo or car load	$5 05@5 70
Pittston and Plymouth, do	5 75@6 00
Shamokin Red or White Ash, do	6 00@6 25
*Lykens Valley Red Ash, do	@6 80
By retail, all kinds per ton of 2,240 lbs	7 50@8 50
*George's Creek and Cumberland f. o. b. at Locust Point for cargoes	4 85@5 00
West Va. Gas Coal	6 50
Youghigheny gas f. o. b. at L. Point, nominal	7 50
Kanawha Cannel, coarse	@12 50

* Freight to New York $2 15.

BITUMINOUS COALS.

Kittaning Coal Co.'s Phœnix Vein, f. o. b. at Phila	$
Lemon " " "	
Cumberland Vein Coal	....
Tyrconnel f. o. b.	$7 00

Prices at Georgetown, D.C., and Alexandria, Va.

Nov. 1873.

George's Creek and Cumberland f. o. b. for shipping $4 60@4 75

Prices at Havre de Grace, Md.

Nov. 1873

Wilkesbarre and other White Ash for Cargoes	$— —@5 00
Lykens Valley	— —@6 50
Shamokin Red or White Ash	— —@5 25

Bituminous Coals (Cumberland).

Georgetown, F.o.b	$4 60
Baltimore "	5 00
New York "	7 25@7 50
South Amboy	6 80

Prices of Foreign Coals.

Nov. 1873.

Duty 75 c. per ton.

Corrected weekly by ALFRED PARMELE, No. 32 Pine street, N. Y.

Liverpool Gas Caking	16 00@18 00
" " Cannel	13 00@15 00
" House "	20 00@21 00
" Orrel.	20 00@— —

Per ton 2,240 lbs., ex-ship.

PRICES FROM YARD.

Liverpool House Orrel, screened	$20 00@22 00
" Cannel, "	22 00@25 00

Per ton 2,000 lbs. delivered.

Prices of Gas Coals.

Nov. 1873.

PROVINCIAL.

Corrected weekly by Louis J. Belloni, Jr., 41-43 Pine st., N. Y

	Coarse	Slack
Block House, f. o. b. at Cow Bay	$2 75	$1 25
Gowrie	2 25	0 00

Corrected by Bird, Perkins & Job, 27 South street.

	Coarse.	Culm of Coal,
Pictou ...nett	$3 00	1 50
Sydney	3 25	1 00
Lingan	2 75	1 00
Caledonia	2 75	1 25

A discount from the prices of the coarse Coal on purchase of 5000 tons and upwards. Duty on all slack coal or Culm : 40c. per ton of 28 bushels, 80 pounds to the bushel. On all bituminous coal or shale : 75 cents per ton of 28 bushels.

AMERICAN.	Nominal quo Currency.	
Westmoreland ...f. o. b.	$9 00	@7 00
Fairmount Gas Coal Co. of N. Y ..."	6 50	@7 00
Despard Coal Co ..."	6 50	@7 00
Penn. ..."	6 50	@7 00
Newburg Orrel Gas ..."	6 50	@7 00
West Fairmount Gas Coal ..."	6 50	@7 00
Redbank Cannel, at Pa ..."	12 00	@0 00
AT PHILADELPHIA		
Westmoreland	7 50	@0 00

Rates of Transportation to Tide Water.

BY RAILROAD.

TO PORT RICHMOND, PHILADELPHIA.

Philadelphia and Reading Railroad, from Schuylkill Haven Lump and St., net, $1 60; Br., Egg and Ch., $1 65; Stove, $1 75 Shipping at Pt. R., 20c., for use at Phil., $2 18 from Pt. Carbon,

MAUCH CHUNK TO ELIZABETHPORT.

L. V. Railroad from Mauch Chunk to Phillipsburgh	$0 72
C. R. R., N. J., Phillipsburgh to Elizabethport	06
Shipping expenses at Elizabethport	25
Wharfage	10
Total	$2 23

MAUCH CHUNK TO PORT JOHNSTON.

L. V. R.R., or L. & S. R. R. from M. C. to Phillipsb'g	$0 72
C. R. R., of N. J., Phillipsburgh to Pt. Johnson	1 06
Shipping expenses	25
Wharfage	10
Total	$2 23

TO HOBOKEN

L. V. R. R., Mauch Chunk to Phillipsburgh	72
Morris & Essex R. R. Phillipsburgh to Hoboken,	6
Shipping expenses	25
Wharfage	00
Total	$2 23

TO SOUTH AMBOY.

L. V. R. R.	..
B. & D. R. R.	} $2
Cam. & Am. R. R.	}
Shipping Expenses,	35
Total	$2 25

PENN HAVEN TO ELIZABETHPORT.

L. V. R R. Penn Haven to Phillipsburgh	54
C. RR. of N. J. Phillipsburgh to Elizabethport	1 06
Shipping expenses	15
Wharfage	20
Total	$2 25

Freights.—Nov. 1873.

TO EASTERN PORTS.	Cumberland. From Georgetown.	Cumberland. From Baltimore.	Anthracite. From Eliz. Port, Port Johnston, Weehawken, and Hoboken.	Anthracite. From Newburgh.	Anthracite. From Rondout.
Amesbury	—	—	—	—	—
Bangor	—	3 25	2 00	—	—
Bath	—	2 75	2 10	—	—
Boston	3 10	2 65	2 15*	2 20	2 25
Bridgeport	—	2 35@—	90	1 15	1 20
Bristol	—	—	1 15	—	1 30
Cohasset Nar'ows	—	—	—	—	—
Derby	—	—	1 15†	1 30	1 30
Dighton	2 70	—	—	1 45	—
East Cambridge	—	—	2 15	2 20	2 25
Fall River	2 60	2 40	1 15	1 25	1 30
Hackensack	—	—	—	—	—
Hartford	—	—	1 40	1 70	1 75
Hoboken	2 15	—	50	—	65
Jersey City	2 15	—	50	—	65
Lynn	—	—	—	—	—
Middletown	—	—	1 15	1 25	1 30
Mystic	—	—	1 20	—	1 40
New Bedford	—	2 45	1 25	—	1 40
Newburyport	—	2 75@2 85	2 30	—	2 35
New Haven	—	2 35@—	90	1 15	1 20
New London	—	2 35@—	1 10	1 20	1 25
Newport	—	—	1 15	1 25	1 30
New York	2 30	2 15	50	—	65
Norwalk	—	—	90	—	1 20
Norwich	—	—	1 15	—	1 35
Pawtucket	—	—	1 25‡	—*	1 40
Portland	3 10	2 65	1 90	—	1 65
Portsmouth, N.H	3 20	2 75	2 75	—	2 45
Providence	2 60	2 40	1 15	1 25	1 30
Rockport		—	—	—	—
Saco		—	—	—	—
Sag Harbor		—	1 10	—	—
Salem		2 70	2 15	2 20	2 25
Stamford		—	90	1 15	1 20
Stonington		—	1 15	1 25	1 30
Taunton		—	1 45		—
Warren		—	1 15		1 30
TO RIVER PORTS					—
Albany		—			—
Catskill					—
Cocksackie					—
Coeyman's					—
Cold Spring		—			—
Fishkill					—
Haverstraw					—
Hudson	2 65	—			—
New York vessels					—
Nyack					—
Poughkeepsie					—
Rhinebeck					—
Rondout					—
Saugerties					—
Sing Sing					—
Stuyvesant					—
Tarrytown					—
Troy		—			—
West Point					—
Yonkers					

* 3 c. per bridge per ton in addition to freight.
† New Haven rate and towing 25 c. extra per ton.
‡ Towing from Providence and return, extra,
‖ And Towing.

St. Thomas	$— —	Gold
Martinique	— —	"
Demerara	— —	"
New Orleans	— —	"
Mobile	— —	"

Foreign and Provincial Freight

Nov. 1873.

Foreign.

Newcastle and Ports on Tyne, per keel of 21 1-5 tons £
Liverpool, 5 per cent primage

TO NEW YORK.

Provincial.

Sydney	
Lingan	$5 00
Cow Bay	4 00
Port Caledonia	4 00
Little Glace Bay	4 00
TO BOSTON.	4 00
Sydney	3 50
Lingan	3 60
Cow Bay	3 50
Port Caledonia	3 50
Little Glace Bay	3 50
TO MONTREAL.	
Caledonia	3 75 gold
TO CUBA.	
Caledonia	9 50 gold.

MARKET REVIEW.

NEW YORK, Nov. 9, 1873.

IRON—Scotch Pig is quiet, but there is, perhaps, more steadiness of tone to the market. Stocks are ample for all present demands, but holders, as a rule, are not forcing sales. Eglinton continues in very light stock, and we quote $38@$39. Glengarnock is in better supply, and quotable at $39@$40. These figures will show a slight advance on previous quotations, caused more by the strengthened views of holders, who seem to think that prices are about as low as they are likely to be. Sales 200 tons Glengarnock on private terms, part cash and part 4 months, adding interest. In American Pig we have no change to note. The stock of Lehigh brands is not large. Eighteen furnaces are out of blast, with more likely to follow, unless some improvement in the demand should set in. The stocks throughout the other districts are beyond the wants of the Trade, and prices, as a rule, are nominal and in buyers' favor. We quote No. 1 $35@$37, No. 2 $30@$31 (with sales), and Gray Forge $25@27. Rails of all descriptions are very quiet; we quote only

$39 for T and $40 for D. H., though 150 tons T are reported sold at $38. Scrap has sold as low as $32 from dock, and from yard $38 is about the nominal figure. Manufactured, from store, is quiet at our quotations.

Import of Iron into New York, from Jan. 1 to Oct. 31, 1873—

	Bar.	Pig.	Sheet, &c.
From Foreign Ports..tons.	8,667 tons.	56,095	bdls. 143,862
Coastwise	1,725	333	10,656
Total........tons.	10,392 tons.	56,428	bdls. 154,518
Same time, 1872..	14,979	90,751	254,502

LEAD—Pig is very quiet, but prices are unchanged, Ordinary Foreign being held at 7 cents, and Domestic 6¾ @6⅞ gold. Bar 9½ cents, Sheet and Pipe 10½ and Tin-lined Pipe 16½, all less 10 per cent. to the Trade.

Import of Lead into New York, from Jan. 1 to Oct. 31, 1873—

From Foreign Ports	pigs. 247,602
Coastwise Ports	40,209
Total..........................	pigs. 287,811
Same time, 1872	390,389

COPPER—Manufactured is nominally steady at our quoted rates, but the business is very small. Ingot remains excessively dull, and prices still yield; some 70@80,000 lb. Lake sold in lots at 21@21½ cents, cash, mostly at 21, and a little at 22, short time.

SPELTER—There is scarcely any inquiry, and we have only to notice sales of a small lot Silesian at 7½ cents gold; and 40 tons Domestic, $8.06¼@$8.12½ per 100 lb. currency.

Import of Spelter into New York, Jan 1 to Oct. 31—

1873........plates. 135,912 | 1872 ....plates. 263,947

STEEL—The market is quiet, but steady at our quotations.

TIN—The stagnation in Pig continues, and without business prices are wholly nominal. Straits is held at 28½@29½ cents for jobbing lots, English L. & F. 27, English Refined 28, and Banca 33, gold. Plates remain very quiet, but prices generally may be written rather more steady; the sales are 250 bxs. Charcoal Tin at $9.75, and 150 do. Charcoal Terne $9.50, gold.

Import of Tin into New York, from Jan. 1 to Oct. 31—

	1873.	1872.
PIGS	No. 64,779	82,616
PLATES	bxs. 855,966	904,896

ZINC—Mosselmann Sheet is nominal at previous quotations, from agents hands—10 casks sold from store, at 8¾ cents net gold. Manganese black oxide 4 cents, do gray 6 cents.

METAL CIRCULAR.

LONDON, October 16, 1873.

The advance to 6 per cent. in the Bank rate, and the general uncertainty and apprehension as to the future course of monetary affairs occupies much attention, and restricts business, prices closing in consequence rather easier.

COPPER—As advised in closing our last weekly report the market suddenly improved under the influence of a large transaction (about 1,000 tons) concluded in Chili Bars, and $84 10s. was freely paid for good ordinary brands, and $94 for Wallaroo. This improvement continued with a general demand, especially from France, and prices advanced 20s.@30s. all round on Foreign sorts. The Chilian advices received by cable on the 13th inst. gave a further impetus, the charters for the first fortnight of September being only 500 tons fine (though the estimated stock had increased 1200 tons), and had it not been for the monetary complications above alluded to, consumers would no doubt have continued to supply themselves freely. The market closes steady, at about 20s. lower all round from the best prices paid.

TIN—Nothing of importance to report, though rather firmer at the close. About 80 tons have been sold during the week at prices varying from £120 to £121 10s. cash and for December, closing with transactions at £121 cash. English is quiet, and rather lower prices have been accepted.

TIN PLATES—Only a limited business doing.

IRON—A fair business at quotations.

SPELTER—Is steady; about 100 tons of special Silesian sold at £27 15s., spot and to arrive, and 25 tons ordinary Silesian at £27 spot. English Spelter has been sold at £28 to £28 10s. Birmingham.

LEAD—Firm.

VIVIAN YOUNGER & BOND.

OFFICE OF EDWARD SAMUEL
Iron Broker and Commission Merchant,
332 WALNUT STREET,

Monthly Market Review.

PHILADELPHIA, Nov. 1, 1873.

AMERICAN PIG IRON, which was nominally quoted in the first week of October at $38@40 for No. 1; $35@36 for No. 2; $29@30 for Grey Forge, has fallen to the present nominal quotations of $35@36 for No. 1; $30@31 for No. 2; $27@28 for Grey Forge. With the exception of one or two forced sales, no business is reported. As the present cost of making is above the quoted price, many furnaces have gone out of blast. Twenty stacks in the Lehigh District, nine in the Schuylkill, and six in the Susquehanna are already reported as out, together with all the Pittsburgh furnaces. All iron industries are so prostrated by our financial disturbance that consumers as well as producers are obliged to suspend operations, and the impression prevails that there will be no general resumption of business before spring. The laboring classes have a hard winter staring them in the face, and it is difficult to foresee how they can tide over it without relief in the practical shape of work and wages.

SCOTCH PIG, notwithstanding the firmness abroad, and the fact that all in New York was held pretty much by one or two parties, has sympathized with American, and is quoted to-day at $6@8 per ton lower than this time last month. Some few sales were reported early in last month, but generally on private terms. In our local market no transactions are reported. Our latest English advices by mail, under date October 15th, Liverpool, give the following figures, F. O. B, in the Clyde:

Gartsherrie, 126s.; Coltness, 128s.; Summerlee, 121s.; Langloan, 123s. 6d.; Calder, 122s. 6d.; Carnbroe, 120s.; Glengarnock, 121s.; Dalmellington, 120s.; Eglinton, 120s.

F. O. B. Liverpool about 7s. per ton more, all round.

Exports to the U. S. for month of August....	9,555 tons.
" " " for eight months ending August 30th	87,968 "
Stock of Pig Iron in store, Glasgow, 25th December, 1872	106,919 "
Stock of Pig Iron in store, Glasgow, 12th October, 1873	39,317 "
Decrease	67,602 tons.

RAILS are without movement. The mills that continue in operation reduced wages 10 per cent. during the month, and a further reduction is, we understand, determined upon. It is the sincere wish of most operators to keep their hands in, at least, partial work during the winter, and they are, consequently, willing to make concessions in price to obtain orders. In the absence of transactions, would quote $69@70 at mills, although for ready money lower figures can be obtained. English rails are quoted at $60@62, gold, New York.

OLD RAILS have been dull and depressed, with but little demand, and no sales of magnitude. One or two small lots of Ts sold here at $40, currency, and about 200 tons in Baltimore at same figure. There are but few rails here, and in New York all the DHs are held by one house, which is not in the market.

MERCHANT BARS are in sympathy with the rest of the list, and can be bought at 3 cents to 3.3 cents. No sales are reported, and many mills have suspended operations, or are running only every other week.

WROUGHT SCRAP is without sale, consequently without price. In the early part of last month some few sales were made at $38@39, but the transactions were too small to be worthy of notice.

As foreshadowed in our last, many works have suspended operations entirely, wages have been reduced from 10 to 20 per cent., and a general antipathy to do business, except for prompt cash (which is not attainable), exists. It is more than likely that this deplorable condition of affairs will last until after the holidays, perhaps into the spring, and in the present uncertainty it is impossible to predict as to the future.

METALS.

NEW YORK, Nov. 6, 1873.

IRON.—Duty: Bars, 1 to 1½ cents ₩ lb; Railroad, 70 cents ₩ 100 lbs.; Boiler and Plate, 1½ cents ₩ lb; Sheet, Band, Hoop, and Scroll, 1¼ to 1¾ cents ₩ lb; Pig, $7 ₩ ton; Polished Sheet, 3 cts. ₩ lb; Galvanized 2½; Scrap Cast, $6; Scrap Wrought, $8 per ton. All less 10 per cent. No Bar Iron to pay a less duty than 35 per cent. ad val.

	Store Prices.
Pig, Scotch—Coltness ₩ ton	44 00@45 00
Gartsherrie	— —@— —
Glengarnock	39 00@40 00
Eglinton	38 00@39 00
Pig, American, No. 1	35 00@37 00
Pig, American, No. 2	31 00@— —
Pig, American, Forge	25 00@27 00
Bar Refined, English and American	— —@— —
Bar Swedes, assorted sizes (gold	— —@137 50
	Store Prices, Cash.
Bar, Swedes, 1½ to 5 x ⅜ & ⅝ 2 sq. & 6 to 12 x ⅜ & ½..	175 00@ — —
Bar, Refined, ⅝ to 2 in. rd. & sq. 1 to 6 in. x ⅜ to 1 in.	82 50@ — —
Bar, Refined, 1¼ to 6 by ¼	87 50@ — —
Bar, Refined, 2⅛ to 2⅞ round 1 & 1⅛ by ¼ & 5:16	90 00@ — —
Large Rounds	92 50@107 50
Scroll	102 50@135 00
Ovals and half-round	110 50@130 00
Band	103 50@105 00
Horse Shoe	117 50@ — —
Rods, ⅝ to 3-16 inch	92 50@125 00
Hoop	120 00@160 00
Railroad	[illegible]
Sheet, Russia, as to assortment (gold)	[illegible] 15

Sheet, Singles, D. and T. Common	—6½@— 6¾
Sheet, D. and T. Charcoal	—6¾@— 8
Sheet, Galv'd, list 10 per cent, discount	— —@— —
Rails, English (gold), ₩ ton	63 00@ 65 00
Rails, American, at Works in Pennsylvania, currency	70 00@ 75 00

COPPER.—Duty: Pig, Bar, and Ingot, 5; old Copper 4 cents ₩ lb; Manufactured, 45 per cent. ad val.

	All Cash.
Copper, New Sheathing, ₩ lb	— @— 38
Copper Bolts	— @— 40
Copper Braziers, 16oz. and over	— @— 40
Copper Nails	— @— 45
Copper, Old Sheathing, &c. mixed lots	21 @— —
Copper, Old, for chemical purposes, 14@16 oz.	— @— —
Copper, American Ingot, Cash	21 @— 21½
Copper English Pig	— @— —
Yellow Metal, New Sheathing & Bronze	— @— 26
Yellow Metal Bolts	— @— 32
Yellow Metal Nails, Sheathing and Slat'g	26 @— —

LEAD.—Duty; Pig, $2 ₩ 100 lbs.; old Lead, 1½ cents ₩ lb Pipe and Sheet, 2½ cents ₩ lb.

Spanish (gold)	— — @7 00
German, do.	— — @7 00
English do.	— — @7 00
Foreign, Refined	7 25 @7 50
Domestic do.	6 37½@6 50
Bar ....(net)	9 25 @ —
Pipe..........(net)	— — @10 50
Sheet	— — @10 50

STEEL.—Duty: Bars and ingots, valued at 7 cents ₩ lb or under 2½ cents; over 7 cents and not above 11, 3 cents ₩ lb; over 11 cents, 3½ cents ₩ lb, and 10 ₩ cent ad val. Store prices.

English Cast (2d and 1st quality) ₩ lb	— 17½@— 22
English Spring (2d and 1st quality)	— 9½@— 10½
English Blister (2d and 1st quality)	— 14 @— 18½
English Machinery	— 14½@— —
English German (2d and 1st quality)	— 12½@— 14½
American Blister "Black Diamond"	— — @— 11½
American, Cast, Tool do.	— — @— 17
American, Spring, do.	— — @— 11
American Machinery do.	— 11½@— 12
American German, do	— 9 @— —

TIN.—Duty: Pig, Bars, and Blocks, 15 ₩ cent. ad val.; Plate and Sheets and Terne Plates, 25 ₩ cent.; Roofing 25 ad val.

	Gold ₩ lb.
Banca	33 @— —
Straits	28½ @29½
English	27 @— —
English Refined Gold	28 @—

PLATES.

Fair to Good Brands.	Gold.	Currency
I. C. Charcoal, ₩ box	$ 9 50 @10 00	$11 00 @11 50
I. C Coke	7 25 @ 8 00	8 50 @ 9 50
Coke Terne	7 00 @ 7 75	8 25 @ 9 25
Charcoal Terne	9 50 @ 9 75	11 00 @11 25

SPELTER—Duty: In Pigs, Bars & Plates,	$1.50 p. 100lb
Plates, Foreign.........(gold) ....p. 100 lb.	7 37½@—7 75
Plates, Domestic.......................p. lb.	8½@—11

ZINC—Duty: Pig or Block, $1.50 per 100 lb.; Sheet 2½c per lb

Sheet .... per lb.—9½ @ 10

San Francisco Stock Market.

BY TELEGRAPH.

NEW YORK, Nov. 6, 1873.

We have advices from the San Francisco Stock Board, dated the 4th inst. The list is irregular, with the tendency upward. The Eureka, G. V. Mining Co. have declared a dividend of $1 per share, payable on the 7th inst. The report is as follows.

Savage	—	—	54
Crown Point	—	—	108
Yellow Jacket	—	—	60
Kentuck, "New Issue"	—	—	13¾
Chollar Potosi	—	—	46
Gould & Curry "New Issue"	—	—	11
Belcher "New Issue"	—	—	74
Imperial	—	—	5¾
Raymond & Ely	—	—	16½
Meadow Valley	—	—	13¾
Eureka G. V.	—	—	—
Ophir	—	—	—
Hale and Norcross	—	—	—

American Institute of Mining Engineers.

OFFICIAL BULLETIN.

Announcements to Members and Associates.

I. The ENGINEERING AND MINING JOURNAL, which is the Organ of the Institute, and contains its proceedings, transactions and notices of meetings, will be sent to each Member and Associate on the payment of his annual dues. Back numbers cannot, as a rule, be sent.

II. Dues are payable in advance at the annual (May) meeting. Remittances should be made, as far as possible, by P. O. Order, payable to the Secretary.

III. The first volume of Transactions of the Institute is in course of preparation and will be sent, as soon as issued, to all members not in arrears.

THOMAS M. DROWN, Secretary.
1123 Girard street, Philadelphia, Pa.

MISCELLANEOUS.

THE ENGINEERING AND MINING JOURNAL.

ROSSITER W. RAYMOND, Ph. D.
JOHN A. CHURCH, E. M. Editors.

PUBLISHERS' ANNOUNCEMENT.

THE ENGINEERING AND MINING JOURNAL *is projected in the intent of furthering the best interests of the Engineering and Mining public, by giving wide circulation to original special contributions from the pens of the ablest men in the professions. The careful illustration of new machinery and engineering structures, together with a summary of mining news and market reports, will form a prominent feature of the publication.* It is the Organ of the American Institute of Mining Engineers, and is regularly received and read *by all the members and associates* of that large and powerful society, *the only one of the kind in this country.* It is therefore the best medium for advertising all kinds of machinery, tools and materials used by Engineers or their employees.

SUBSCRIPTION—$4 per annum in *advance;* $2 50 *for six Months.*

ADVERTISEMENTS—*The rates are as follows: Inside pages,* 25 *cents per line each insertion; the outside or last page,* 40 *cents per line. Payment required in advance.*

NEWS-DEALERS *will be supplied through the agency of the* AMERICAN NEWS COMPANY, *No.* 121 *Nassau street, New York City.*

COMMUNICATIONS *of all kinds should be addressed to the Secretary. The safest method of transmitting money is by checks or Post-office orders, made payable to the order of* WILLIAM VENTZ. *Correspondence and general communications of a character suited to the objects of* THE ENGINEERING AND MINING JOURNAL *will always be welcome.*

The Postage on THE ENGINEERING AND MINING JOURNAL *is twenty cents a year, payable quarterly in advance, at the office where received.*

THE SCIENTIFIC PUBLISHING COMPANY.

WILLIAM VENTZ, SECRETARY.

27 Park Place,
NEW YORK CITY.

P. O. Box 4404.

CONTENTS FOR THIS WEEK.

WE trust that in these hard times our subscribers and advertisers will keep in mind that prompt payments on their part are vitally important to the continuance of our business. Like other creditors, we have relaxed as far as possible, the severity of our rules requiring payment strictly in advance; but this concession is limited by the circumstance that our own creditors, to wit, contributors, printers and clerks (with occasionally an editor) must be paid weekly in cash. Will our friends, who are in arrears through carelessness, remember that what is a little matter to each of them, becomes, in the aggregate, a matter of life or death to us?

A DESPATCH from Rome, Italy, says that the sulphur mines of Prapaolo, in that kingdom, have been destroyed by an earthquake. Mother Earth appears to be doing her best to give philosophers an insight into her workings, and, no doubt, we should be thankful; but it is to be hoped, she will turn her attention to some other industry than mining. She seems to be as uneasy as if the Italian miners were so many fleas, and this is the second time she has warned them of what terrors they may look for when she is really awakened.

A FALL of one-third in the price of pig iron is the response of the iron trade to the collapse in Wall street. The market is necessarily very dull, and the extension of manufacturing facilities, except by far-sighted and strong capitalists is, of course, stopped. What the future is to bring forth no one can say, and he who should predict beyond the winter, would be a bold man. Spring may bring a good trade, and it is more than likely that it will find iron masters prepared to make their metal at a considerably smaller cost than they have done this Fall. There can be little doubt that a thoroughgoing re-adjustment of prices will take place with more or less rapidity, which will, it is to be hoped, leave us in a less abnormal state. The transition process is not a pleasant one, and stoppages and reduction of wages on every hand tell how hard pressed some—or rather *all*—manufacturers are. These movements of the employers are sometimes resisted, as by the puddlers in Troy, who struck to prevent the reduction, but, as a rule, it is probable that no continued struggle will take place. It is one of the misfortunes of laborers, and, at the same time, a criticism upon their claims for better pay, that, as a class, they never save anything. No matter how prosperous their condition, a strike or lockout finds them poor. Fortunately the American workmen are, for the most part, careful students of current events, and usually capable of judging their position pretty accurately. They seem to acknowledge, by their actions in the present emergency, that a great change must be made in the prices of all labor. Something of the same kind is taking place in England, though on a much less formidable scale. The iron manufacturers in the North of England lately made a determined effort to effect a reduction of 12½ per cent. in puddlers' wages, which now stand at 13s. 3d. per ton. They say that at present prices half-a-crown a ton—say 60 cents currency—represents all the difference between profit and loss on manufactured iron, and they proposed to increase this by taking about 40 cents from the puddlers. This attempt has failed, but it was based on the prices obtained in the three months preceding October. Since those months ended, the disasters to trade in this country have been exhibited to a world alarmed for the prosperity of its best customer, and when a renewed attempt is made, it will probably succeed. Thus the discrepancy which exists between English and American prices, and which has been intensified by the break in the market on this side, is likely to be somewhat lessened by a fall in wages abroad, a fall which is looked upon with hope by English iron masters, as the beginning of a new turn of Fortune's wheel in their favor.

THE last rail has been laid on the International Bridge at Buffalo, and Canada now has a new and very important line of communication with this country. This great work has, fortunately, been finished before the panic came to put a stop to almost all forms of railway work. It belongs to what will, for years to come, be known as the most brilliant period of Canadian railroad engineering, a period in which a most comprehensive plan for directing the products of our Western States to Northern channels, and making them pay tribute to Canadian determination and thrift, has been carried out. Railroading there is anything but holiday work, and the roads are pretty much in the condition of our Pacific road. They run through a country that is too poorly settled to give them that immense traffic which a great road absolutely needs, and they have not the privilege our Pacific road enjoys, of charging exceptionally high tolls. The bid for the carriage of our crops was as shrewdly as boldly made, and it accomplished a great deal toward obtaining the coveted business, while the advantages which Canada may reap from these lines of communication, cannot fail to be very great. But since that scheme was planned, and partially carried out, our own roads have taken the alarm, and begun a systematic extension of their carrying facilities on a scale fully as grand. The Canadian Pacific has received what must be looked upon as a *quietus*, although its construction is a matter of treaty obligation, to which Canada is fully pledged, and we fear that Canadian roads will find themselves deeply involved in the consequences of the American panic.

OUR Colorado exchanges come to us full of the question now raised with much vigor in the Territory, of a full coinage mint at Denver. We sympathize with the desire of the citizens of Colorado to have better facilities than those they now enjoy; but the erection of stamps and dies for coinage is not necessary to give them all they need or want. The granting of power to the Branch Mint at Denver, to pay for bullion in coin, will answer every purpose. There is no coinage mint at New York City, though there ought to be one, to save trouble and risk of sending bullion to Philadelphia; but the lack of it causes no inconvenience to the public at large. If there were a coinage mint at Denver, it would either coin only that part of the gold and silver produced in the Territory—which stays in the Territory. The rest—being intended for shipment—would be left in bars as at present—the cheapest and safest form for shipment. Money should be coined at those points where it is likely to remain in the largest amounts; that is, at the money centers. Colorado cannot keep a dollar in the Territory that is needed for export, just by putting a stamp on it. She can make it more expensive to export, that is all.

Chicago wants a mint, too; and there are some good reasons for putting one there. But the multiplication of mints is a great evil, as all practical experts in coinage are aware. The periodical difficulties in the management of the San Francisco Mint illustrate how hard it is to control to the requisite degree of nicety, the delicate, and yet heavy, operations of such an institution. The mints at Dahlonega, Charlotte and New Orleans were long ago discontinued; and the Carson mint has benefitted nobody that we know of, except the contractors that built it, and the laborers they employed. Even concerning the usefulness of the mint at San Francisco, we are heretics enough to doubt; but the refinery interest in that city is too strong to permit the subject to be thoroughly ventilated and discussed.

WE continue this week the report of the Easton Meeting of the American Institute of Mining Engineers. The paper of Mr. OSWALD J. HEINRICH, the publication of which is delayed by the preparation of the necessary diagrams, was one of the most important presented at Easton. It constitutes an extremely valuable contribution to the discussion of systems of coal extraction—a discussion which has gone beyond the limit of mere empty lamentations over waste, or crude recommendations of remedies inapplicable under present conditions. Mr. HEINRICH, having formerly explained the system employed in the Midlothian Colliery, under his charge, was told that it could not be economically employed in other American fields. His reply is a thorough, detailed, and very impartial calculation which will, doubtless, be scrutinized with care by the anthracitic members (if we may thus irreverently term them) of the Institute. The beauty of it is, that it *can* be scrutinized. Right or wrong, it is not vague; and if erroneous, it is incumbent on the critics to show in what point the error lies.

Mr. ENGELMANN's paper, which we published last week, is brief, clear, and exact, and will, therefore, be valuable to those who are studying the merits of different systems and apparatus for concentration, and who want, first of all, authentic data.

The papers of Mr. J. J. BODMER, of London, are the first fruits of the foreign relations established by the Institute. They are interesting and timely, and we trust that the distinguished Engineers and Metallurgists of England, France and

Germany, who have recently been elected to membership, will not be slow to imitate Mr. BODMER's example, and to give us the benefit of their professional experience.

Mr. ALEXANDER L. HOLLEY's paper on Tests of Steel produced upon the Institute an effect which the perusal of it will reproduce upon the reader. Mr. HOLLEY has a way of hitting the nail on the head, and driving it in. Not everybody can strike both hard and true. The keen perception and full recognition of the value of chemical analysis which this paper displays, is all the more significant since it comes from one whose eminence as a mechanical engineer might excuse in him a prejudice in favor of exclusively physical tests.

The Report against the St. Louis Bridge.

IN compliance with law and custom a committee of army engineers has inspected the great bridge building at St. Louis, to ascertain whether it is an impediment to navigation. The Board was composed of Generals SIMPSON, WARREN, and WEITZEL; Colonel MERRILL, and Major SUTER; and the standing of these officers is such that their report cannot fail to have great weight with Congress. After careful examination they have decided that the bridge is a serious obstruction to navigation; that it will practically cut the Mississippi river in two at St. Louis; that in its present form it will compel the transhipment of freight designed for the upper part of the river, and that some correction must be applied to remove this defect. This conclusion is based upon a comparison of the height of the middle arch above the water level at various stages of the river with the heights of the steamboat chimnies and upper works. The bridge is composed of three arches, and the engineers leave the side arches out of the discussion altogether, as they are somewhat lower than the center span. Of the latter a space 174 feet long—that is 87 feet on each side of the middle line—only is considered. The reason why this width is chosen is that it corresponds to the space required by law for draw-bridges in similar situations, and which varies from 160 to 200 feet. The chord of this central portion of the middle arch is 5 feet below the crown of the arch, and 50 feet above the city directrix. A diagram, annexed to the report, on which is exhibited the height of a large number of river boats at various stages of the water, shows that not only will many of them have to lower their chimnies, but that many of them will be unable to pass at all on account of the upper works, which reach above the line of this chord. The engineers first discuss the practicability of lowering the chimnies, or the upper part of them, and of cutting down the pilot houses, deciding against both measures. They say:

"The apparently unmeasurable height and size of the chimnies in general use on these steamboats are really essential to secure a good draft to the furnaces, and economical combustion of fuel. Artificial means to procure the same end are generally very expensive and often ineffective. Although it is a comparatively easy task to lower small chimnies, dealing with those of a large size is a very serious matter, indeed. Their weight is so utterly disproportionate to their strength, even when new, that no machinery yet devised will enable large chimnies to be lowered either wholly or in part without very great labor and danger. The elevated portion of the pilot-house is necessary to enable the pilot to have an unobstructed view of the river ahead and astern of his boat. Experience has decided this point most clearly."

They also condemn the adoption of an arch as a means of crossing large rivers used for navigation, on the ground that arches do not afford an equal height over their whole width. A boat which fails to slip through the center must infallibly come to grief against the lower side portions of the arch. This fault is the more decided at St. Louis, because the spring of the middle span is at about the same level as the high water of 1844. It may well be supposed that the difficulty of passing the bridge in its exact center will be very great, especially in foggy or windy weather; and St. Louis is a place much given to fogs. The piers are too far apart to afford the pilot an accurate direction; and lights hung on the arch will not be very serviceable, because they will necessarily hang directly overhead. When it is remembered that the larger part of the river business is done at high water—when the current is especially rapid, and that the large New Orleans boats usually cease running when the water falls below 20 feet above extreme low water, it is plain that the St. Louis bridge is a very serious obstruction to free navigation. The report says:

"A large portion of the St. Louis river front is above the bridge, and several elevators, sugar refinery, and other similar buildings are already located above it. These could not safely be reached by the large boats during the high stages, and much inconvenience would be entailed. But the Board consider these interests in a measure local, and of infinitely less importance than the national interests involved in the question. The Government has expended, and is still expending, large sums of money in improving the navigation of the Upper Mississippi, Missouri, Illinois, and other rivers, for the express purpose of allowing the largest steamers to navigate them. It would, therefore, seem entirely out of keeping with this general policy to allow, at the very threshold of these improvements, a structure which would debar a large proportion of existing steamboats from using them. The Board are therefore unanimously of the opinion that the bridge, as at present designed, will prove a very serious obstruction to the navigation of the Mississippi River. They would moreover state that arch trusses, like those under construction, present so many difficulties to free navigation that in future their use should be prohibited in plans for bridges over navigable streams."

The bridge being condemned, the question now is to correct its faults. Unfortunately this is a very serious problem, and the able engineers who criticise the structure find that no change can safely be made in the bridge itself. In fact the possible alterations are few in number. The arches may be raised, but this would require the simultaneous raising of all three spans, and the building of new approaches, since the piers have been built to withstand the thrust of the unloaded arches alone, and are not strong enough for heavier work. For the same reason the center span cannot be replaced by a straight truss or other device. If the bridge is raised, the costly tunnel under the city will be useless. All these remarks show that any system of reconstruction would be enormously costly, and the board therefore turned their attention to another remedy. They say:

"Under these circumstances, the board do not feel justified in recommending any change which would involve the complete remodeling of this magnificent structure, now so nearly completed. At the same time, as already stated, they deem it absolutely necessary that some provision should be made for allowing large boats to pass the bridge with safety whenever they find it necessary to do so. They would therefore recommend, as the most feasible modification, a plan which has been already tried and found efficient at the railroad bridge over the Ohio River at Louisville, Ky. Let a canal, or rather an open cut, be formed behind the east abutment of the bridge, giving at the abutment a clear width of water-way of 120 feet. The shore side of this cut should be laid out on an easy curve joining the general shore line about 500 feet above the bridge and 300 feet below it. The river side may be entirely open, but the shore side should be revetted vertically with stone or with crib-work to a height of about five feet above extreme high water. This wall should be provided with ring-bolts and posts to enable boats to work through the cut with lines. Let this opening be spanned by a draw-bridge, giving a clear span of 120 feet in width. By this plan boats as large as any now built would be able to get through the bridge in any weather, at any stage of water, and only at the cost of some little delay. The steamboat-men have stated to the board that they would be satisfied with this modification, and the engineers of the Bridge Company only raise as an objection the delay to trains caused by opening and shutting the draw. While recognizing the validity of this objection, the board deem that the difficulty can be mitigated, if not entirely overcome, by providing machinery capable of opening and closing the draw with any desired rapidity. They think, moreover, that it will only be in exceptional cases that boats will desire to pass through this draw, so the delay to trains from this cause will not be excessive."

This then is the end of the great Saint Louis Bridge. It is, as the board of Engineers report, "a magnificent structure," but one who looks back at its history can hardly approve the recklessness with which the larger questions involved have been decided, however ingenious the special engineering devices employed have been. Had the first pier been left on a clay bottom as was intended when the works for its construction were begun, its fragments would now probably be far on their way toward New Orleans. A "bluff scour" is reported to have cleansed out the channel between the piers to below the depth of the intended foundation. Then the difficulty experienced in securing steel of proper strength to withstand the thrust of the arches, was developed only after the designer had fully committed himself to the arch system. These are but the most obvious facts in a history which is recent and familiar to all. The condemnation by the Army Board of the arch, as a means of crossing navigable streams, will probably act as an effectual stopper to similar recklessness in the future, and designers of bridges will be expected to adhere to modern instead of ancient methods of construction.

As to the remedy proposed by the board, it may be well to say that it is in effect but the restoration of the natural condition of the Mississippi before there was any Saint Louis or any railroad. On the east side of the river were low, flat and swamp lands, which in times of high water allowed the passage of a vast body of water, and therefore extended important relief to the main stream, and doubtless prevented many a local flood. These low lands have been filled up by the railways, and when this work was completed, Captain EADS came along and planted three huge piers in the narrowest part of the river. Under such circumstances serious floods sooner or later must be the consequence, and the relief extended by the proposed canal will therefore be important in more ways than one. In fact it would be well to make the canal large enough to offer decided and sufficient relief in case of unusually high water.

CORRESPONDENCE.

Mr. Peppers Steel Again.

TO THE EDITOR:

SIR—In brief answer to an editorial article in the JOURNAL of Oct. 1, commenting upon what you are pleased to call "Peppers Steel," under that heading you apologise to your readers for noticing it at all. I think an apology was due, for reasons entirely different from those stated. My steel had not been manufactured in public or offered in market; and no publication for the public in regard to it had been requested or authorised by me. The circular which you criticise, had printed on its title page, "Confidential;" it was left for the editor of the JOURNAL with an express message requesting perusal, as preliminary to investigation and trials by him that he has never made. Such trials of manufacturing operations have been supervised by many who *do understand the subject*, and of the highest authority, every one of whom, so far from regarding it absurd, give it their approval and endorsement, and whose testimonies in due time will be authoritatively published; but it was designed by me from the beginning, that before any publication in any paper, that *public* trials and demonstrations should be made, and for that purpose, before the hasty and premature article in the JOURNAL was written, and at the earliest day after securing my patent rights, entry was made at the existing fair of the American Institute, as appears from the accompanying letter of the General Superintendent, for the public manufacture, investigation and exhibition of the silicon steel at the fair, which you are earnestly and respectfully advised and requested to witness, for more information and clearer knowledge of "Pepper's Steel." I do not question in the least the entire competency, fairness, and integrity of purpose with which the writer of the article in the JOURNAL would conduct such investigation himself, if undertaken by him; and I doubt not that any requirement or participation of his will be readily complied with by the judges at the investigation to come off at the American Institute.

In the mean time that the issues between the JOURNAL and myself so prematurely made, may be fully understood by your readers before final trial, I have to state:

It is stated in the article of the JOURNAL, that the process consists in the use of pure white quartz sand only, in which the wrought iron is converted into steel, and that my method is precisely parallel to that called cementation, where wrought iron bars are heated in charcoal; and to that other called oxidizing cementation where cast iron bars are heated in sand.

The article further says, that I say as quoting from my pamphlet verbatim, "that if it is desired to heat metal beyond its fusing point, *without fusion* all that is required is to place it in sand, and to heat the sand," and the results I am represented as claiming from this process you call phenomena. Speaking of my process according to your construction of it, as precisely parallel to the well known processes of which you speak, and of my claim to my invention as *new*, you give the exclamation point after *new*.

Now this whole representation as to what my pamphlet contains, is without intentional misrepresentation as I believe, or I would not regard you as a foeman worthy of my steel; but reference to the circular itself will show that I make no such ridiculous statement of contradiction in terms of heating the metal beyond its fusion point, *without fusion*, and this simply by placing it in the sand, and heating the sand, and so expressed as by heating with ordinary heat, and with ordinary heating of the sand. The whole purport of the circular speaks of the application of intense heat, and as from its surroundings and the mode of application of the heat without any fusing point whatever under the conditions of the application, however great the heat. It expressly distinguishes between the ordinary application of heat in the carbon cementation process, and of the annealing of wrought iron in sand, and of my process, not claiming by any possible construction as new, or my invention, any such processes as are stated by you to be parallel to mine. All that I claim as new and my invention is in essential difference, or addition to any other known process, and it is this novelty that you unsparingly denounce as absurd and impossible.

Now, as the steel I produce by my process is claimed by me to be owing solely to such new conditions thus ridiculed, if I produce the results claimed as differing from other steel, however produced, surely then the invention is new, according to your own showing.

The cementation process of making blistered carbon steel from wrought iron, and of annealing cast iron in sand, to give the iron malleable properties, was known to me as in common use before my critic had learned his alphabet, and both are disclaimed as my invention, in the circular, and in all my specifications for patent rights. The annealing process of giving wrought-iron-properties to cast iron was never carried to the extent of making steel of any kind, and could be only done with extreme care and circumspection, as only one of the methods of making silicon steel as described by me. As the carbon contained in cast iron is a flux to the iron, it would preclude silication of the solid iron, unless decarbonization should co-exist with the silication. Making carbon steel, or any steel as containing carbon, by any process, is no part of my discovery and invention. In making steel from carbon iron without change of form by my process, it is not enough to decarbonize the iron in the sand by oxidation of the carbon into carbonic acid or oxide, but this must be accompanied and succeeded by a greatly increased heat, such as the silica and burning silicon alone can give from their unequalled heating properties, the iron silicating silicon entering into the composition of the metal, the surplus silicon of the small portion of the sand or silica deoxidized passing off as silicic acid, or entering as a silicate into the crust of the sand, or passing off in the slag, but almost the entire of the sand remains intact, without change, imparting its heat for the process. Of course, wrought iron as already decarbonized, requires no decarbonizing process to be converted into the silicon steel, but the greatly increased increments of heat the sand alone can impart are still necessary to effect the conversion of the iron into steel. The sand need not be absolutely pure quartz sand; the common white sand of the sea shore will suffice. The heat acquired and imparted by the sand, and as without a flux infusible, is such that no other steel or mercantile iron could withstand without the sand, and not flux or be rendered worthless; and to this greatly increased temperature I attribute, in part, allotropic effects of heat as heat in producing the great change in the iron, and as also, in part, giving the extraordinary working, hardening and self-welding properties of the steel at an intense white heat, from any fire, and as with or without further use of the sand, with again a heat that could not be applied to any other steel or metal without destroying or rendering worthless the metal; but, of course, the heat without the sand has its limits also, though bearing much greater degrees of heat than other steel or metal. Carbon iron, as cast iron, exposed to the same heat, in the same sand, and in the same vessel or furnace in which I make silicon steel most perfectly, and in the shortest time, or as continued without detriment to the steel indefinitely, will be melted in a few minutes' time—proof positive that the exemption from fusion in the manufacture of the silicon steel, as described in the circular, is not because of lack of heat from the use of the sand, and that a fusing point from any temperature, however far exceeding any that can be produced without the sand, cannot be reached. The infusibility differs from that of pure iron without alloy, and as such possessing no mercantile value, for my steel is made of iron with alloy, as contained in all merchantable iron, and fusible without the sand.

The silicon steel can be made of any decarbonized iron immersed or surrounded in its protecting and silicating sand, without carbonization of the iron, from the products of combustion of the fuel, passing through the sand, or of oxidation from the air blast. It requires actual contact of *solid* carbon with the iron at whatever heat to carbonize the iron, and hence the steel can be made in any fire as commonly used for metallurgic purposes.

Pepper's steel is not carbon steel as ever made before; the process is different; the appearance is different; no other steel has all the properties of wrought iron and steel combined; no other steel receives additional hardness like it, or works equal to it, welds upon itself or to iron without a flux. If not silicon steel, what is it? The analysis shall be given to the readers of the *Engineering and Mining Journal*, in common with the rest of the public.

CALVIN PEPPER.

We desire to do justice to all, and, in printing the obscure explanation of Mr. PEPPER, fully prove to our readers that we did justice, in our recent editorial article, to him and to his process. He complains that his circular does not claim the ability to heat a metal above its fusion point without fusion, as we said it did, but toward the latter part of his letter he expressly acknowledges the claim, and explains it; we cannot, therefore, have misrepresented him.—EDS.

The American Institute of Mining Engineers.

EASTON MEETING.

[Continued from Page 292.]

SESSION OF WEDNESDAY MORNING, OCT. 22.

THE Institute met at 9.30 A.M., President RAYMOND in the chair. After the usual routine notices, and election of new members (for the names of whom, see complete list published last week), a paper was read by OSWALD J. HEINRICH, of the Midlothian Colliery, Virginia, on

THE SYSTEM BEST ADAPTED TO WORK THICK COAL SEAMS.

In this paper, which will be published, with accompanying drawings, hereafter, the author compared the pillar system with that of cross-working and gobbing-up, giving detailed estimates of cost for each.

Mr. ROTHWELL remarked that he was glad this subject of the economical working of coal-seams had been again brought up. It could not be discussed too often. He thought that the importance of the subject was beginning to be realized in the anthracite regions, and that already a change for the better had set in. When we consider that 50 or 60 per cent. of anthracite coal is lost in mining, the necessity for reform in methods of working is apparent. Where the operators are likewise the owners of the mines, they realize the importance of economy in working. In the bituminous region of West Virginia, the cost of mining by the chamber and pillar system was ten per cent. more than by long wall, and the men made 10 per cent more wages on the latter system. The loss of coal in pillar working was 40 per cent., against 10 to 15 per cent. in long wall, and the coal obtained by the latter was much better and larger.

THE PRESIDENT said that although it was not the custom of the Institute to return formal thanks for each paper read, he knew he expressed the sentiment of the meeting in thanking Mr. HEINRICH for his admirable analytical discussion of this subject. It is just such papers that our profession needs. He appreciated, moreover, the feelings of the members in hesitating to discuss the paper on first hearing—it was one requiring careful study.

A recess of ten minutes was then taken to enable the members to be personally presented to Dr. W. C. CATTELL, President of Lafayette College.

Dr. CATTELL expressed his gratification that the Institute had honored the College by holding one of its meetings there, particularly on a day so memorable to them as the dedication of a building for the furtherance of those pursuits with which the Institute was in entire sympathy. As an evidence of his high appreciation of this organization, he would mention that of the many honorable titles of the orator of the day, he had selected for insertion in the College circulars that of "President of the American Institute of Mining Engineers." Dr. CATTELL concluded by tendering the freedom of the college buildings to the members.

The President then read, by title, a paper by Mr. HENRY ENGELMANN on

SOME RESULTS OF WET CONCENTRATION OF ORES BY MEANS OF THE UTSCH AUTOMATIC JIG AND THE "FINE GRAIN JIG."

This paper was published last week in our columns, pp. 296 and 297.

Four papers by Mr. J. J. BODMER, of London, England, were then read by the President, on

A PROCESS FOR DISINTEGRATING OR SUBDIVIDING IRON; MODE OF SUBDIVIDING, AND SPECIAL USE OF SUBDIVIDED BLAST-FURNACE SLAG; BLAST-FURNACE SLAG CEMENT; MANUFACTURE OF COMPRESSED STONE-BRICKS.

Specimens of cinder, bricks, and iron scale were exhibited. [The papers will be published in our columns, and the specimens may be seen in the collection of the Pardee Scientific Department of Lafayette College.]

Prof. FRAZER inquired if it were known whether differences of temperature of the slag and of the rolls caused the resulting granulated slag to have different properties?

Mr. PECHIN had tried some experiments on making slag-bricks in a small way, with interesting results. He had mixed a highly calcareous slag, which would disintegrate of itself on exposure, with lime, and formed a plastic mass, which could be readily moulded. When bricks thus made were once dry, water had no effect on them. On treating a glassy slag in the same way, the process of hardening was much slower, but after the lapse of two weeks the one brick was as hard as the other. He had furthermore noticed a difference in the working and hardening of the mixture when different amounts of lime were used. Thus, when five to six of slag and one of lime were used, the mass was very plastic and could be readily moulded, whereas when four parts of slag were mixed with one of lime, the mass set so quickly that it was impossible to work it. The value of cinder in replacing sand in mortar, he thought, was considerable, not only on account of the superiority of the mortar, but also as a saving of lime.

Dr. HUNT remarked that the action of blast-furnace cinder on lime was analogous to the action of puzzolana and volcanic ashes. Crystallized silicates have but little action on caustic lime, but when these silicates have been submitted to high temperatures, near or beyond fusion, they then acquire the property of combining with caustic lime. Volcanic ashes may be considered to be finely comminuted cinder, and, mixed with fat lime, gave the famous cement of the Romans. In time it had been observed that this cement could be imitated by using *calcined* clay with lime. We may look upon a blast-furnace, therefore, as a miniature volcano, and the slag as its melted lava.

Mr. F. FIRMSTONE mentioned an instance of the formation of a very hard stone from blast-furnace cinder without any admixture. There have been some pieces of cinder at the Glendon Works which have lain in a moist place for ten or twenty years. They are now so hard that they will turn the point of a pick.

It was suggested that during this time they may have taken up lime from the water.

REDUCED CARBON IN THE BLAST FURNACE.

Mr. FIRMSTONE then exhibited a substance found in No. 2 Furnace, at the Glendon Iron Works, in taking out the old lining. It consists of very fine black powder, which burns before the blow-pipe, and has the smell of coal-dust, lamp-black, or charcoal-dust.

It came from between two rings of brick, in a space of about an inch, which had been filled with loam.

A careful examination showed that there was no fissure through which coal-dust could have worked, hence Mr. FIRMSTONE thought, it must have been deposited from the gas, which will work through a very small crack.

According to Mr. BELL, carbon is deposited from carbonic oxide in presence of oxide of iron, which, in this case, would be supplied by that contained in the loam.

Mr. RAYMOND made some remarks on

THE OCCURRENCE OF ANTHRACITE IN NEW MEXICO.

He exhibited a specimen of this Anthracite, from the Ortiz Mine Grant, about 15 miles southwest of Santa Fe. The beds belong to the lignitic formation of the Galisteo, which HAYDEN and LESQUEREUX believe to be Tertiary, but which NEWBERRY long ago pronounced, on the evidence of distinctly cretaceous overly ing strata, to be Cretaceous. The anthracitic character has been imparted to the lignite by dykes of porphyritic material, many of which occur on the Grant. He thought it probable that the eruptive rocks had overflowed, as well as broken through, the coal bearing sandstones, and hence that a large part of the many thousand acres probably underlain by the coal in this locality would be found more or less affected, giving anthracite or semi-anthracite. The coal presents the usual anthracitic characters, having somewhat less specific gravity, and perhaps more water than the hardest Pennsylvania coals. According to the analyses of LECONTE and others, it contains from 85 to 93 per cent. of fixed carbon; but he was surprised the other day, to find in HAYDEN's report of the Geological Survey of Wyoming and contiguous Territories, published in 1871, a series of analyses by Prof. PERSIFOR FRAZER Jr., according to which the amount of carbon is only some 69 per cent. The coal analysed is there described as "bituminous coal from Old Placer Mines, San Lazaro Mountains, New Mexico," which is the exact locality from which the specimens analysed by LECONTE and others, and the specimen now exhibited to the Institute, were taken. The specific gravity of the coal analysed by Professor FRAZER, is given by him as 1.443. The discrepancy between his analyses and earlier ones is in the amount of "volatile substances," including both hydro-carbons and oxygen or "combined water," aggregating nearly 21 per cent. The matter requires further explanation. If there has been no mistake as to the specimens analysed, we must conclude that the character of the coal is variable—a hypothesis not unlikely, considering the admitted nature of its metamorphosis, but one which Mr. RAYMOND hesitated to adopt, in view of the uniform appearance of the coal and its behavior under the boilers of the New Mexico Mining Company, where it was burned for several months continuously, giving an intense heat, and the short blue flame of anthracite, without any appearance of hydro-carbon. The specimen exhibited had lain exposed to the weather for four years without physical alteration.

During Mr. RAYMOND's examination of the locality, he had found a new exposure (probably the effect of a recent rainy season) where, in the side of the bluff, five coal-beds were seen *in situ*, one above the other, within a vertical section of a little over one hundred feet. Three of them were workable beds, having (to judge from the outcrops) three to five feet of good coal each. He could not be positive that this was all anthracitic, no analyses having been made; but the broken outcrops had that appearance. The locality was very near that of the "Old Placer" mine.

Prof. FRAZER. During HAYDEN's geological survey of Colorado and New Mexico, in 1869, I visited the Real Dolores, and was directed by Col. ANDERSON to the outcrop of the anthracite bed spoken of by the President. It lay from ½ to ¾ mile from the Old Placer colony near the foot of the "Apache lookout," a high bluff to the north of a ravine on the south side of which the opening was made.

I had seen LECONTE's account of this coal, and expected it to look just as this specimen does. We found a dyke crossing the line of outcrop, and ascribed the production of anthracite from the lignite to its influence. The first specimen, of which I made an analysis in Laramie with the mouth blowpipe, (and which was very small,) gave a percentage of fixed carbon nearly as great as that reported by LECONTE. The other specimens which I found among my other collected minerals were carefully analysed by me at the University of Pennsylvania, and a mean from the whole was taken, with the result published as supplementary to HAYDEN's Report of next year. The appearance of the specimens which gave this unexpected variation, was in every respect (as nearly as I can remember) like that now exhibited.

Mr. ROTHWELL thought the experiments that had been made on the weight of coal when exposed to atmospheric influences, and to heat, might throw considerable light on the subject of the lost carbon in coals *in situ*.

Mr. F. FIRMSTONE mentioned that they had not been able to notice any deterioration in anthracite coal when exposed to the weather, so far as its effect in the blast furnace went. He cited the case of a pile of Buck Mountain coal which had been exposed in the yard for two or three years, and at the end of that time was used in the blast furnace with equal effect to fresh coal. He couldn't say that the pile itself might not have lost in weight.

Mr. J. C. KENT had had a similar experience. He had been accustomed to consider "freshly mined coal" to be superior to that which had been exposed, perhaps from the fact that miners of coal were so careful to emphasize its "freshness." He had, however, used in his furnaces some coal that had lain three years in the yard, and it did full duty in the furnace, and no diminution of amount and quality of gas could be noted.

Mr. LOISEAU stated, in answer to a question, that he had made some of his artificial fuel from coal dust that had been exposed for 25 years, and that it had been burned in stoves, grates and furnaces, and under boilers with the best effect.

Mr. A. L. HOLLEY then read a paper on

TESTS OF STEEL.

(This paper is published in another column.)

Dr. DROWN remarked that, while fully appreciating and endorsing Mr. HOLLEY's views with regard to the importance of careful and minute analyses of steel as a basis for the manufacture of its different varieties, it occurred to him that, perhaps, it might be found that steels having identically the same chemical composition would show different physical properties consequent upon variations of treatment, whether cast moderately or very hot—whether rolled or hammered etc. He had seen stated, for instance, that phospor-bronze showed great difference of physical properties with the same chemical composition, though he did not know whether this statement was to be relied on.

Mr. BRITTON gave an account of a long series of analyses he had undertaken on rails to determine the effect of foreign ingredients. He obtained pieces of iron rails of all kinds—good, bad and indifferent. In some that had been in use 25 to 30 years, and had literally worn out, he found 0.3 per cent. of phosphorus, and 0.06 per cent. of carbon. The amount of sulphur was very low. Although these rails were said to have been made from a single billet, he had, by polishing and immersion in acid, found unmistakable signs of piling. From these analyses he concluded that in iron rails 0.3 per cent. of phosphorus might exist without damage. In a number of rails obtained from the Pennsylvania Railroad, which had been in use eight to ten years, and had proved to be in every respect good rails, his analyses revealed a great deal of what he would call worthless iron. The top, for instance, was decidedly cold short. It was, therefore, to the judicious combination of different characters of iron in piling, that the good quality of the rails were due.

Dr. HUNT dwelt on the importance of a close study of the effects of minute variations in chemical composition of the metal on its physical properties. Thus, in the case of Swedish iron, so justly esteemed for its purity, we know its excellence is in inverse proportion to the amount of phosphorus it contains. If there are isomorphous conditions under which the same substance may exist in combination with iron, it is important to know it; and in no way can we arrive at a satisfactory comprehension of the whole subject, than by just such a thorough chemical investigation as Mr. HOLLEY suggests.

Announcements were made by Mr. J. C. KENT, of the Local Committee, regarding the arrangements for the afternoon excursion to the Warren Pipe Foundry and the Andover Iron Works, in Phillipsburg, N. J.; and the Institute adjourned to meet again in the evening.

[TO BE CONTINUED.]

A Process for Disintegrating or Subdividing Iron.*

BY J. J. BODMER, OF LONDON.

IN 1855 FRANZ UCHATIUS patented in England his process of manufacturing cast steel. The first experiments on a practical scale were made at the Ebbw Vale Iron Works, Monmouthshire. The charge consisted of a mixture of cast-iron with about 20 per cent. of a pure iron ore, and with or without other ingredients. In order to obtain the cast-iron in a subdivided condition, UCHATIUS granulated molten pig-metal by running it into water, which during the operati was kept well agitated, and found that "the finer the iron is granulated, the s will be the resulting steel.

The writer is not aware that granulated iron has been used practically, otherwise than in the above-named process; and until 1866 no other process of subdividing iron than by granulation was known. In April, 1866, an English patent was obtained by the writer for subdividing blast furnace and other slags and metals in a molten condition by passing the same through one or more pairs of rolls. In reference to iron, the idea was, in following up the direction pointed out by the Uchatius process, to obtain better results in the puddling process by means of a thorough amalgamation (not simply a mixture) of the iron with the oxides and other ingredients in the charge itself.

Experiments were made. A quantity of iron direct from the blast furnace was subdivided (or laminated) by passing it through a pair of plain rolls. The rolls were hollow, and water was made to pass through them to keep them sufficiently cool. Without giving differential speed to the rolls, sheets were obtained about 1-16 in. thick, and from about 100 sq. in. surface downwards. With differential speed, the iron falls from the rolls in the shape of scales, as minute as may be desired, and easily regulated by the proportions of the wheels. In order to try the effect of a mixed charge (iron and oxides), small laminated iron was mixed with roll scales, and throughout about a dozen charges of 4½ cwt. in the common puddling furnace, charge for charge was made in 25 minutes' time.

In charging the subdivided mixture, it was spread over the whole of the surface of the furnace bottom. In from three to five minutes after closing up the furnace door, the surface of the charge was in a viscous, half-molten condition, and rabbling commenced. The temperature of the furnace, however, proved insufficient, the charge never melted completely, and although the balls stringled well, the iron was not strong.

This result appeared to prove that with sufficient heat the desired object would be obtained, and a further patent was applied for by the writer, in 1869, describing the means of producing a perfect and uniform amalgamation of iron and oxides, with or without other ingredients.

The specification describes different ways of carrying out the process. The main features are these:

1. The oxides and admixtures are fed upon the stream of liquid iron, on its way to the subdividing rolls. A plain and very reliable measuring apparatus is here made use of.

2. The oxides and admixtures (issuing from the measuring apparatus) are fed upon the subdividing rolls simultaneously with the liquid iron.

3. The oxide and admixtures are melted by themselves, with or without iron, and are then fed together with the stream of iron, or separately, but simultaneously with the latter, upon the subdividing rolls.

In either case, the result is *a scale, every particle of which consists of the exact proportions of the ingredients of the charge*; and the writer cannot but believe that with the required degree of temperature for the treatment of such a mixture, very perfect results would be obtained, either in the puddling or in the last melting process.

At the meeting of the Iron and Steel Institute at Liege, August, 1873, the subject of using granulated iron in the puddling process was discussed in connection with a granulating apparatus. A paper was read in relation to it by Mr. CHAS. WOOD, of Middlesbro, and Mr. S. DANKS made important statements, based upon his own practical experience. At the Cincinnati Works Mr. DANKS had used thousands of tons of stove plates in his puddling machine, and had found that iron charged in the form of thin plates melts more rapidly and more uniformly than in any other shape or form, and that the yields and quality were of the best he ever obtained. [The writer has not a report before him which renders Mr.

* A paper read before the American Institute of Mining Engineers at Easton, Pa., Oct. 22, 1873.

DAVIES' statement in his own words, but believes the above to express what he said.]

Now, whilst running liquid pig-metal into water agitated by any of the well-known means is certainly a simple process, there are three points, in respect of which laminating or rolling appears to be preferable.

1. The mechanical arrangement for granulating in water should ensure a sub-division into minute particles, an admixture of larger lumps being objectionable with reference to uniform melting. Laminated or rolled iron, on the other hand, permits of the use of comparatively large sheets, which, being all of one uniform thickness, melt with the greatest ease and uniformity. At the same time, in cases in which minute subdivision is required, the rolling process produces the same to perfection, by increasing the differential speed of the rolls.

2. Iron granulated in water easily sticks to and twines itself in the fettling, thereby chilling the same to some extent, which is not the case with laminated iron.

3. Running iron into water, unless the operation is carefully watched, easily leads to accidents by explosion, whilst the laminating process does not give rise to danger. A side runner into the pig-bed is kept in readiness, and in case of a hole breaking out, the side-runner is thrown open and no damage can occur to the rolls.

The Mode of Sub-dividing and Special Use of Sub-divided Blast-furnace Slag.*

BY J. J. BODMER, OF LONDON.

THE four different modes, more or less practised for sub-dividing slag, (that is, producing slag sand,) are the following:

1. Crushing the slag from the lump in Blake's crusher, by edge runners or other suitable means.

2. Blowing water, steam, cold or hot air, into the stream of viscous slag whilst it runs from the furnace. So treated, the slag takes the form of a fibre, similar to spun glass; and where the stream of slag is imperfectly hit by the current, globules are formed, from the size of a pea down to that of a small pin's head. Such slag fibre has been used for packing steam pipes, covering boilers and similar purposes, as a non-conductor of heat.

3. Running the slag in its liquid condition into water. This is a very simple and easy mode of sub-dividing it. The slag thus obtained is of a spongy, porous nature, and exceedingly light. For practical purposes, this process does not offer, however, the advantages which might be expected. Spongy slag has been tried largely for ballasting purposes on railways and roads in Belgium; but it has not been found suitable, because the light and spongy particles keep moving and changing position, and do not settle down into a sufficiently firm and solid mass. It is, however, well adopted for certain descriptions of concrete. It holds water most tenaciously, and hereby offers advantages in regard to the gradual hardening of the lime. How far its great sponginess, however, interferes with the resistance to crushing power, the writer has no experience. Where employed in the manufacture of bricks, in the process described as "Bodmer's Patent," spongy slag has to be crushed, before it can be used, in order to permit its attaining the required degree of dryness.

4. Passing the liquid slag through rolls, (Bodmer's Patent). This mode of disintegrating or sub-dividing blast-furnace slag, consists in passing the slag in its fluid state, direct from the furnace, into a pair of rolls revolving either with equal or with differential surface speed. If the object in view is simply to obtain the slag in a convenient form for its removal, the rolls may be opened as wide as practicable. From rolls going at equal surface speeds, the slag issues in the shape of a belt of the width of the rolls, and of a thickness of about ¼ in. (or more or less) The slag may be allowed to deposit itself in layers in the truck or bogie, placed underneath the rolls; or it may be fed upon a roller forwarding apparatus, upon which it will cool in moving along and drop in pieces into a bogie or other receiver; or it may be forwarded by a screw, a chain belt, or other means. With plain rolls going at differential surface speeds, or with one or both rolls corrugated, the slag will issue in larger or smaller pieces or slabs. Slag produced in this manner and without coming into contact with water, retains its crystalline fracture and hardness, and is in the most favorable condition for ballasting, and for the manufacture of concrete.

If the slag is intended to be used in the manufacture of bricks, mortar, or other cementing compounds, plain rolls, going at differential speed, are used, set more or less close, according to the desired thickness of the scale. When the slag on issuing from the rolls is allowed to drop into water, it is rendered amorphous, without becoming spongy, and without retaining the water in the manner peculiar to spongy slag. Such slag being very friable, can be further disintegrated, if desired, with the greatest ease.

With nearly closed rolls, and considerable differential speed, a very thin and fine scale is produced, especially suitable for slag-cement.

Instead of employing one pair of rolls only, at the blast furnace, two pairs, one pair discharging itself into the other, may in many cases be used with advantage.

Tests of Steel.*

BY A. L. HOLLEY, OF BROOKLYN, N. Y.

THE intention of this paper is not to discuss this important subject in all its bearings, but merely to point out why mechanical tests of steel, as ordinarily made, are not, *alone*, of any special value to engineers—certainly not to general mechanical engineers.

The agents of the Barrow Hæmatite Steel Company, one of the largest and most successful Bessemer establishments in England, have recently distributed a report, made by SIR WILLIAM FAIRBAIRN, on the transverse, tensile, and compressive resistances of certain bars of this steel. The number of tests is very large; they seem to be careful and minute; and the modulus of elasticity, the work up to the limit of elasticity, and the limit of working strength, are fully tabulated according to the latest formulæ.

This is very well—indeed, it is indispensable, as far as it goes; but it goes no further than to inform the ordinary engineer that there is an unknown substance which possesses these physical properties. As to *what* the substance is, the report gives him no working knowledge, for not a single analysis is given of any of the bars tested. The most that is said of some of them is that they are either "hard" or "soft," which is sufficiently evident from the experiments. "A bar of steel" is, in the present state of the art, a vastly less definite expression than "a piece of chalk." To the engineer who wants steel for a specific purpose, it gives only the faintest clue, to say that steel is hard or soft. There are a dozen grades of both hard and soft steel, adapted to different purposes. Rail steel is soft, and boiler-plate steel is soft, as compared with many structural steels, and with the whole range of spring and tool steels; but the one perfectly adapted to rails would be useless for boilers.

In order that engineers may know what to specify, and that manufacturers may know not only what to make, but how to compound and temper it, the leading ingredients of each grade of steel must be known. Pure iron would be unfit for nearly all structural purposes. Upon the substances associated with it depend its hardness, malleability, stiffness, toughness, elasticity, tempering qualities, and adaptations to various structural uses. These ingredients are, indeed, impurities, but the *term* "impurity" unfortunately implies a defect, whereas the *thing* may really impart the essential quality. All the usual ingredients give what is called "body" to steel. Carbon, within specific limits, as is well known, gives hardness, elasticity, resistance to statical strains, and tempering qualities. Under certain conditions of composition it even gives resistance to sudden strains. Manganese (and this fact, by the way, is not so generally known) gives, in different proportions, hardness, toughness, malleability and elasticity. Chromium imparts similar qualities, but to what precise extent we do not know, in default of a proper comparison of chemical and mechanical tests. Silicon, although considered a bane by steel makers generally, and, singularly enough, advertised as the great panacea for the weaknesses of steel by certain modern inventors, has probably, in proper proportions, a healthful influence on the physical properties of steel. Even phosphorus, the arch enemy of the Bessemer and open hearth manufacturers, may in some degree be a valuable ingredient.

Whether or not certain foreign substances, which, separately added, produce similar results, would produce a better result if combined in certain proportions—for instance, whether carbon alone in any degree, or silicon alone in any degree, would make as good a steel for certain uses as carbon and silicon combined, it is, in default of proper experiments, impossible to state. The probability is, that there is a proportion of carbon and manganese which would give the highest possible value to all structural steels. We formerly added spiegeleisen to decarburized Bessemer metal solely to impart manganese to the oxygen of the oxide of iron formed in the Bessemer process. We now add a larger proportion of spiegeleisen, not only to remove the oxygen, but also to mix manganese with the steel. And we think we find that if the proportions of silicon and phosphorus are sufficiently low, and carbon does not exceed a third of one per cent., manganese to the amount of three-quarters of one per cent. gives the resulting product a high degree of toughness and hardness combined—a degree of suitableness for rails, which no proportion of either carbon or manganese, not associated, can impart.

When we consider that two or three-tenths of one per cent., and in some cases a fraction of a tenth of one per cent. of foreign metals, will change the character of steel in a high degree, and when we farther consider that the physical results of these combinations have never been tested or analysed in any thorough and comprehensive manner, we may well reiterate the common expression that the iron and steel manufacture is in its infancy.

But it is not necessarily in its infancy. We simply do not develope it. The general complaint of engineers and machinists is, that they occasionally get, but can never get regularly, the precise quality of steel they require; and yet it is probable that thousands of tons of steel have been made which are suitable for each of these purposes, but have been used for others, and that the precise grade required in every case could be reproduced by the ten thousand tons. The trouble is that neither the user nor the maker knows what the material *is*. They have put no mark on it by which they can recognize it; they have kept no recipe. All they can do is to use ingredients of the same name, and approximately the same quality, and to guess at the physical properties of the product, aided by such crude tests as can be made during manufacture. Mr. WM. H. BARLOW, in a late address on modern steel before the British Association, says that one reason why steel is not more used for structural purposes is, that the metal is of various qualities, "and we do not possess the means, without elaborate testing, of knowing whether the article presented to us is of the required quality." But neither Mr. BARLOW, nor any of his associates in government experiments, proposes the true solution of the difficulty. It is no more necessary

* A paper read before the American Institute of Mining Engineers, at Easton, Pa., Oct. 22, 1873.

to test one or two of each lot of bars to destruction, in order to find out the quality of the rest, than it is to burn up a Chinese village to get roast pig.

If the user would *analyse* not one, but twenty samples of the steel that meets a particular want, and then base his order on an analysis that should come within the highest and lowest limits of the samples, he would get substantially the same metal every time. The problem is a more difficult one for the steel maker, since he must analyse the many materials that go into his product; but if he imposes the same restrictions on the makers of these materials—in short, if from the ore and limestone and coal, up to the finished bar, each user buys by analysis, and pays in proportion to uniformity, the production of steel of the most multiform grades and qualities, each homogeneous and uniform to any extent of production, becomes a possible, if not a comparatively easy, matter.

What are Sir WILLIAM FAIRBAIRN, and Mr. BARLOW, and Mr. KIRKALDY, and the other great experimenters in the physical properties of steel—in its adaptation to certain specific uses—what are they doing to relieve the engineering world from these uncertainties? They are simply discovering the vast number of qualities which steel may be made to possess, without giving more than a clue to the method by which these qualities may be pre-determined and re-produced. They are going to a vast expense of time and material to inform us, not that a certain combination of metals, but that a *bar of steel*, has such resistance and elasticity. This sort of experimenting has much the same value as the steam-engine tests of a late chief engineer in the navy, of whom it is said, that in a coal consumption test he would calculate the ashes to ten places of decimals, and guess at the coal put into the furnaces.

Moreover, Sir WILLIAM FAIRBAIRN may be doing injustice to other steel makers, to BROWN, CAMMELL, and BESSEMER—bars of whose steel he has also similarly tested, and found not quite so suitable for certain purposes as the Barrow bars are. But he neglects to make it clear that the disparaged bars may be better than these particular Barrow bars for other purposes. He makes the mistake which we should suppose Sir WILLIAM, of all men, would not make, of being absurdly general and random in one element of his conclusions, while he is fractionally accurate in others—of cramming the whole matter of chemical ingredients into the terms "hard" and "soft."

The first and easiest step in the desired direction is to find out what X is. It is not necessarily a bar of steel made by TURTON & SONS, which one tool-maker will swear by, and another will swear at; nor is it necessarily a boiler-plate steel which PARK BROS. made once, and FIRTH got at twice, and SINGER, NIMICK & Co. hit two or three times. It is a steel which TURTON, and FIRTH, and PARK, and SINGER, can, either of them, make by the ten thousand tons, if you will only tell them what it is made of, as well as what its physical qualities are. In the various uses to which engineers have applied steel, there are a vast number of specimens which have long fulfilled all the requirements. When more steel of the same sort is wanted, the usual method is either to apply to the same maker, who kept no complete record, and does not know what is wanted; or to get bids based on a stereotyped and very inadequate physical test, for instance, that the bar must stand such and such a blow from a drop. The lot of steel is made, and is, as well it may be, very heterogeneous in physical character, although it may be in accordance with the one test. The result is that, under wear, some of it fails, or, under load, an excessive margin of safety must be allowed. The obviously rational way to reproduce a lot of steel which is proved suitable for any purpose, is to analyse many samples of it—at least for carbon, manganese, silicon, phosphorus, and any element which exceeds a tenth of one per cent., and thus to give the steel maker a recipe for making it.

It may be suggested that this chemical synthesis of steel will be ruinously costly. For certain exact purposes, such as the members of a long-span bridge; or for certain fine purposes, such as gun-barrels, the cost of analyses, or any loss in applying to other uses the lots of steel that were not up to the mark, would be very small, compared with the extraordinary margin of strength that must be given to an uncertain metal, and compared with the cost of occasional failures under final test. And this cost, whatever it is, the user—that is to say, the public, should and must bear.

But steel makers will find that working by analysis is not so very formidable, after all. The color test of carbon is already applied to all charges of all Bessemer and open hearth makers, and it is one of the most important. There is another view of the case: After a certain experience in comparing mechanical tests, which are comparatively easily made, with the more costly determinations of manganese, phosphorus, &c., the expert will not need to analyse every charge. He will learn to read manganese, approximately, in an elastic limit test, just as the expert blacksmith can now read carbon quite accurately by the water-hardening test. Herein will lie one of the values of the combined mechanical and chemical tests—that they will supplement and prove each other.

When the proper amounts of carbon, manganese, silicon, &c., for certain uses are known, it will not be impossible to approximate to them, in the Bessemer process, to a very helpful degree, and in the open hearth and crucible process, to a reasonably accurate degree. Of course, the character of the ingredients must be much more definitely known than at present, and numerous batches of nominally the same ingredient, such as pig iron, blooms, or puddle balls, must be mixed, so as to largely dilute any high degree of impurity which any one batch may contain.

The thing first in order is, of course, to ascertain the mechanical properties of all grades of steel—not merely the individual resistances to destructive strains, which are but the stones that compose the mosaic, but the resistance within the elastic limit, which is the finished picture. To this end experiments like those of Sir WILLIAM FAIRBAIRN are indispensable, but to these must be added analyses of every grade of steel that can be produced, or the character of the metal is but half known.

In the present state of constructive and metallurgical art, it thus seems not only vitally important, but highly feasible, to increase in a large degree the uniformity of all grades of steel, and to make grades adapted to all special uses, instead of following the hit-or-miss and large-margin system, or want of system, that now obtains. Of course the change must come slowly, and its early stages will be attended with difficulty and expense; but there can be no question as to its ultimate success and its immense advantage in constructive and manufacturing engineering and art.

What probable expense of experimenting is to be considered when it will increase, possibly double, the resistance of metals to specific stresses, and decrease the present enormous margin of safety? It seems unaccountable that Government commissioners have so long neglected the chemical half of the problem—have so long neglected to complete the circuit, so that the metal will tell us its own story.

Improvements upon Eggertz's Method for Determining Combined Carbon in Steel.

TO RELIEVE myself from the thraldom of monotonous routine work that would otherwise absorb nearly all my time, the following improvements for the execution of Eggertz's method for determining carbon in steel were devised.

A balance, consisting of a very fine thread of glass, with a pan in two parts, one a cup and one a cone, serves to weigh the steel. A horizontal drill, with a glass tube to form a hopper, makes, and conducts the drillings of steel, as they are made, to the balance pan, which is properly supported about one-eighth of an inch above a point to which it settles, when a two hundred milligramme weight is placed in the pan. Being thus set, a sample of steel is placed in the drill lathe, the drillings, as before mentioned, falling into the pan below. As soon as the two hundred milligrammes weight is in the pan, the pointer sinks to the index, when the drill is stopped. By passing a tube through a hole in the balance table, the lip of the tube offeringa support for the balance cup, while the cone is pressed down with a pair of tweezers, the drillings at once fall into the tube, and are ready for treatment with acid.

A glass funnel is made, with a capillary opening at the contracted lower end. This is fused with a T tube, the lateral branch of which is passed through the window of the laboratory to remove the fumes. A rubber nipple is placed on the lower end of the T tube, into which the tube containing the steel is inserted. Three cc. are now drawn into the funnel tube, and fall in drops upon the steel below. At the expiration of this action the tube is transferred to a bath kept at the temperature of 130° C.

At the end of twenty minutes from drawing in the acid, the operation is completed; the whole of the carbon has entered into a clear yellow solution, which has a depth of color proportionate to the amount of combined carbon in the steel. The tubes are cooled down to a normal temperature, and, compared with a series of standard colors, when it is easy to read off the amount of carbonized carbon in a given sample of steel.

The accuracy and ease of execution of this method leaves little to be desired, while it is of great value in ascertaining the amount of carbon in different specimens of steel, or the regularity of its diffusion in different parts of the same cast.

EDWARD K. TAYLOR.

MACHINISTS' SUPPLIES

B. F. STURTEVANT'S

PATENT IMPROVED

PRESSURE BLOWER,

FOR CUPOLA FURNACES AND FORGES.

Also manufacturer of the Sturtevant Patent Improved Fan Blower and Exhaust Fan. Send fo illustrated catalogue.
B. F. STURTEVANT, 72 Sudbury street, Boston, Mass.
n29:1y

KROM'S PATENT DRY-ORE
CONCENTRATOR
AND COMPLETE MACHINERY
FOR CRUSHING SCREENING
AND CONCENTRATING ORES.

Minerals and Ores in which the difference of specific gravity is so slight and which are also sometimes in such fine particles as to defy separation by any other machinery or method, are rapidly separated by this Concentrator.

Mr. W. Bement, of Georgetown, Col., concentrating Silver ores, says: "I am satisfied your machines can not be beaten; they are simple, require no power (comparatively,) and do not get out of order."

A comparison is challenged between the results obtained by the approved methods of water concentration and the complete system of dry-ore concentration in the amount of ore saved, quantity concentrated, economy of working, and comfort of the operators and workmen

Parties interested in mining are invited to call at No. 210 Eldridge street, New York, where they may see a machine in operation and have samples of their own ores crushed and concentrated.

For information and circulars, apply to

S. R. KROM.
No. 210 Eldridge street, New York City.

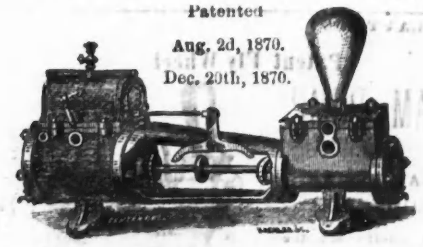
THE SELDEN DIRECT-ACTING

STEAM PUMP

A. CARR, Manufacturer & Proprietor.

Patented

Aug. 2d, 1870.
Dec. 20th, 1870.



Combining simplicity and durability to a remarkable degree. Its parts are easy of access, and it is adapted to ALL PURPOSES for which Steam Pumps are used.

AS A MINING PUMP

It is unsurpassed. Also,

Steam, Gas and Water Pipe, Brass Work.
Steam and Water Gauges, Fittings, etc. etc.

CARR PATENT STEAM RADIATOR.

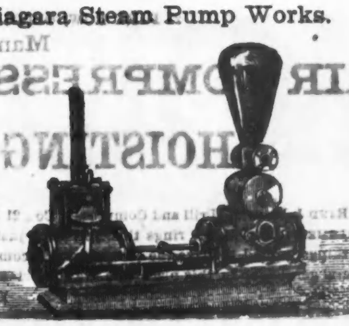
Send for Price-List and Circulars.

Address A. CARR,

feb15.72:24 43 Courtlandt Street, New York.

STEAM PUMPS.

Niagara Steam Pump Works.



This Pump has taken the first premium at every Fair in the United States where there has been a practical test.

CHARLES B. HARDICK,

No. 23 ADAMS STREET, BROOKLYN, N. Y.,

Sole Manufacturer of

HARDICK'S PATENT DOUBLE-ACTING

STEAM PUMPS AND FIRE ENGINES,

Patented in England, Belgium and France. Send for circular. feb-15-1y

---

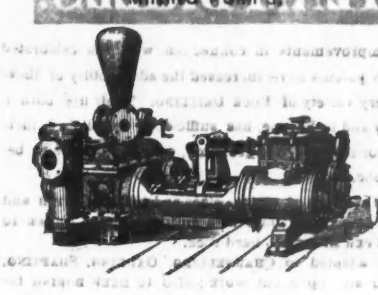
HYDRAULIC WORKS.

MANUFACTORY,

BROOKLYN, N. Y.

Steam Pumping Engines, Single and Duplex, Worthington's Patent, for all purposes, such as Water Works Engines, Condensing or Non-condensing; Air and Circulating Pumps, for Marine Engines; Blowing Engines; Vacuum Pumps, Stationary and Portable Steam Fire Engines; Boiler Feed Pumps, Wrecking Pumps.

MINING PUMPS.



Water Meters, Oil Meters; Water Pressure Engines.

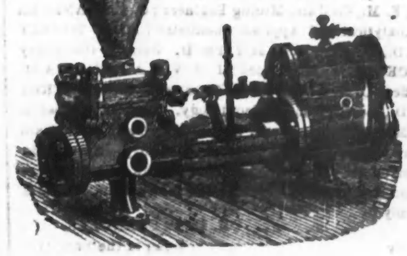
Steam and Gas Pipe, Valves, Fittings, etc. Iron and Brass Castings.

Send for Circular. H. R. WORTHINGTON,

jan2-1y 59 Beekman street, New York.

Hand Power

Lever detached.



GEO. F. BLAKE & CO.,

MANUFACTURERS OF BLAKE'S PATENT

STEAM PUMPS

No. 79 LIBERTY STREET, NEW YORK.

Factory 61 Chardon St., Boston, Mass.

A specialty made of the manufacture of DOUBLE-ACTING PLUNGER PUMPS for mining purposes—combining economy of space, capacity, and great durability. All wearing parts made of composition metal.

Also, Boiler Feed Pumps, Fire Pumps, Tank Pumps, Wrecking Pumps, etc., etc.

Send for Illustrated Price Circular. m-26-3m

COAL SHIPPERS

THE NEWBURGH ORREL COAL COMPANY

Mines at Newburgh, Preston Co., W. Va.
Company's Office, No. 53 S. Gay St. Baltimore, Md.
C. OLIVER O'DONNELL............President.
CHAS. MACKALL............Secretary

This Company offer their very superior Gas Coal at lowest market prices.

It yields 10,996 cubic feet of gas to the ton of 2,240 lbs. of good illuminating power, and of remarkable purity; one bushel of lime purifying 6,792 cubic feet, with a large amount of coke of good quality.

It has been for many years very extensively used by various Gas Companies in the United States, and we beg to refer to the Manhattan, Metropolitan, and New York Gas Light Companies of New York, the Brooklyn and Citizens' Gas Light Companies of Brooklyn, N. Y., the Baltimore Gas Light Company of Baltimore, Md., and Providence Gas Light Company, Providence, R. I.

The best dry coals shipped, and the promptest attention given to orders. sep21-1y

---

Philadelphia and Reading

COAL & IRON CO.

OFFICE, No. 9 PINE STREET.

E. A. QUINTARD, Agent.

NEW YORK, March, 1873.

OFFER

Hard and Free Burning White Ash Coals,
Schuylkill Red Ash,
Alaska Red Ash,
Shamokin White Ash,
Shamokin Red Ash,
North Franklin,
Lorberry, and
Lykens Valley Coal.

ON BOARD, AT PORT RICHMOND,

PHILADELPHIA,

OR

DELIVERED IN NEW YORK,

AND AT

ALL PORTS ALONG THE SOUND AND HUDSON RIVER.

Circulars of Prices will be issued on the 20th of each month.

COXE BRO.'S & CO., CROSS CREEK COLLIERY, Miners and Shippers of the Celebrated

Cross Creek Free Burning Lehigh Red Ash

COAL.

FROM THE BUCK MOUNTAIN VEIN.

OFFICES;

Philadelphia, No. 200 South Fourth street.
Drifton, Jeddo P. O., Luzerne Co., Pa.

Agent in New York, SAMUEL BONNELL, Jr.,
Room 43, Trinity Building
feb-1 111 Broadway

DETHOLD & CO.,

ANTHRACITE AND BITUMINOUS

COALS.

Office, 40 Trinity Building, New York. [illegible]-1y

STEPHEN S. LEE & SON,

Miners and Shippers of

GEORGE'S CREEK COAL.

SWANTON MINES,

No. 49 West Lombard street,
may28-tf BALTIMORE.

MARYLAND COAL CO.,

Miners and Shippers of the best George's Creek Cumberland Coal.

Office No. 12 Trinity Building.
W. W. BRAMHALL, Secretary & Treasurer.
A. CHAMBERLIN, President.
jan23.1y JOHN K. SHAW, Vice President.

THE DESPARD COAL COMPANY OFFER THEIR Superior DESPARD COAL to Gas Light Companies throughout the country.

MINES IN HARRISON COUNTY, West Virginia.
[illegible], Locust Point, } Baltimore.
Company's Office, No. 29 South st. }

AGENTS:

PARMELEE BROTHERS, No. 32 Pine street, New York. BANGS & HORTON, No. 31 Doane street, Boston.

Among the consumers of Despard Coal we name Manhattan Gas Light Co., New York; Metropolitan Gas Light Co., New York; Jersey City Gas Light Co., Jersey City, N. J.; Washington Gas Light Co., Washington, D. C. Portland Gas Light Co., Portland, Maine.

Reference to them is requested. may30-1y

"IRON" (WITH WHICH IS INCORPORATED the MECHANIC'S MAGAZINE,) a Journal of Science, Metals, Patents and Manufactures, Engineering, Building, Railways, Telegraphy, Shipbuilding, Factory News, etc., etc.

Subscription, 30 s. per annum, post paid.

To be had of all Newsvenders and from the offices 90 Cannon street, London, England.

Advertisements.

Advertisements admitted on this page at the rate of 40 cents per line. Engravings may head advertisements at the same rate per line, by measurement, as the letter press.