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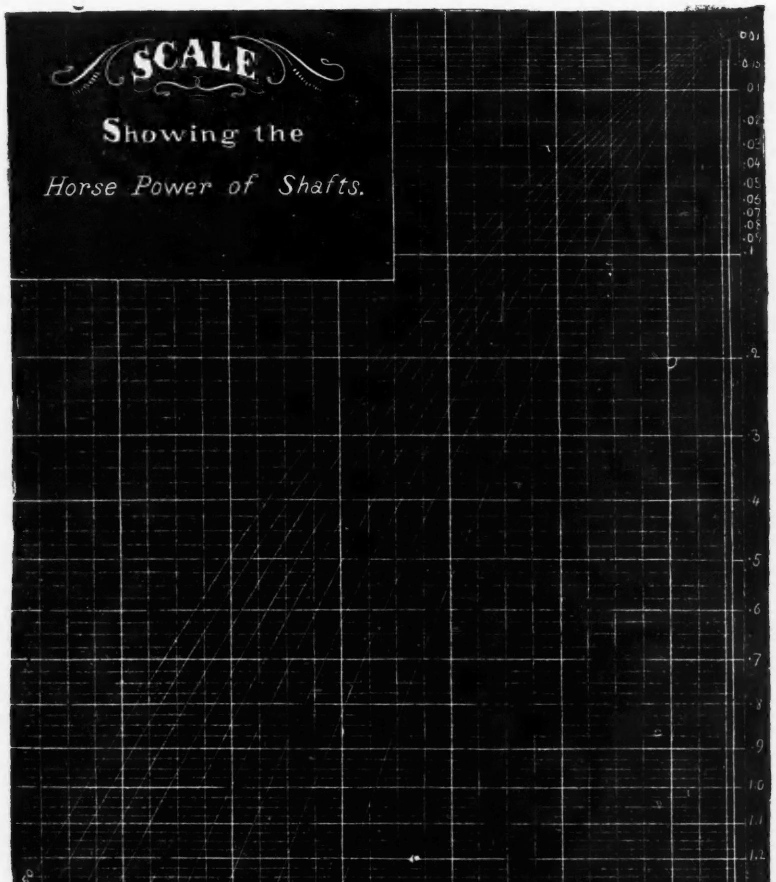
Horse-Power of Shafting.

THE requirements of a machine shop in the extreme West are, to some extent, very different from those presented by a similar establishment in the East. There machinery is not infrequently ordered by men who, knowing nothing of machines, are suddenly called upon to plan, build and work quartz mills of



greater or less importance. Such men inevitably make a great many mistakes, and experience has slowly taught them that is is better to lay their circumstances before some mechanical engineer and follow his plans. But occasionally that cannot be done, and if the manufacturer of machinery in the West is anxious to have his work turn out well he must act as schoolmaster as well as engineer. To this end Messrs. H. J. BOOTH & Co., of San Francisco, have placed in their catalogue a number of rules, diagrams and other guides to those who are engaged in milling. We have published some of these before, and print this week a scale showing the horse-power of shafting. As a specimen of the instructions given, we take the following short chapter from the catalogue of the firm.

"In the transmission of power, properly proportioned shafting is of the utmost importance, both as regards economy of first cost and endurance. Shafting should always be proportioned to the work that is to be done, reference being had to all the circumstances and requirements of the work, as well as the manner in which power is to be taken off from the shaft. We have inserted here a scale, showing the horse power of shafts under different conditions. It is designed to show the power of shafts for one revolution; therefore, the power for any given number of revolutions is found by multiplying the power indicated by the scale by the number of revolutions. At the bottom of the scale are marked the diameters of shafts opposite to lines running vertically and equi-distant. The horizontal lines are numbered in the margin from ·001 to 2.8, indicating the horse power of given shafts under given conditions. The curved lines are numbered from 50 up to 250, and are used according to the conditions under which the shaft is made to work. Thus, for a crank or first motion shaft, subject to irregular and very severe strains, the line marked 250 should be used; for a common line shaft in a mill the line marked 125 will give good and sufficient strength. The power of very light running shafts, not bearing any weight nor subject to intermittent strain, may be taken from the line marked 50. The line marked 125 allows a working strain of 1-15 of the breaking strain of the shaft; the line marked 50 indicates a strain of 1-7 of the breaking strain; and the line marked 250 indicates a strain of 1-35 of the breaking strain. Three problems occur, which are readily solved by the use of this scale:

First—Having given the diameter of the shaft and the number of revolutions, to find the power. Suppose the shaft to be 4 inches diameter, an ordinary line shaft in a mill, and making 100 revolutions per minute. For such a shaft take the line marked 125; follow up the line marked 4 inches, until it meets this line; the horizontal line occurring at this intersection will show ·51 as the horse power of the shaft for one revolution. Since the shaft makes 100 revolutions in a minute, it will transmit in that time 100 times .51 or 51 horse power.

Second—Having given the diameter of the shaft and the power per minute, to find the number of revolutions: Take for example, a line shaft 4 inches diameter and 51 horse power. A 4 inch shaft as above, will transmit ·51 horse power to every revolution, therefore, 51 divided by .51 gives 100 as the number of revolutions that it makes per minute.

Third—Having given the horse power to be transmitted, and the number of revolutions, to find the diameter of the shaft. A line shaft is to transmit 51 horse power at a speed of 100 revolutions per minute. What is its diameter? Fifty-one horse power divided by 100 revolutions gives .51 horse power to one revolution. Following .51 from the margin in the scale to the line marked 125, and taking the line, that occurs at their intersection, down to the bottom of the scale, it is found that 4 inches is indicated as the diameter of the shaft.

The supports for ordinary shafting should be arranged with reference to the amount of power that is to be taken off from the shaft from between them. When there is no power taken off, the distances between the bearings should be, in feet, 5 times the cube root of the square of the diameter of the shaft in inches. When power is taken off between the bearings by belts, 4.5 should be used as a multiplier instead of 5. Gear wheels should always be put as near as possible to a bearing."

Fire-Damp in the Anthracite Mines.

BY AN EXPERIENCED PRACTICAL MINER.

THE following facts and suggestions are offered, not so much for the sake of instructing others as to induce experienced persons to take up the discussion, and throw what light they can upon a most important subject.

Carburetted hydrogen (or fire damp, as called by the miners,) is the gas that gives us the most trouble. It is met with at present in the majority of our coal mines, and it seems that we cannot expect to be free from its presence in our deep mines, as it undoubtedly increases as we develop our mining resources, and especially as we get deeper. There has been a great increase in the quantity of gas met with in the Wyoming district during the last three years ; in fact, there are but very few coal mines in the district at present that do not generate more or less of it, except the collieries where the Red Ash vein only is worked. There is something strange about the non-appearance of fire-damp in the Red Ash vein. It is generally supposed that the deeper mining is carried on the more gas we will meet; and the Red Ash vein is the lowest workable seam of coal that we have. But so far as the writer's knowledge goes, very little, if any, fire-damp has yet been found in it in the Wyoming valley. In that valley, the following mines are opened on this seam, and most of them working : on the south side of the valley are Shaft No. 2, Wilkesbarre Coal and Iron Company, 280 feet deep ; a tunnel opened by the Franklin Coal Company, above water level ; also a tunnel above water level at Hartford mines, Wilkesbarre Coal and Iron Company; one at Solomon's Gap, worked by the New Jersey Coal Company; one at Sugar Notch, by the Wilkesbarre Coal and Iron Company; a drift and slope at Warrior Run colliery, by A. J. DAVIS & Co.; Espy Tunnel, by CHAS. PARISH, Esq.; several drifts and one deep slope at Nanticoke, Susquehanna Coal Company ; one tunnel at Wanamie, Lehigh Coal and Nav. Company, and drift at Mocanoqua.

West of the Susquehanna river are the following : Several drifts of the Paxton Coal Company, at Shick Shinny ; they are many feet above the level of the river, hence it is not surprising that there is no gas found there, although we have found fire-damp above water level in some of the other veins.

Several miles east and north of the latter place we have the Harvey Drifts and Slope, and the Grand Tunnel and Union mines, Avondale Shaft, Jersey Slope, Washington Drift and Slope ; also, the Nottingham Shaft. Up to the present none of these are known to be generating gas. Why it is so I am at a loss to imagine. However we have plenty of fire-damp in most of the other veins, and until the time arrives when it can be put to a better purpose than now, when its activity is confined to roasting human beings and destroying property, we will not crave its presence in the Red Ash vein. The following details will give your readers some idea of the quantity of gas generated in some of the mines.

In 1871, I visited the Pine Ridge Shaft with the mine boss, and in examining its workings, we proceeded with safety lamps on our way to a new road which the proprietors were cutting for the double purpose of making a shorter road to bring out the coal from the old workings and cutting an overlying vein. In driving through the rock across a small synclinal axis the bottom of the said overlying vein was exposed, and at this point an extraordinary quantity of gas was met with. We could ignite the gas along the roof for 100 or 150 feet, and could do so two feet from the roof. Finding that there was quite a strong current of air passing that way we measured it, and found 25,000 cubic feet per minute passing. At a subsequent period the company opened out gangways in this vein, in which operation the gas would ignite from almost each blast, setting the coal on fire, etc. To extinguish the fire a 2½ inch hose or pipe was attached to the column pipe of the pump in the hoisting shaft, which is 400 feet deep. The hose, after being connected to the column, was stretched along the roadside through the gangway, a distance of 400 or 500 feet, to the place of fire. This pipe was kept in readiness at all times, and all they had to do was to bring on the inside section, which was a flexible part, and turn on the water. During the short time required to bring into operation the hose and turn on the water, the fire would burn like a blast furnace. The same means of prevention had to be employed in the rock tunnel when approaching the upper vein, the gas igniting from blasts and setting the wooden air brattice on fire, and in some instances before adopting this plan, the brattice had to be broken down to cut off its connection with the lower vein.

In the month of May, 1872, an explosion of fire damp took place, by which two lives were lost (see Inspector's Report for 1872 for a full report) in the above mentioned place. A new return air-way has since been made to ventilate this section separately, and this air-way was driven for 130 feet, 7 feet wide by 6 or 7 feet high, by picking, no powder being used, the superintendent of the company, Mr. A. NICOLS, deeming it advisable not to use powder on account of the very large quantity of gas generated. The day following the explosion referred to, the inspector, with Mr. JOHN T. MOORE, the mining boss, made the following air measurements, the fan being at its usual speed of 75 revolutions per minute, and the velocity of air current 645 feet per minute. He found 33,862 cubic feet per minute passing through the main tunnel on this side of the shaft. By opening a certain door in the tunnel, the opening of which had been the cause of the explosion above referred to, the amount of air was reduced to 9,120 cubic feet per minute through the upper seam air-way, and the velocity of current was 190 feet per minute ; the door being left open twenty minutes, the gas had accumulated along the roof just over the point where the 9,120 cubic feet of air had been found, to the depth of three feet and extending back along the gangway for quite a distance. The reason of its accumulation was that at this point the gangway was higher than elsewhere. Again, the door in the tunnel was closed, causing the air to circulate more strongly through this air-way in the top seam, and, on measuring, 16,320 cubic feet per minute was found passing through at a velocity of 340 feet per minute. The gas would ignite in the safety lamp for nearly ten minutes at a low point along the roof, after this current was forced through, showing that it required about 15,000 cubic feet of air per minute to keep that one small opening clear of standing gas, or to keep the atmosphere below the exploding point.

At a subsequent period, 10,500 cubic feet was found passing through a cross-cut between the main air-way and a gangway being worked on the north side of the mine, and notwithstanding that the said cross-cut was within four feet of the face of the gangway, the gas would ignite in the lamp in the face or eighteen inches from the roof just opposite the cross-cut where the air came out.

Similar facts could be mentioned regarding the outflow of gas in the Mill Creek Slope, Henry shaft and Prospect shaft workings. It has been found very difficult to blast where the gas is so strong; as it is, the men have had to use various methods of overcoming the difficulties in the way of blasting, sometimes using touch paper—made of saltpeter, etc.—sometimes double tubes or blasting barrels —one to explode the blast and the other for an escape for the force of the gas— and in some even the blasting fuzes have been and are now used. Often a large grained powder must be employed or it will be blown out through the blasting barrel.

It is very strange to find that different parts of the same seam of coal, even at the same depth from the surface, do not have any similarity as regards the discharge or generation of fire damp, and that sometimes where there is no interruption or dislocation, but a regular continuation of the seam, the only change being the appearance of an anticlinal axis dividing the small troughs or synclinals, there will be an extraordinary development of gas. It will often be found that gas is abundantly met with on approaching an anticlinal, and especially just as we are about to cross the ridge into another small basin, or trough, which may be extraordi arily full of gas, especially if there be no other outlet convenient from the said synclinal trough or basin. Sometimes we strike these spoon-shaped basins at their lowest point, and, as a matter of course, all the gas from below the end will have a tendency to escape at this point, hence such strong feeders or outflows of gas at such points. Again, it seems strange that the gas does not find an escape through the fractures in the rocks on the anticlinals on either side of those troughs or basins, for the rocks have more or less of those crevices or fissures. Also the next vein below, some twenty or thirty feet down, may not generate nearly as much gas as the upper vein does in the same trough. This may, perhaps, be accounted for, to some extent, by the different kind of the rock overlying the two seams, yet that will not meet the whole case. It seems sometimes that those troughs or basins ; when the veins are not cut, that is, where the coal is solid on, and continues over, the anticlinal axis into another basin, would be the most likely place to meet the greatest amount of gas, and that in those basins which have their rims cut open either by the seam cropping out to the surface, or into the sand, should have been more drained of their gas ; and, in fact, less gas is met with there. Yet we have some instances where gas is found even where the coal has been denuded on the anticlinal axis and nothing left except alluvium, or a mass of loose gravel and sand overlying it. And in other places this gas is found in mines above water level, and where there are but 20 or 30 feet of covering on the coal seam. Still this is a rare case.

It may be that some of your readers, interested in this question, will favor us with their views as to the probable cause of the great difference between the various seams in generating explosive gas, or fire damp, even when under similar pressure ; and why it is that one seam—and that one the lowest of a series—does not give off any fire-damp in the coal field just referred to, and to all appearances in the same basin or trough, where gas is met with in the overlying seam.

This gas is not regular in its mode of outflow or discharge, which is affected in various ways. Changes in the atmospheric pressure have much to do in the matter ; but the greatest effects occur from other causes, which alter the condition of the mine. So long as the ventilation and other conditions of the mine remain the same, such as the areas of the air-ways, area of the work open, *i. e.*, no new ground being cut, nor any of the roof falling, or floor loosening, or swelling out, or raising—then it is that change of atmospheric pressure has its greatest effect, but no mine can remain in that state while being worked. Hence a mine in full operation can not be without continual changes in its circumstances, even when the management is in good hands ; but much more if the management be otherwise. The atmospheric pressure varies, and no attention being paid to it, the fan or other ventilator is left to run along, with very little care being taken to keep the current steady—except in our most firey mines where the matter *must* be attended to. The areas of the main air-ways and their tributaries are almost continually changing by the falling of the roof, besides that, the cross-cuts in pitching seams are often blocked, more or less, first one, then another, and next is the continual opening and closing of the main doors—many of which are only single where they should be double.

In addition to the above, the area of the mine excavation is constantly changing, gang-ways and their parallel air-ways are being driven to penetrate into new territory, and are necessarily ahead of the other workings. Most of our mines have been opened with a view to having their shaft, slope, or tunnel near the center of the property ; hence it is that a mine can be opened very soon after commencing to drive gangways, as, in this way, much new ground is cut in a limited time. Besides the gang-ways and their accompanying air-ways, driven water level, there is a variable number of other new openings going on, such as chambers, 30 to 50 in number, depending much upon the size of the seam, length of run, or, in other words, width of the tract or lot of ground along the strike of the seam ; also upon the capacity of the machinery for hoisting or that of the breaker, as well as upon the management of a part or the whole of the concern.

To come back to the subject of the changeable condition of the mines—it will be perceived that there are a great many things that may endanger the life of a man working in a mine generating fire-damp, besides his own share of vigilant care which he must always exercise. Suppose there are 40 working places in a colliery, and about 400 tons of coal are cut and sent out daily, then there would be $400 \times 9 = 3,600$ square feet of new surface exposed each day ; but it would be much more than this, as our mines are not worked on the long wall system; hence the sides, or pillars left, add to the exposed surface, and they also will give off gas, for a time at least. In this way the area of excavation is increased, besides the exposing of fresh surfaces and the cutting of many feeders or blowers, of this gas, in the same manner as springs of water are met with in cutting fresh ground; but of 40 or 50 places, very likely one or more will strike changes of coal which often cause large outflows of gas, such as slips or crevices and dirt seams or joints, each hour. As the mine remains idle the gas, no doubt, drains off considerable.

The Coal Fields of China.

BARON VON RICHTHOFEN lately read a paper on "The Distribution of Coal in China." After sketching some of the results of travel in which he was engaged from 1868 to 1872, and which extended through almost all the provinces of the country, he said that geographical and geological researches were the chief objects he had in view. He was guided in choosing his routes by the notice given by natives of the occurrence of coal in certain localities, and thus he was enabled to visit nearly all the coal fields of importance. China was almost exclusively made up of the most ancient formations. The existence of very developed systems of strata of Silurian, Devonian, Carboniferous, and Permian ages was proved by the discovery of the prolific occurrence of fossils in numerous localities. No one of the formations was more universally distributed through the country than the Carboniferous, which contained coal beds wherever it occurred, together with the coal-bearing strata in Permian and probably Triassic ages; and those he comprehended as the Chinese coal measures. Owing, however, to the fact that this was the most recent series of strata taking part in the structure of the country, and being made up in the main of soft rocks, the coal measures had undergone a vast destruction by denudation, the degree to which it had taken place determining, in general, the wealth in coal of each separate section of the empire—while, in the maritime provinces, the coal measures had been completely removed in many places, and imperfectly preserved in those which were most favored. There are, further inland, other provinces, chiefly Shansi, Hoonan, Yunnan, and Kensu, where the amount of denudation has just been sufficient to put the same strata under the most favorable circumstances, and render accessible marvellous treasures of coal not outrivalled by those of any other region of the globe. In other regions, again, as in the inner basin of the province of Sz'chuen, the coal measures had suffered so little destruction, that the coal beds were buried in depths not accessible to the miner, although the existence of a coalfield to the extent of about 100,000 square miles was demonstrated by outcroppings which occurred during the whole line of its periphery. Though not yet able to compute from his materials the probable extent of coal-bearing ground in China, the Baron believed that that empire vies in this respect only with the United States, and being probably ahead of them, may prove to be of all countries of equal extent the richest in coal. Attention was chiefly directed to the province of Shansi, which contains at least 30,000 square miles of coal-bearing ground, the greater portion of which carries bituminous coal of superior quality, while the rest constitutes the largest known anthracite coalfield. In many places the price of the finest anthracite in large lump is 7d. per ton at the pit's mouth, while bituminous coal is even lower, the miners' work consisting in a little more than quarrying, and the seams attaining the thickness of 30 feet. Among the consequences which might result from these discoveries, the most important appeared to be the eminent capability of China for manufacturing purposes, an immense amount of very cheap and skilled labor being available to carry out manufactures of all kinds; the circumstance that the country is adapted to the establishment of an extensive set of railroads, the construction of which will be promoted by the density of population, the great amount of inland traffic and the physical features of large portions of the Empire, and finally the future connection by rail of China with Europe, for which one line only is perfectly feasible, leading through the province of Kansu, the basin of Hami, and the regions of Hi, on the confines of Russia, a line which is favored throughout its extent by the occurrence of coal.

Union of Employers of Labor.

THE effect of high wages and strikes on the manufacturing industries of England, and particularly on the iron industry, is showing itself in a union or combination of employers. The movement is a very important one, though we believe it will be short-lived, and we greatly doubt its desirability. The proposed effort "to influence legislation," of course in the interest of one class, contains within itself the germ from which may grow much evil, since it divides with a still more marked line the interests of employers and employees. We believe the true, because the most just, solution of the "labor question" will be found in the general adoption of arbitration for settling disputes, and by the adoption of some form of co-operation by which the employee will have a direct interest in the product of his labor. The following are the proposed rules:

1. The Federation shall be designated "THE NATIONAL FEDERATION OF ASSOCIATED EMPLOYERS OF LABOR."

2. The object of the Federation is to promote and maintain such relations between Capital and Labor as will secure perfect freedom to both, and conduce to the welfare of the whole community. To attain this object the Federation shall—(*a*) Watch over, with a view to influence, all legislation affecting industrial questions and the relation of employers and employed. (*b*). Collect and disseminate throughout the country information bearing upon industrial questions. (*c*). Endeavor to secure co-operation and unity of action in arranging or resisting demands made by combinations of workmen (so far as such demands may affect the Federated trades, as a whole), by becoming the medium of communication between those trades.

3. The Federation shall consist of the representatives of such associations of employers of labor as, being accepted by the Council, shall agree to these rules, and shall pay the entrance fee and subscribe to the general fund the amounts hereinafter specified.

4. Every association of employers, when admitted as a constituency of the Federation, shall pay an entrance fee of five shillings per one hundred pounds on one week's average of the wages paid by that Association, and shall further pay to the common fund an annual subscription of five shillings per one hundred pounds on one week's average of the wages paid for the time being by that Association, which shall be due in advance on the first day of January of each year.* In the event of no return of average wages being made to an Association by its members, the amount to be contributed shall be assessed by the committee of that Association.

5. Should additional funds be necessary, the council shall call a meeting of the Federation, which shall decide what steps shall be taken in reference thereto.

6. For every annual payment by an Association equal to the required subscription upon one week's average of £3,000 in wages, it shall have the privilege of appointing annually one representative to the Federation. Every member of the Federation shall be entitled to vote by proxy, to be entrusted to some member present at the meeting. *N.B.*—The council may admit individuals or firms as members of the Federation, upon such terms and in such manner as they may from time to time determine.

7. There shall be a meeting of the Federation in London within two months of its provisional formation, at which a president, a treasurer, and an executive council of not less than twenty nor more than fifty members shall be elected for the management of the business of the Federation. An annual meeting of the Federation shall be held for the purpose of discussing questions concerning the Federation, and at which the president, the council, the treasurer, and the auditor shall be elected for the year, and a report, with audited accounts, shall be presented. The council shall meet every three months; not less than five shall form a quorum.

8. The council may, at its first or any subsequent meeting, of which due notice shall have been given, elect a chairman and vice chairman, and may, from time to time, appoint such committees and officers as they may deem expedient.

9. The council shall determine the time and place of all meetings of the Federation, and shall have power to call special meetings by a resolution of their body.

10. The chairman (or a vice-chairman, in his absence) may, at his own discretion, call a special meeting of the council; and the Secretary shall, on the requisition, in writing, of three members of the council, or of twelve members of the Federation, call a special meeting of the council. The council may, if they see fit, call a special meeting of the Federation, on the written requisition of twelve members of the Federation. All meetings of the Federation shall be called through the secretary, by a notice of not less than seven days.

11. It shall be the duty of the treasurer to receive and account for all moneys belonging to the Federation, and to make payments on receiving an order of the council, accompanied by an account.

12. It shall be the duty of the secretary to attend all meetings of the council and of the Federation, to provide for the taking of minutes of their proceedings, and for the receipt and payment to the treasurer of all moneys of the Federation, and for keeping of books of account. An agent may also be appointed who shall watch all proceedings, either in the press or in the legislature, bearing upon the interests of the Federation, and shall, under the authority of the council, take such steps as may be desirable to promote its objects.

13. Any association or member, under rule six, may withdraw from the Federation by giving six calendar months' notice of their intention to do so, and paying to the treasurer any moneys due to the Federation at the expiration of their notice. Upon the expiration of this notice, all the interest of the Association in the funds of the Federation shall cease.

14. Any association or member, under rule six, may be expelled from the Federation which has in the judgment of the council, contravened these rules, or otherwise offended against the regulations of the Federation and all the interest of that association in the funds of the Federation, shall thereupon cease. No expulsion shall take place except at a special meeting of the council, of which notice, drawing attention to the intended expulsion, shall have been given. Any association or member so expelled shall have the right to appeal to the next general meeting of the Federation.

15. The council shall have power to make such by-laws as are not inconsistent with these rules.

16. These rules, and any subsequent rule which may be adopted, shall neither be altered or cancelled, nor shall any new rule be made, except at a special general meeting of the Federation, of which four weeks' notice shall be given, stating the object and particulars of the proposed change.

*Thus:—An association, the members of which pay equal to an average of £5000 weekly, would have to pay an entrance fee of £12 10s., and an annual subscription o £12 10s.

Phosphor-Bronze.

THE result of three years' experiment, on the part of certain manufacturers in Europe, of the use of the phosphor-bronze, which contains 85 per cent. of copper, tends to affix a high value to this alloy. In the instances referred to it has been used to much advantage for the great bearings of the plates in general rolling mills, in cases where the rollers weighed five tons. It was found that the gear, when made of hard cast iron, broke frequently; this was replaced by wheels of ordinary bronze, and then by those of phosphor bronze. The duration of ordinary bronze wheels did not exceed, on an average, five months, while those made of phosphor-bronze wore for about nine months. This material has also been applied with great advantage not only in the making of pinions, but in the driving axles of mills; in the latter case the superiority seeming to depend not on the hardness, but on the very great resistance of the alloy, the arbors in the phosphor-bronze twisting much less than those made of forged iron, and not being liable to break like those of cast iron. To give an idea of what is thought of it by the judges at the Vienna Exposition, we may remark that it obtained the following awards: in Group I. for cog-wheels, tuyeres, and bearings, the Diploma of Merit; in Group VII, for revolvers and parts of harness, the Medal of Progress; and in Group XII. for its application to guns and other war material, the Medal of Merit.

The value of phosphor-bronze as a metal is retained indefinitely, for, unlike other alloys, it can be remelted without any material loss or alteration of its quality; while heavy steel castings, on the other hand, when worn out or broken, are comparatively worthless. A great variety of objects hitherto worked in iron and steel may now be cast in phosphor-bronze; and in many cases they require only a polish to make them ready for use; beside which they possess the merit of not corroding, as articles of iron or steel do. Its great fluidity, compactness, and fine grain, as also its beautiful color, especially recommend it for decorative art, and the perfection of the castings greatly reduces the cost of chasing and finishing. The phosphor-bronze alloys, made for rolling, drawing, or embossing, will stretch more than copper, or any of its ordinary compounds. Plates have been reduced, by a single cold rolling, to one-fifth of their thickness, the edges remaining perfectly sound and without crack. Another advantage of phosphor-bronze is its incapacity of emitting sparks. Tools, knives, scissors, and other articles, such as locks, keys, &c., have therefore already been largely adopted by gunpowder manufacturers.

As a material for ordnance it is also attaining a position of first importance. The Prussian government lately ordered a series of experiments to be made on phosphor-bronze, to determine its resistance to breaking under various strains. The first bar of phosphor-bronze fixed on the stretching machine was tried by pulls of ten tons per square inch, and resisted 408,230 pulls, whilst a bar of ordinary bronze broke before even the strain of ten tons per square inch had been attained. A second bar of phosphor-bronze withstood 147,850 pulls of twelve and a half tons per square inch. Still more favorable results have been obtained on a machine by which the test bar was repeatedly bent, as often as 40,000 times per day. Phosphor-bronze resisted 862,980 bends of ten tons per square inch. Best gun metal broke after 102,650 bends of the same force. Another bar of phosphor-bronze is being tested, and has withstood, up to the present time, 1,260,000 bends of nine tons force per square inch.—*Exchange.*

Danks' Puddlers and their Disadvantages.

THE uninitiated frequently ask why it is that Mr. DANKS' rotary puddlers are not more generally used, and we believe that there are no records which would let a seeker after truth into the secret. The following from the *Engineer* sums up some of the difficulties which have been met with in England:

"The principle of rotary puddling had been foreseen many years before its practical success was demonstrated, just as some of the greatest inventions of modern times—the steam engine and the electric telegraph in particular—had been foreshadowed by men who never lived to see their ideas take the form of accomplished facts. It is to Mr. DANKS that the honor and emolument due to the practical success of rotary puddling have accrued. But the Danks process, as it is euphemistically termed, is still so far short of perfection that our iron manufacturers have not seen their way to its adoption on a large scale. There are not more than half-a-dozen firms in this country that have as yet displayed sufficient faith in the Danks process to undertake it; and although it has now been before the world since May, 1868, and although our ironmakers have been more or less familiar with the *rationale* for nearly three years, the process has not passed out of the doubtful region of experiment. There are many practical men, who, either from ignorance or prejudice, disbelieve in the practicability of rotary puddling, while admitting that in principle it is thoroughly correct. Mr. DANKS has had to encounter the vexation and difficulty which is ever thrown in the way of those who promulgate a new order of things. At the Carlton Ironworks, near Stockton-on-Tees, and at the Erimus Ironworks, near Middlesbrough, the Danks process is now being tested on a large and complete scale. The proprietors of these works have fairly taken the bull by the horns. They have faith in the principle of rotary puddling; they believe that Mr. DANKS has hit upon the proper and correct mode of reducing that principle to practice; and they have resolved to conquer all the lions that beset their path in bringing the principle to a successful issue. It is no secret that up to the present time the results obtained at these works have not been altogether satisfactory, but we are glad to know that there are no difficulties of an insuperable character. At the Erimus and Carlton Works it has, at least, been demonstrated—(1) that the services of skilled puddlers can be dispensed with, so that the labor necessary to work the Danks furnaces can be purchased at a cheaper rate than that requisite for the ordinary puddling process; (2) that the yield of the Danks furnace is about five times as much as that of the ordinary puddling furnace; (3) that the quality of the yield is so much superior as to secure for the Danks puddled bars about £1 per ton more than for the iron made in the ordinary furnace; (4) that the labor of the men who work Danks furnaces is mere child's play compared with that of hand-puddling; and (5) that there is an economy in the consumption af coal.

"There are, however, countervailing difficulties and disadvantages which cannot be ignored. The first cost of a Danks plant is very much larger than that of the ordinary kind, all the appliances being on a gigantic scale, and this consideration alone will operate against the extensive adoption of the system until its practical superiority has been proved beyond all dispute. Then, the cost, or rather the loss, of a breakdown of a Danks furnace is a much more serious matter than it would be in the case of an ordinary plant; an accident to the squeezers might lay off an entire establishment for weeks, as, indeed, happened at the Carlton Works when they were set going some two months ago, whereas the breakdown of a shingling hammer in an ordinary plant would not necessarily stop the working of a single furnace. At the Carlton Works there is only one squeezer for the eight Danks furnaces built, and although it is found adequate for that number, it is obvious that until another squeezer is provided, and this would involve a very large additional outlay, there must be a constant liability to accidents which would involve in a moment the stoppage of the entire works. The same considerations apply to the rolls. A mill of exceptional size and power is required to manipulate such large masses of iron as the Danks furnace produces. That at the Carlton Works is probably the heaviest and most powerful mill in the world. It is quite adequate to rolling all the iron which the eight rotary furnaces are capable of producing, but a very trivial accident to the rolls might compel the entire stoppage of the works, and this risk can only be obviated by providing duplicate machinery. But the question of cost is not the only difficulty, for the huge masses of metal thrown into the furnace have a tendency to destroy the lining, and when the lining gives way the furnace itself will speedily follow. The granulation of the iron has been suggested as a remedy for this defect, and it does not seem to be one that is insurmountable, although it causes no little anxiety to practical men."

Effect of High Wages at the English Collieries.

LARGE numbers of agricultural laborers, weavers and others, tempted by the large wages earned by colliers, are leaving their pursuits and seeking work in the coal mines of England. In Derbyshire this course is causing much ill feeling among the miners, who seem determined to strike unless the new hands are obliged to pass through a certain apprenticeship under regular miners. The real cause of this opposition of the pitmen is naturally the reduction in wages, which will necessarily accompany an abundance of laborers, but it is also urged, and with good reason, that the mines cannot be considered safe where a number of men wholly or partially ignorant of pit work, are employed; and doubtless accidents will occur only too frequently to justify this assertion. But when the pitmen propose that none but those belonging to their association or union shall be allowed to work in the mines, they are following a course which, being in itself unjust towards others, and interfering with the rights of both employers and employees, cannot fail to injure the cause it is designed to help.

THE COUNCIL BLUFFS IRON WORKS is an establishment, founded for the purpose of supplying the Mining Territories with machinery for mining and milling. Its proprietors have had many years' experience, both in using and making machinery of this kind, and their patterns are those which are most approved in American practice. For the present, and probably for some time to come, the distributing stations for all metal work to a large portion of the Territories must necessarily lie on the Missouri river, as the nearest practicable point. For, however brilliant the future of the iron business in the Far West may be, that future cannot be considered a near one. Such places as Council Bluffs, lying near a plentiful supply of raw material, will continue to be points of general distribution. The Council Bluffs Iron Works have branch offices in Denver, Salt Lake City and San Francisco. They have been established upon a paid-up capital of $100,000, and are prepared to furnish the improved pans, settlers and amalgamating machinery of all sorts. Their machinery will be found scattered all through the various mining districts, and we have frequently heard it highly praised by those who were using it. Mr. C. F. HENDRIE is President and Mr. R. J. CORY Secretary of the works, which are at Council Bluffs, Iowa. In our advertising columns there will be found an announcement by them.

STOCK DISTRIBUTOR FOR BLAST FURNACES.—The *Mining Gazette* (Lake Superior) speaks of an "invention for an improvement in smelting or blast furnaces," which has just been made, and which, if the advantages that are claimed for it are even half sustained, must to a considerable degree revolutionize the manufacture of iron. It is called "Stock Distributor," and consists of a cylinder and valve attachments, by which the stock used in the manufacture of iron can be distributed and located in any part of the furnace at the will of the operator. The apparatus is said to be the invention of one of the large iron firm of GRISWOLD & Co. We presume the only control attempted over the distribution of stock is to place the large lumps at the center or sides as the smelter desires.

THE COAL TRADE.

NEW YORK Jan. 15, 1874.

THE dullness of the month has been sharply broken in upon by a rupture of the good relations existing between the Schuylkill Companies and their laborers. In accordance with a suggestion of Mr. GOWEN, the employers proposed to the workmen the acceptance of $2.25 instead of $2.50, as the minimum upon which to base the payment of wages for the coming year; the maximum remaining unchanged at $2.75. It does not appear probable that the change would have in any way affected the miners, as there are at present no signs of such a fall in prices as to cause a reduction of wages. But the miners took alarm in some way, and struck at once, without waiting for the 17th of the month, when their committees are to meet and present the result of the vote in their several districts. The proposition for a reduction comes from the same powerful combination which last year operated as steadily to the miners' advantage as to that of its own members. But though the advantage of the combination is clearly recognized by the men, they seem to have a fear of what that alarming monopoly may possibly do, which is really ludicrous. A monopolist trades union in conflict with a monopolist capitalist's combination is a sight worth watching, and the fact that there is such vigorous war between them is a proof how little favor monopoly of any kind, has to hope for in this country.

As the case stands at present, there are good probabilities for an adjustment of the dispute on the 17th. The reason has not yet been brought forward for pressing the reduction claimed, and the miners have made no effort to obtain an increase. The operators can withdraw their demand without embarrassing themselves, and unless there is really a desire among employers to neutralize the depression of prices by allowing the strike to continue, the difficulty will probably be removed on Saturday. The policy of causing strikes for the sake of their influence upon the market, is one often charged against the operators by persons who know nothing about mining; but it is an assertion which, at the most, has but a very doubtful basis. In the other districts mining continues at the old basis.

The effect of the suspension of work in the Schuylkill Valley can only be to stiffen the prices, and even if the quarrel is settled on the 17th, the market will still feel the effect of the miners' decided action. Whether any advance will take place on the 20th we cannot pretend to predict, but it is hardly possible that any general movement can take place, and the coming list will probably show that like those which have preceded it, the prices are governed strictly by individual considerations.

Miners' Wages and the Cost of Mining in the Wyoming Region.

In our anthracite mines the miners are paid so much a ton for cutting and loading the coal into cars; this price varies according to the thickness of the veins, the hardness of the coal, the pitch or inclination of the beds, nature of the roof, and a variety of other conditions which make the work more or less difficult, and which vary not only from one mine and one vein to another, but different parts of the same mine in the same bed are paying different prices, on account of these changes in the character of the coal. In the flat, or moderately inclined seams of the Wyoming Valley, where the coal is worked exclusively by the chamber and pillar system, a miner can cut on an average about thirteen tons of clean coal in his day's labor of say 7 to 8 hours, in a vein of from seven to nine feet in thickness. At a few of the mines the coal is weighed as it comes from the pit, and 2580 to 2800 lb. are allowed to make one ton (2240 lb.) of clean coal. If the coal be very clean and free from slate or shale bands, 2500 lb. as it comes from the mine, yields 2240 of clean coal after breaking, but more usually it takes 2800 lb. to give a ton. Where the character of the coal is such that the miner can cut 13 tons a day, that is, in our most favorable collieries, he is now paid 54 cts. per ton for cutting and loading; he employs a laborer to whom he pays $2 50 per day, to load the cars (13 tons) and finds his own tools, powder, etc. Powder he buys from the mining company, present price $3 00 per keg (25 lb.) and that amount will blast down on an average 25 to 30 tons, or say one pound powder to the ton of coal. Where the company employs miners by the day, they are paid $2 50; laborers working inside are paid by the company $2 00 to $2 25 per day, and when paid by the miners $2 50 per day. Boys working in the "breakers" receive from 50 cents to $1 00 per day. Gangways are driven from 10 to 12 feet wide by 7 feet (or the thickness of the vein) in height, making about 8 to 9 cubic yards, say 8 to 9 tons of coal per yard advance. This is about the work of one miner and his laborer per day. The miner is paid for gangways from $4 00 to $5 00 per yard advance, and gets 54 cents per ton for the coal taken out. Counter gangways, where the work is dry and not difficult, cost $3 50 to $4 00 per yard and the coal. "Cross headings" through the pillars are paid $2 50 per yard and the coal; opening a chamber off the gangway costs $9 00 and the coal. The company pays a man to put in the frog for the track which leads into the chamber, but the miner lays his own track and sets his own props, except the roof is very bad, and then the "mine boss" makes such an extra allowance for setting props as the case may appear to demand.

Air-ways are driven at least 36 feet area of section. Sinking shafts, say 10×20, to 12×30, through the coal measures of the Wyoming Valley costs from $125 to $200 per yard. There is very little timbering required in these cases, as the sandstone of the anthracite fields is so hard as to stand perfectly, in most cases, without timber. The shaft is, however, generally lined with boards to keep the water from falling in the hoistways. Men driving gangways work longer "shifts," that is, more hours than those in the chambers, and where it is desired to push work, two shifts of twelve hours each, or even three shifts of eight hours, are organized; in this way a gangway may be driven as much as 60 yards a month, where no special difficulty is encountered. A shaft of the dimensions above given can be put down where the ground is favorable and the quantity of water not very great, at the rate of 30 feet a month. Sometimes as much as 45 feet is driven in a month, using hand drilling, but usually 20 feet is considered a fair average. With machine drilling this rate can be considerably increased, though the cost is not much diminished.

The cost of mining coal is made up of a number of items, which we may give with sufficient accuracy for this region as follows:

Average cost of cutting	60c per ton	(2240 lb.)	
Breaking, packing, and preparing coal, say	25c	"	"
Hoisting, hauling, repairs, dead work, superintendence, &c., say,	60c	"	"
Royalty or ground rent (varies from 20 to 35)	30c	"	"
Interest on capital invested in improvements........	25c	"	"
Total $2.00			

The ground rent is, of course, intended to cover the interest and sinking fund on the capital invested in land.

The question of wages would be incomplete without giving at the same time the cost of living.

House rent at the mines costs $10 to $15 per month for a house containing four rooms, cellar, wash-house, and a garden plot, say 50×150 feet. Flour at retail, $8.50 to $11 per bbl. (196 lb.); sugar at retail, 9@11½c. per lb.; butter at retail, 35@40c. per lb.; eggs, 30@35c. per dozen; meats, 9@16c. per lb.; Indian corn, per bushel, $1.20; Oats, 75c.; Wheat, $1 60; @$2.00.

LEHIGH WAGES.

The wages paid in the Lehigh region (Hazleton) are: Cutting coal, Hazleton vein, 50c. for 48 cubic feet; Buck Mountain vein, 55c. for 48 cubic feet; miners working by day, $14 per week; miners' laborers, $11 to $12 per week; outside laborers, $9 to $10.50 per week; gangway very various, from $5 to $8.

ANTHRACITE COAL Mined for the week ending Saturday, January 10, 1874.

SCHUYLKILL REGION.	WEEK. tons.	YEAR.* tons.
†Philadelphia and Reading Railroad.....	35,903	51,745
Shamokin and Lykens Valley............	4,496	4,496
WYOMING REGION.		
Delaware and Hudson Canal Co...........	31,334	38,284
Delaware, Lackawanna and Western RR....	42,144	58,340
Pennsylvania Coal Co....................	19,855	26,400
†Lehigh Valley RR.......................	16,150	23,249
Central Railroad of New Jersey...........	3,887	3,887
LEHIGH REGION.		
†Lehigh Valley Railroad..................	48,465	63,126
Central Railroad of New Jersey...........	13,201	13,201
SULLIVAN REGION.		
Sullivan and Erie Railroad...............	25	25
Total....................................	215,460	282,753

* Year beginning January 1st.
† Two days in first week of January, estimated at 2-5 of the production.

Shipments of Bituminous Coal for the Week Ending Jan. 10.

	Week. Tons.	Year. Tons.
Cumberland and Pennsylvania RR.	34,516	34,516
Cumberland Branch RR...............	3,425	3,425
Philadelphia and Reading RR.......	5,554	7,162
Barclay RR............................	4.205	5,829

Wholesale and Retail Prices of Coal.

New York.

	Lump.	Steamer.	Grate.	Egg.	Stove.	Chestnut.
Wyoming Coals.						
Scranton	5 05	5 15	5 25	5 40	5 70	5 05
Lackawanna.........	5 70	5 80	5 90	6 05	6 35	5 70
Pittston	5 00	5 00	5 10	5 10	5 60	4 90
Wilkesbarre	5 50	5 60	5 70	5 85	6 15	5 50
Newport & Plymouth	....	...	5 80	5 95	6 25	5 65
Susquehanna Coal Co.	5 70	5 80	5 85	6 00	6 30	5 65
Lehigh Coals.						
Old Company.........	6 30	....	6 15	6 15	6 30	5 50
Sugar Loaf	6 30	....	6 15	6 15	6 30	5 50
Hazleton	6 30	....	6 15	6 15	6 30	5 60
Honey Brook.........	6 30	....	6 15	6 15	6 30	5 60
Spr'g Mount. Coal Co.	6 30	6 35	6 35	6 35	6 30	5 70
Beaver Meadow......	6 50	....	6 35	6 35	6 45	5 70
McNeal	6 30	6 30	6 15	6 15	6 30	5 60
Schuylkill Coals.						
Schuylkill White Ash.	5 85	5 85	5 95	5 95	6 25	5 20
" Red Ash..	...	....	5 95	6 10	6 40	5 20
Shamokin W. & R. Ash	....	....	6 05	6 25	6 45	5 35
North Franklin......	....	....	6 45	6 45	6 35	5 25
Lorberry	....	....	6 75	6 75	6 75	5 60
Lykens Valley........	....	....	....	7 35	7 35	6 00

At Georgetown, D. C., and Alexandria, Va.

George's Creek and Cumberland f. o. b. $4 60@4 75, wholesale.

Baltimore.

Wholesale Prices to Trade.

Wilkesbarre, by cargoes or cars................	$6 25@....
Pittston and Plymouth........................	6 00@6 50
Shamokin Red or White Ash.....................	6 00@6 25
Lykens Valley Red Ash.........................	6 80@....
George's Creek and Cumberland f. o. b. at Locust Point for cargoes......	4 75@5 00
West Va. Gas Coal f. o. b. at Locust Point	6 50@....
Kanawha Cannel, coarse........................	13 00@....
Tyrone..	7 25@....
Ritchie Mineral of West Virginia..............	19 00@....

Buffalo, N. Y.

Anthracite................................	$6 50@ 7 00
Youghiogheny Gas Coal.....................	6 00
Catfish Lump...............................	4 75
" Nut..................................	3 50
" Nut and Slack.........................	3 00
" Slack.................................	2 85
Connellsville coke.........................	8 00
Beaver Gas Coal............................	6 50

Boston, Mass.

English Cannel............................	$28 00@30 00
Cumberland................................	7 65@ 8 00
Anthracite, cargo.........................	7 50@ 8 00
" retail..................................	8 50ₜ 9 00

Chicago, Ill.—Jan. 12.

Purchases only made for immediate requirements.

Lehigh prepared............................	$10 50
Lackawanna.................................	9 00
Erie.......................................	8 50
Walnut Hill................................	8 50
Brook......................................	8 00
Blossburg..................................	8 50@9 00
Cannel.....................................	9 00@9 50
Hocking Valley.............................	6 50
Indiana Block..............................	7 00
Barclay....................................	6 00
Kirkland grate.............................	8 00
Minonk.....................................	5 50
Wilmington.................................	5 00
Midway.....................................	6 50

Cincinnati, O.—Jan. 16.

The market is steady. The prices afloat are:

Ohio River................................	9 cents per bushel.
Pittsburgh................................	11 " "
Anthracite................................	$10 50 per ton.

The following are retail prices delivered to customers:

Ohio River................................	14 cents per bushel.
Kanawha...................................	15 " "
Pittsburgh................................	16 " "
Cannel....................................	24 " "

Cleveland, O.—Jan. 12.

Briar Hill................................	$4 50
Massilon..................................	4 00
Massilon nut..............................	3 50
Chippewa..................................	4 00
Hocking Valley............................	3 75
Morris....................................	4 00
Cleveland Lump............................	3 50
Silver Creek..............................	4 00

Detroit.—Jan. 10.

Market steady.

Lehigh Lump...............................	$11 00
Scranton nut..............................	9 50
" stove...................................	9 50
" egg.....................................	9 50
" grate...................................	9 50
Blossburg.................................	9 00
Willow Bank...............................	8 00
Briar Hill................................	8 50
Brookfield................................	8 50
Chippewa..................................	8 00
Massilon..................................	8 00

Indianapolis.—Jan. 12.

Per 100 lbs.

Brazil Block..............................	25 c.
Highland..................................	22 c.
" steam...................................	20 c.
Anthracite................................	60 c.

Brazil nut	18 c.
Slack Coke	12½ c.
Virginia Cannel	45 c.
Indiana Cannel	36 c.
Steam Nut	15 c.
Hocking Valley	30 c.
Coke per bush	14 c.

Louisville, Ky.

Pittsburgh, afloat	per bushel, 11 cents.
" retail	" 16 "
Kentucky	" 12@14 "
Indiana and Peacock Pomroy	" 18 "

Anthracite $10 per ton delivered, and $9 00 afloat.

New Orleans, La.—Jan. 10.

Pittsburg, wholesale, per bbl	70 c.
" to steamboats "	60 c.
" to manufacturers	75 c.
" at retail per bbl	$1
Anthracite	$12 00@13 00

Philadelphia.

Broken	$5 50
Egg and Stove	5 75
Chestnut	4 75
Pennsylvania and Westmoreland Gas	7 50
Broad Top	5 25
Powelton Sterling	5 25
Derby	5 50

Pittsburgh, Pa.

Connellsville coal	per ton, $2 50
Youghiogheny, at mines	2 00
" at Pittsburgh	2 50
Coke on cars " "	3 25
" " " " ovens	2 25
Castle Shannon on Platform	per bushel, 9½ c.

Anthracite, $7 25 on cars.

San Francisco—Jan. 20.

West Hartley, wholesale	$17 00
Australian, "	11 00@12 00

St. Louis, Mo.

Anthracite, delivered	$13 50
Illinois coal, retail	per bushel, 10@14 cts.
" " manufacturers	" 9@13 "
Big Muddy	" 14@18 "
Trenton	" 12½@16 "
O'Fallon	" 10@14 "

In East St. Louis prices are 4 cents less.

Toledo.—Jan. 13.

Grate	$9 50
Egg	10 00
Stove	10 00
Chestnut	10 00
Lehigh Lump	11 00
Blossburg	8 50@ 9 00
Briar Hill	7 00
Bituminous	$4 50 to 6 50 as per quality.

Montreal.—Jan. 12.

Scotch Steam, 2000 lbs. ex yard	$8 00@ 8 50
Lower Port, do	7 00@ 8 00
New Castle Grate, ex yard	9 00@11 00
Welsh Anthracite, per 2000 lbs	9 00@10 00
English Coke	— —@— —
Lump Lehigh, per 2000 lbs	9 00@ 9 50
Grate	8 00@— —
Egg, American Anthracite	8 75@— —
Stove, " "	9 00@— —
Chestnut " "	8 50@— —

Prices of Foreign Coals.

Jan. 1874.

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@18 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, "	23 00@25 00

Per ton 2,000 lbs. delivered.

Prices of Gas Coals.

Jan. 1874.

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 50	$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.

The shipments from the Provincial Ports have ceased for the season, and will not be resumed before next Spring. Our quotations, therefore, are merely nominal.

AMERICAN.		Nominal qu. Currency.
Westmoreland	f. o. b.	$8 50@9 00
Fairmount Gas Coal Co. of N. Y.	" Balt.	6 50@7 00
Despard Coal Co	" "	6 50@7 00
Penn	"	8 50@9 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 and Penn		7 50@0 00

TO NEW YORK.

Provincial.	
Sydney	
Lingan	$5 00
Cow Bay	4 00
Port Caledonia	4 00
Little Glace Bay	4 00

TO BOSTON.

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.

FREIGHT RATES ON COAL FROM PHILLIPSBURG TO POINTS ON RAILROADS IN NEW JERSEY.

Central Railroad of New Jersey.

Springtown	$0 55	Flagtown	1 70
Bloomsbury	65	Ricefield	1 70
Valley	75	Three Bridges	1 70
Asbury	85	Bound Brook	1 50
Hampton	90	Flemington	1 75
Junction	90	Dunnellen	1 55
Glen Gardner	1 00	Plainfield	1 60
High Bridge	1 05	Fanwood	1 60
Annandale	1 10	Westfield	1 60
Lebanon	1 20	Cranford	1 60
White House	1 25	Elizabeth	1 60
North Branch	1 35	Communipaw	1 50
Raritan	1 45	Bergen Point	1 50
Somerville	1 45	Jersey City	1 50
Neshanic	1 70		

From Mauch Chunk, $1 15 additional.
" Upper Lehigh, 1 74 "
" Ashley, 2 04 "

Delaware, Lackawanna and Western Railroad—Morris and Essex Division.

Stewartsville	$0 60	Whitehall	1 40
Broadway	60	Boonton	1 40
Washington	75	Paterson	1 30
Port Murray	90	Bergen Junc.	1 45
Hackettstown	1 00	Clifton	1 45
Waterloo	1 15	Morris Plains	1 65
Andover	1 95	Morristown	1 65
Newton	2 25	Madison	1 70
Stanhope	1 20	Milburn	1 80
Drakesville	1 25	Summit	1 80
Chester	1 80	South Orange	1 75
Ironia	1 75	Chatham	1 75
Succasuna	1 55	Bloomfield	1 65
Vanatta	1 55	Orange	1 65
Port Oram	1 40	Montclair	1 75
Dover	1 40	Newark	1 62
Rockaway	1 50	Hoboken, for consumption	1 80
Denville	1 60	Hoboken, for shipment	1 26

Pennsylvania Railroad—Belvidere Division.

Manunka Chunk	$1 00	Lambertville	1 30
Belvidere	92	Moores	1 30
Hutchinson's	76	Titusville	1 39
Martin's Creek	67	Somerset Junction	1 30
Warren	67	Greensburg	1 30
Carpenterville	67	Asylum	1 30
Fdingers	67	Trenton	1 30
Riegelsville	67	Woolsey	1 60
Holland	76	Pennington	1 64
Milford	90	Marshall	1 68
Frenchtown	1 00	Hopewell	1 73
Tumble	1 10	Barbers	1 45
Point Pleasant	1 15	Ringoes	1 50
Bull's Island	1 20	Copper Hill	1 55
Prallsville	1 25	Flemington	1 60
Stockton	1 25		

Twenty cents per ton less when 5 cars at a time are consigned to one party, provided that where the reduction makes the rate $1—a ton, or less, the rate will be $1.

Pennsylvania Railroad—Amboy and New York Division.

Jersey City	$2 64	Howell	2 22
Newark	2 88	Farmingdale	2 32
Waverley	2 42	Prospect Plains	2 00
Elizabeth	2 36	Cranberry	1 96
Linden	2 30	Hightstown	1 90
Rahway	2 26	Imlaystown	2 04
Uniontown	2 20	Sharon	2 00
Campbell's	2 12	Davis	2 08
New Brunswick	2 02	Cream Ridge	2 10
Voorhees	2 30	Hornerstown	2 10
Middle Bush	2 34	New Egypt	2 04
East Millstone	2 40	Cookstown	2 00
Dean's	1 88	Wrightstown	1 94
Monmouth Junc.	1 82	Pembertown	1 96
Rocky Hill	2 14	Birmingham	2 06
Plainsboro	1 74	Ewansville	2 04
Princetown Junc.	1 72	Vincentown	2 30
Princetown	1 98	Smithville	2 02
Lawrence	1 64	Mt. Holly	1 98
Morrisville	1 54	Lumberton	2 22
Tullytown	1 66	Medford	2 32
Bristol	1 74	Hainesport	2 02
Schenck's	1 80	Hartford	2 10
Cornwell's	1 84	Moorestown	2 16
Torresdale	1 88	Stiles	2 22
Holmesburg Junc.	1 94	Merchantsville	2 26
Holmesburg	2 16	Windsor	1 84
Rowlands	2 18	Newtown	1 78
Bustleton	2 22	Yardville	1 70
Frankford	2 02	White Hill	1 66
Kensington	2 02	Bordentown	1 64
South Amboy	2 22	Lewistown	1 90
Mantau	2 16	Florence	1 74
Old Bridge	2 06	Burlington	1 84
Spotswood	2 02	Beverly	1 90
Jamesburg	1 94	Delanco	1 94
Englishtown	2 08	Riverton	2 02
Manalapan	2 10	Camden	2 18
Freehold	2 16		

Twenty cents per ton less when 5 cars at a time are consigned to one party, provided that where the reduction makes the rate $1 a ton, or less, the rate will be $1.

The rate of freight, including wharfage and shipping expenses, from Mauch Chunk to South Amboy, Elizabethport, Port Johnson and Hoboken, is $2 46.

Rate of freight from Mauch Chunk to Newark, $2 47; to Philadelphia via. North Pennsylvania RR., $2 00.

Philadelphia and Reading Railroad.

RATES OF FREIGHT FROM SCHUYLKILL HAVEN.

Landingville	$0 50	Phoenixville	1 50
Auburn	54	Perkiomen Junc	1 54
Port Clinton	71	Valley Forge	1 56
Hamburg	81	Port Kenedy	1 58
Shoemakersville	86	Bridgeport	1 65
Mohrsville	88	Rambo's	1 67
Leesport	92	Swede Furnace	1 68
Tuckerton	96	West Conshohocken	1 70
Reading	1 04	Egbert's	1 75
Exeter	1 14	West Manayunk	1 92
Birdsboro	1 18	West Falls on Schuylkill	1 92
Monocacy	1 20	Nicetown	1 92
Douglasville	1 24	Belmont	1 92
Pottstown	1 31	Philadelphia	2 02
Limerick	1 40	Richmond retail yards	2 02
Aramingo	1 42	Richmond for shipment	1 92
Royer's Ford	1 43		

From Mt. Carbon, 7 c. per ton additional.
" Port Carbon, 8 " "
" Tamauqua, 15 " "
" Pine Grove, 20 " "

Chestnut and Pea Coal 25 c. per ton additional, unless released by shipper.

Ithaca and Athens Railroad.

RATES OF FREIGHF FROM STAIE LINE.

Factoryville	$0 10	Vanettenville	$0 60
Spencer	70	West Denby	80
Newfield	85	Ithaca	75
Bingham	40	Ithaca for reshipment	53
North Spencer	75	Strattons	85

Rate from Lackawanna Junction to State Line, $2; for shipment, $1 34; for all points on I. & A. & Cayuga Lake Railroad, $2.

Rate from State Line to Cayuga Bridge, for Rochester and Charlotte, $1 02; Buffalo, 93c.; for all other points on New York Central Railroad. $1 06; Cayuga Bridge, local, $1 44.

Through rate from L. & B. Junc. to Buffalo, via I & A. C. L. Railroad and N. Y. C. Railroad, $3 80; to Rochester as above, $3 32.

Freights—January 15.

TO EASTERN PORTS.	From Elizabethport, Port Johnson, South Amboy and Hoboken.	From Philadelphia.	From Baltimore.
Amesbury	....	....	....
Bangor	....	....	....
Bath	....	....	3 25
Boston	2 10	2 60	2 50
Bridgeport	1 90	2 00	2 00
Bristol	1 30	....	....
Charlestown, Mass	2 10	....	....
Chelsea, "	2 10	....	....
Davenport	1 10	....	....
Derby	....	....	....
Dighton	....	....	2 50
East Cambridge	....	....	....
Fall River	1 30	2 00	2 00
Hackensack	....	....	....
Hartford	1 40	....	3 25
Hoboken	50	1 30	1 55
Jersey City	50	1 30	....
Lynn	2 10	....	....
Middletown	....	....	....
Mystic	....	....	....
New Bedford	1 40	2 00	2 25
Newburyport	....	2 75	3 00
New Haven	90	1 50	2 00
New London	1 10	1 65	2 00
Newport	1 35	2 00	....
New York	....	1 30	1 60@1 80
Norwalk	90	....	....
Norwich	1 15	....	2 25
Pawtucket	....	....	....
Portland	2 00	2 60	2 50
Portsmouth, N. H.	2 25	2 75	3 75
Providence	1 40	2 00	2 00
Rockport	....	....	....
Saco	....	....	....
Somerset	....	....	....
Sag Harbor	....	....	....
Salem	2 10	....	....
Stamford	90	....	....
Stonington	1 10	....	....
Taunton	....	....	....
Warren	....	....	....
Washington	....	....	....
Warscham	....	....	2 50

There is very little coal being shipped from Philadelphia, and rates of freight are very irregular.]

MARKET REVIEW.

NEW YORK, Jan. 8, 1873.

MR. WM. PAULSEN, No. 10 Burling Slip, has favored us with the following estimate of the *production*, *importation*, and *consumption* of Pig Lead, with especial reference to the amount used for the manufacture of *White Lead* in the United States, for the year 1873:

	Tons.
Utah produced	10,000
Missouri produced	11,000
Galena produced	3,500
California produced	2,500

Smelted in New York and vicinity.....	7,000	
Smelted in Pittsburgh, St. Louis, and Chicago..........................	2,000	
		36,000
Coastwise receipts..........................		2,000
Total..........................		38,000

FOREIGN IMPORTATIONS.

In New York, 1,3000 fine, 3,500 common.	16,500	
Against an average importation since the year 1862, of 25,400 tons annually.		
In Philadelphia (imported)...... Tons.	3,500	
In Baltimore "	1,250	
In Boston "	650	
Total of foreign Lead imported....		21,900
The stock in New York on Jan. 1, 73, was	1,500	
The stock in New York on Jan. 1, '74, was	1,000	
		500
Thus, amount of foreign Lead consumed in 1873.		22,400
Total foreign and domestic, tons		60,400

The amount of ordinary Lead used in New York I estimate at about 1000 tons p. a.

I estimate the amount of Pig Lead used for the manufacture of White Lead in 1873 as follows:

IN	Foreign.	Domestic
New York....	12,000	300
St. Louis, Mo....		5,000
Philadelphia....	3,500	500
Pittsburgh....		4,500
Salem, Mass....	1,500	
Cincinnati, O....		2,000
Buffalo, N. Y....		1,000
Boston, Mass....	1,000	
Chicago, Ill....		1,000
Baltimore, Md....	1,250	
Louisville, Ky....		500
Cleveland, O....		500
Taunton and New Britain....	500	
Total....	19,750	15,300

Total for White Lead, 35,050 tons.

LOUISVILLE, Ky., Jan. 12.

The general aspects of this market have continued to improve, and a further advance in American pig has been established in the leading markets—the total gain since the time of the greatest depression, being about $5 per ton. In the local market there has been considerable inquiry from buyers looking around for bargains, but very little business is being transacted. We quote Pig Iron as follows:

Hanging Rock Foundry X No. 1........	$41 00@$42 00
No. 1 Charcoal..................	40 00@ 41 00
No. 2 Foundry..................	34 00@ 35 00
No. 3, or mill..................	31 00@ 33 00
No. 1 stone coal foundry Missouri red, short..................	30 00@ 31 00

CHARCOAL CAR-WHEEL IRON.

Ohio Hecla..................	65 00@ 00 00
No. 1 Red River cold Blast..............	60 00@ 61 00
Nos. 3 & 4 Red River and Cottage........	60 00@ 61 00
Nos. 5 & 6 White Iron..............	60 00@ 61 00

TENNESSEE CHARCOAL CAR-WHEEL IRON.

No. 1 Dover cold blast..............	56 00@ 58 00
No. 2 " " "	56 00@ 58 00
White and mottled..............	56 00 a 58 00

DETROIT, Jan. 11.

Scotch pig net..............	$46
Lake Superior pig net..............	44
Flat bar iron..............	3.25
Horse shoe iron..............	5.50
Best Norway nailrods..............	8½c.@9c.
Best ham'd Swedes iron..............	8½c.@9c.

The following we extract from *The Shipping and Commercial List* of the 14th inst.

IRON—There is very little demand for Iron of any description at present. Dealers are about the only parties in market, and Importers are unwilling to sell at prices offered by them. Consumers buy very sparingly, and sales, as a rule, are limited. The late arrivals of Scotch Pig tend to depress the market, most of which is, however, being placed in yard—importers refusing to sell at present rates. About the only business done has been in Glengarnock, of which some 2@300 tons sold part at $41 50, though now $42@43 is asked, with none offering at less. American Pig moves slowly, $36 is an outside figure for No. 1, though most companies refuse to sell below; we hear sales of 300 tons No. 1 Lehigh, delivery soon, and 500 do. Gray Forge, both on private terms. Old iron of all descriptions is held firmly abroad, and correspondingly so here. There is, however, a lack of inquiry, and prices are somewhat nominal. Scrap is held abroad at $47@$47 50 for shipment, while here we cannot quote over $40@$42 50 from yard. There is some inquiry for Rails, but we hear of no business. We learn from good authority that the Rolling Mills throughout the country are running at a loss of $5@$10 per ton, which at the present rate of raw material, which cannot continue long, as it seems to be definitely settled among the Trade that the price of the raw material must either come down or the manufactured article must advance, or many of the smaller firms will be compelled to close out entirely. As noted above, during the last six months the manufacturers of Rails and Bar have been running at a loss, and, notwithstanding the mill prices have advanced from the lowest points of the late panic, are still selling at unremunerative figures, as the raw material has advanced in price as much as the manufactured article. Some of the Trade look for a good business, and think that prices will go higher, both for the raw material and for the manufactured article, while, on the other hand, it is supposed that as the great demand caused by the late Boston and Chicago fires having been filled, that as soon as prices make a show of advancing more furnaces will be put in blast, which will cause a greater supply, and will counteract any great advance that may be looked for, over the present ruling rates. Refined Bar from store, is steadily held at previous quotations. Russia Sheet is quiet.

LEAD—Foreign Pig remains dull, the little demand that exists being almost wholly for domestic. Foreign may be quoted 6¾@6⅞ cents gold for Ordinary. About 100 tons Domestic sold, in lots, at $5 90@$6 per 100 lb., gold. Bar 9¼ cents, Sheet and Pipe 10.

COPPER—New Sheathing is steady at 33 cents, and Bolts and Braziers 35; Bronze and Yellow Metal Sheathing 26, and Y. M. Bolts 32, net cash. For Ingot, there is more demand, and prices are firm; sales have been made of 150,000 lb. Lake at 24¾ cents; and 50,000 lb. for end of January 25; 26 cents is asked for middle of February, and 25½ bid. 90,000 lb. old Government Brass sold on private terms.

STEEL—There is a moderate demand for English, while best American is in fair request at old prices.

SPELTER—Remains dull. 15 tons Silesian sold at 7⅞ cents gold; and 25 do. Domestic, 8 cents currency.

REGULUS ANTIMONY—Is held at 13½ cents gold, for small parcels from store—a lot of 25 casks sold at 13 gold.

ZINC—Mosselmann Sheet is steady and held at from 8¼@8¾ cents gold.

San Francisco Stock Market.

BY TELEGRAPH.

NEW YORK, Jan. 15, 1874.

The following reports from the San Francisco Stock Board are dated January 8th and 13th. Without exception the list has declined, Yellow Jacket forming the most important feature in the report, being quoted at $87 per share, a decline of $33 as compared with our last. A dividend of $5 per share has been declared by the Belcher Mining Company, payable on the 10th instant, and also of $3 per share by the Crown Point Mining Co., payable on the 12th inst. The Eureka Grass Valley Co. will declare no dividend this month.

		Jan. 8.	Jan. 13.
Savage..............	—	98	100
Crown Point..............	—	110	106
Yellow Jacket..............	—	88	87
Kentuck, "New Issue"..............	—	20	25
Chollar Potosi..............	—	65	67
Gould & Curry "New Issue"..............	—	27	27
Belcher "New Issue"..............	—	114	114
Imperial..............	—	7	8½
Raymond & Ely..............	—	48½	51½
Meadow Valley..............	—	13	13½
Eureka G. V..............	—	16	16
Ophir..............	—	—	—
Hale and Norcross..............	—	—	—

The following quotations, from the Boston Stock Board, under date of Jan. 15, representing the price bid for Copper Stocks, are kindly furnished us by J. E. GAY, 32 Pine st.:

Calumet and Hecla Co..............	144
Copper Falls..............	25½
Central..............	34
Quincy..............	45½
Ridge..............	8
Rockland..............	1½
Phoenix..............	15
St. Clair..............	1

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 the Transactions of the Institute, containing proceedings, papers, rules, list of members, etc., is now ready, and has been sent to every member. Extra copies can be obtained of the Secretary, for $5 00 each. A few copies have been reserved by the Council for purposes of exchanges, etc., with libraries, scientific societies, or technical journals. The lists for these objects are now in course of preparation. Professor THOMAS EGLESTON, of the School of Mines, Columbia College, New York City, has charge of the list of foreign periodicals and professional societies, to which copies of the Transactions should be sent; Professor F. PRIME, Jr., Lafayette College, Easton, Pa., has the list of technical and public libraries in this country, and Mr. RAYMOND that of American periodicals and professional societies. Each of these gentlemen desires suggestions from members of the Institute; and from the names suggested the final lists will be made up, governing the distribution of free copies of the Transactions.

IV. The Council earnestly requests members to forward to the Secretary, for preservation, copies of all printed mining and geological reports, particularly pamphlets, which may fall in their way. It is believed that by this means a large amount of valuable fugitive information concerning different regions and properties in this country, may be caught and preserved.

V. According to the Fourth Rule of the Institute, the Vice Presidents and Managers have classified themselves by lot, with the following result:

Vice Presidents: Messrs. ROTHWELL, PECHIN and BLANDY retire May 1874; Messrs. COXE, EGLESTON and BLAKE retire May 1875.

Managers: Messrs. PETTEE, PRIME and FIRMSTONE retire May 1874; Messrs. MAYNARD, SYMONS and LESLEY retire May 1875; Messrs. CORYELL, HEWITT and HUNT retire May 1876.

VI. The next meeting of the Institute will be held in New York City, beginning on Tuesday evening, February 24th. Further announcements of the arrangements will be made hereafter.

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.
RICHARD P. ROTHWELL, C. E.
Editor of the Coal and Iron Department.

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.

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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.*

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THE SCIENTIFIC PUBLISHING COMPANY.

WILLIAM VENTZ, SECRETARY.
27 Park Place,
P. O. Box 4404. NEW YORK CITY.

CONTENTS FOR THIS WEEK.

ALL communications on subjects connected with coal and iron are cordially solicited; they should be addressed to RICHARD P. ROTHWELL, under whose direction that department of the Journal is conducted.

MEMBERS and Associates of the American Institute of Mining Engineers will find this week, in the Bulletin of the Institute, a number of new and important announcements. It should be generally known that the Volume of Transactions can be had, by members or others, of the Secretary, on payment of $5.

A CORRESPONDENT wants to know what M'ANDREW means, in his report on Coal Mine Inspection, by "information, data, matter and thing." As to the first three particulars, we cannot speak positively; but the "thing" referred to is doubtless the clerkship of the Schuylkill district—and a very good "thing" it is for M'ANDREW!"

THE telegraph announces the partial destruction of Helena, Montana, by fire. This is the second or third devastating conflagration which has attacked this thriving mountain city of the North. We trust that, as heretofore, the energy of our Montana friends will surmount all difficulties and disasters, and rebuild in fairer and more substantial form their pleasant metropolis.

WE desire to express our hearty thanks to Mr. GRANT WHITE who has brought the full weight of his condemnation down upon the barbarous word *scientist.* He says in the January *Galaxy:* "The word *scientist* has been brought to my attention by more than one correspondent. It has attained a degree of usage among those who it would seem are dissatisfied with 'scientific man' and 'man of science,' and who doubtless, with like displeasure of 'literary man' and 'man of letters," will soon contrive some dreadful combination in *ist* to use in their stead. *Scientist* appears to me, as it does to many others, intolerable, both as being unlovely in itself and improper in its formation. 'Sample-room' language gives us *drinkist, shootist, walkist,* and the like, with an undisguised incongruity which has a ridiculous effect, partly, at least, intentional, if not wholly so. Those words are regarded as the creations of exquisite humor by the persons who use them; nay, their very use is looked upon as an indication of latent powers which would place the user, if he would but let himself out, foremost in the ranks of the noble army of 'American humorists.'"

THE annual report of Hon. JOHN JAY KNOX, Comptroller of the Currency, is an able and interesting document, and has attracted considerable comment. Its clear and business-like discussions of such subjects as free banking, legal reserves, financial panics, etc., may be recommended to many newspaper and magazine writers who ventilate their ignorance and their eloquence together, on these themes; while for those who possess the ability to comprehend questions of finance and the bearing of facts upon them, the data afforded in this document will serve as material for wise inductions. We are particularly interested in a technical and mechanical question raised by the Comptroller on page 49, as follows:

"The present arrangement for burning notes to ashes, as required by section 24 of the act, is very unsatisfactory, the law having evidently contemplated that the burning should take place in the Treasury building. I recommend that an appropriation be made to test by experts the practicability, and to authorize the purchase, of suitable machinery for grinding to pieces mutilated notes, thus utilizing the paper material now lost, amounting in value to thousands of dollars annually."

This very sensible proposition ought to be practicable. Indeed, something of the kind was practised under Mr. MCCULLOCH, though not with perfect convenience and success. The waste of burning should cease.

The Institute of Mining Engineers.

AN important meeting of the Council was held in Philadelphia on Saturday last, at which it was decided to hold the February meeting of the Institute in New York. We trust that the choice of locality, so convenient to a large number of the members, will secure a very general attendance. The arrangements for this meeting will be announced hereafter more in detail. That there will be no lack of attractions, or of the substantial elements of a successful session, we need scarcely say. A good deal depends, however, upon the earnest co-operation of those members who are not able to attend the meeting. We appeal to them to maintain their vital connection with the Institute by contributing papers to represent them.

Another matter of great importance is the proposal of new members. It has been, hitherto, the policy of the Institute to receive into membership such persons only as voluntarily requested to be elected or were proposed, with their own consent, by their friends. We have never, as a body, solicited any one to join us. The present active membership of the Institute comprises about 250 names; and careful estimates of expenses show that, if it can be raised to 300 names, the receipts from annual dues will be sufficient to permit not only the publication of all proceedings in the ENGINEERING AND MINING JOURNAL, and the supply of the Journal to all members, but also the *annual* issue of a volume of transactions similar to that which has just appeared. There will be no difficulty in obtaining fifty new members if the present members will but take pains to bear the matter in mind and to speak of it, as occasion serves, to other engineers who may not yet have had their attention called to the subject.

Recent private advices from England indicate that the British Iron and Steel Institute will not be able to visit this country during the present year. The proposed meeting of that society in the United States will probably be postponed until 1876. While, on many accounts, we regret this decision, we cannot but congratulate both Institutes upon the pleasant and cordial relations which the invitation and its reception have established between them. The subject so auspiciously opened will not be allowed to fall into oblivion; and whenever our brethren from over the water are able to visit us, either individually, or in a body, we shall be ready to show them that our offers of a hospitable entertainment were not mere empty words.

Another matter in which the co-operation of members is earnestly desired is the accumulation of mining reports and pamphlets, which will in time acquire considerable historical value, as records of explorations and commercial undertakings. Each member of the Institute is earnestly requested to forward to the secretary a copy of every mining report which he can control. The danger that the secretary will obtain many duplicates need not cause uneasiness. They are easily exchanged with other collections, or, in the worst case, they can go to the paper-dealers. The accumulation of a large and comprehensive collection of such reports would be in many cases very convenient to members, who would be spared the necessity of keeping stacks of pamphlets themselves, since they would know that any one they desired could be found on application on the shelves of the Institute. A library of this kind would be more specially useful than any book-collection which the Institute is at present likely to be able to get together.

New Methods of Making Iron.

WHOEVER examines a general work on metallurgy, will find that in the manufacture of nearly every metal those methods which have been invented in England are distinguished by a lavish use of fuel. In the present day the extension of accurate information has brought about, in most new works, a combination in which part of the operations are performed in English apparatus, and part in the furnaces invented in other countries; but formerly the distinctive difference between English and continental practice was the almost exclusive use of the reverberatory furnace in the former, and of the shaft furnace in the latter. The late rise in the cost of coal found the English smelters loaded down with apparatus which had been designed for conditions in which cheap fuel played the leading part. Since that rise the great theme of discussion in our mother country has been the problem of economising fuel. For many processes, such as those for treating ores of copper and lead, the simple replacing of the reverberatory furnace by the shaft, in some of the operations, will undoubtedly effect a considerable saving in fuel and labor without diminishing the quality of the product. Even in those operations which require the use of the reverberatory furnace, a great deal may be accomplished by introducing the gas generator, a means of economy which is too much neglected in all countries. But neither of these improvements seems to have attracted especial attention in the present emergency. On the contrary, the great talk is of new inventions, most of which relate to iron smelting. We have called them "new" and also "inventions," but so far as we have noticed they are, for the most part, revivals of rejected suggestions or operations based on principles which have long been well known and perhaps thoroughly tried.

One of the new processes is intended to produce iron direct from the ore, and we can present it in no better form than by printing the following item, cut from an English exchange :

"Among the exhibitors on 'Change in Wolverhampton, on Wednesday, was Mr. GERHARD, the inventor of the process of making iron direct from the ore, who, with Mr. CADDICK, has works at Bradley, and whose system has been commended on behalf of the iron workers by Mr. CAPPER, the Union agent. Mr. GERHARD showed small samples of splendid cast iron, which attracted great attention. Mr. GERHARD advocates his system in the manner following :—Mr. BELL has recently stated before the Committee on Coal, in the House of Commons, that he estimates that 5½ tons of coal are required to produce a single ton of bar iron ; but Mr. BENNET AITKENS puts the amount at 6 tons 7 cwt. Suppose out of, say, 6 tons, 2 tons are required to produce a ton of cast iron, the remaining 4 tons are required to produce a ton of bar iron. The protoxide of iron, containing 77·78 per cent., requires 21·43 of carbon. The magnetic oxide, containing 72·41 per cent., requires 28·56 carbon, and sesquioxide, containing 70 per cent., requires 32·17 carbon. Admitting that the three descriptions of iron ores were employed in the making of cast iron, 30 lb. of carbon would be sufficient to produce 100 lb of cast iron, or a ton of iron weighing 2,400 lb. would require 720 lb of carbon, a saving of 3,760 lb. of carbon in the production of 1 ton of cast iron, which can be realized by using the "iron coke." The next thing to be considered is the converting of cast iron into wrought iron. It can be compared to ascending and descending an isosceles triangle, instead of walking on the base. It is evident that when heavy pieces of solid pig iron are placed in a puddling furnace to be melted the greater portion of the heat must be wasted, and after it is liquefied a much longer time is required to eliminate the carbon it contains, and other extraneous elements of which it is composed, with a continuation of an immense waste of fuel."

All this waste, together with the 3,760 lb. of fuel per ton before mentioned, is to be saved by Messrs. GERHARD & CADDICK. And what is their process? That question is concisely answered by the *Colliery Guardian* :— "Mr. GERHARD makes a compound of iron ore, flux, and carbon, pitch being included in the last named ingredient. This compound, which is called 'iron coke,' is put into the puddling furnace in the same way as pig iron, and in much less time than by the old method, and at a much less expenditure of labor and fuel, a 'heat' is produced. The two processes, known as 'melting' and 'boiling,' are entirely dispensed with, the operation of 'balling' being all that is required of the puddler." In our poor judgment three conclusions may be drawn from this description : First, that the process cannot be less wasteful of fuel than ordinary puddling, but in all probability the 3,760 lb. coal per ton iron, before-mentioned as saved by avoiding the blast furnace, would be all used up in the long continued heating of the "iron coke." Second, the great amount of cinder which the puddle ball would necessarily contain, if any but the purest ores were worked, would prevent the production of even a middling grade of iron. Third, that the process does not differ essentially from that described by us a few weeks ago, when we pointed out how one English establishment was daring enough in its use of fuel to employ the reverberatory furnace for making iron direct from the ore. The process of Messrs. GERHARD & CADDICK must evidently be dismissed as a not very enlightened attempt to obtain economy from the apparatus least adapted to afford it.

Next we have a process which entered the world with much greater *eclat* than the foregoing, but was met on the threshold by a decided storm of disapproval. Sir FRANCIS KNOWLES read, last November, a paper before the Society of Arts, in which he advocated a process of his own. Sir FRANCIS garnished his paper with many mathematical determinations and a good deal of chemistry, but in spite of these he did not make his suggestions always clear, and the following description, gathered from his long paper, is presented with all due reserve as to errors. He does not propose to do away with the blast furnace, but starts with pig iron as his raw material. This he melts in a cupola, runs the fluid metal to a finery which is lined with emery or bauxite (an alumina mineral) mixed with oxide of iron or manganese and a little caustic soda. These materials are selected because one of the fundamental requirements of the process is the removal of phosphorus, by treating the metal under a basic scoria containing soda, and which is not to contain in any case more than 30 per cent. of silica. Heat is supplied by making a gas containing 70—80 per cent. of carbonic oxide, which is blown with air, both heated to 500 deg. Centigrade, into the bath near its surface. The gas burns, producing a high heat with a neutral flame, and at the same time throws the melted iron up against its cover of basic sodic cinder. Every part is therefore brought in contact with the refining agents—caustic soda and iron oxide. If the iron contains very much silicon, phosphorus and sulphur, it undergoes a preliminary fining with iron ore alone, and then one with the prepared scoria. We infer, though the author does not say so, that a removal of carbon does not take place to any great extent in the finery.

Next comes the transformation of the fined metal to wrought iron or steel, and this is done in a converter which is unlike Bessemer's and yet of the Bessemer type, but it is not necessary to describe it. Air is blown in below the metal and iron or steel is made. These operations correspond to the requirements which the author lays down as the basis of his process. They are :

1. The separation, as far as possible, of the heating process from the chemical process.

2. The securing of a highly basic scoria—or cinder—of not exceeding thirty per cent. of silica, by means of finery and converting furnaces, in which that acid is not present.

3. The employment of caustic soda in conjunction with pure and rich oxide of iron in the elimination of the sulphur and of the phosphorus.

4. Where pure cast-iron is treated, and superior iron or steel is to be produced, the use of nitrate of soda, or of permanganate of soda.

Of these the first is already commonly employed in the Bessemer process, and to some extent, with the Danks puddler also. The second may be valuable, and the use of a basic scoria is certainly a promising mode of refining. But the idea is not a new one. It has been made before, and the only objection was that no one saw the way clear to make and use it with economy. Sir FRANCIS KNOWLES forms it of pure ore and caustic soda, and in so doing he enters at once into opposition to the results of trials, which have continued for years, and some of which belong to the early experiments in iron working. He does not say how often a given amount of scoria can be used, but soda and pure ores are certainly too costly for reckless treatment, and as to minute quantities we do not think that a homœopathic dose of either will do the least good. This fining by a neutral flame is the great point in the process. To remove phosphorus and sulphur without burning the carbon from the iron (if that is really the object sought) is an operation which may bear good fruit if it can be done cheaply. But that is the point. The author proposes to make his gas by heating coke and limestone in retorts, and it is exceedingly doubtful whether the method is economically possible. There is, so far as we know, only one apparatus in common use which produces oxygen, or a gas of high heating power, on the large scale, and the requirements of that apparatus are such that its utility as a source of independent fuel is problematical. SIR FRANCIS endeavors to eliminate waste as much as possible by collecting the gases from the cupola and finery, and enriching them to the necessary point by adding pure carbonic oxide from the retorts.

To repeat, the first of the requirements laid down by the author is old; the fining process, though not a suggestion to be straightway rejected, is at least doubtful in theory, and decidedly so from the stand-point of cost ; the use of soda in any form is probably too costly now, as it has frequently been found to be by experimenters for half a century back. We believe the author exhibited some samples of iron made in his own works, but we have seen no discussion of them in comparison with the ores or raw material from which they were produced. The concluding paragraphs of his paper were given to the subject of steel making, which he treated in such a way as to strip his preceding remarks of the weight which the exhibition of accurate knowledge and sound judgment upon operations already in use would have given them. He describes with considerable circumlocution the production of steel directly from the ore. And how was it done? Why, by carefully analysing the ore so as to compute a proper scoria, and then adding charcoal in just such proportion that after allowing for oxygen, alkalies, etc., there should be enough carbon remaining to make steel of the required grade. This our author presents as a new process ! We do not wish to speak of this paper or its author with any harshness, but we submit that a man who does not know that this has been constantly done for years, and is one of the ordinary modes of steel making, is hardly a fit person to undertake the improvement of an industry, the present condition of which is the result of long years of accurate and skillful investigation. Doubtless many modes of working have been rejected from erroneous views of cost and difficulty, and it is always in order for any person to reconsider any of the tabled problems of the past, but in doing so he should give some evidence that he is acquainted with the fact that it is an old question revived, and should clear the ground for his discussion by fairly meeting the objections to it.

Wells, Fargo & Co.'s Bullion Statistics for 1873.

THE San Francisco *Alta* published, on January 1st, the following letter from JOHN J. VALENTINE, General Superintendent of Wells, Fargo & Co.'s Express. In the statement of production of the precious metals all the Mining States and Territories west of the Missouri river are represented, with the sole exception of New Mexico. In regard to the reliability of the statement for some of the Territories the letter explains itself.

SAN FRANCISCO, Dec. 31, 1873.

EDITORS ALTA : We hand you herewith a copy of our annual statement of precious metals produced in States and Territories west of the Missouri River—including British Columbia—during 1873. A comparison with the statement for 1872, published in *The Alta* of January 3, will show that the aggregate exceeds that of 1872 more than $10,000,000. Arizona, California, British Columbia, Oregon, Washington, Idaho and Montana, decrease. Nevada, Utah and Colorado, increase. The increase in Nevada alone is nearly $10,000,000, the total product of which about equals all the others. As stated in our report of 1872, we only touch the borders of Arizona ; therefore the figures given do not furnish a correct basis for estimating the product of that Territory, but it is inappreciable as compared with the others. Mexico is represented in silver only, and the amount named will not give a correct idea of the product of the Pacific or West Mexican coast, as the Pacific Mail Steamship Company carry, independent of Wells, Fargo & Co., in addition to which large amounts are conveyed by British war vessels to Panama or San Francisco, of which we make no record.

The combined product of all shows—For 1872, $62,236,913 ; for 1873, $72,258,693—undoubtedly the largest yield for one year in the history of the Pacific coast. Yours truly, JOHN J. VALENTINE, Gen'l Supt.

STATEMENT OF PRECIOUS METALS PRODUCED IN STATES AND TERRITORIES, WEST OF MISSOURI RIVER, DURING 1873.

States and Territories.	Gold dust and bullion by express.	Gold dust and bullion by other conveyances.	Silver bullion by express.	Ores and base bullion by freight.	Total.
	$	$	$	$	$
California	15,709,956	1,570,995	264,771	480 000	18,025,722
Nevada	219,141	43,828	30,183,921	4 807,617	37,254 507
Oregon	1,146,991	229,398	......	......	1,376,389
Washington	171,951	34,390	3,054	......	209,395
Idaho	1,171,131	234,226	938.297	. ...	2,343,654
Montana	3,241.238	648,247	3,325	....	3,892,810
Utah	112,003	22,400	1,210.434	3,561,500	4,906,337
Arizona	37,074	7,415	3 289	......	47,778
Colorado	1,856,639	......	839,862	1,386,767	4,083,268
Mexico	....	......	868,798	......	868,798
British Columbia	1,041,696	208,339	......	......	1,250,035
Total	......	......	......	......	$72,258,693

Deducting $2,118,833 for Mexico and British Columbia, the product of mines on United States territory, excluding New Mexico, is therefore, according to Mr. VALENTINE, $70,139,860.

NEW PUBLICATIONS.

A PRACTICAL MANUAL OF CHEMICAL ANALYSIS AND ASSAYING, *as applied to the Manufacture of Iron from its Ores, and to Cast Iron, Wrought Iron and Steel, as Found in Commerce.* By L. L. DE KONINCK, DR. Sc., and E. DIETZ, Engineers. Edited with notes by ROBERT MALLET, F. R. S., F. G. S., M. J. C. E., etc. London, Chapman and Hall. For sale by D. Van Nostrand, New York.

If it is true that no complicated manufacture of modern times can be successfully carried on and improved without the continual aid of science, then we shall be prepared to expect that in localities in which any such manufacture is extensively and successfully followed, the sciences related to it will be thoroughly investigated in theory and reduced to form as practical arts. This is particularly the case with the manufacture of iron and steel ; and no one who has personally observed the perfection and the proportions of this business in Belgium, will be surprised to find that it is accompanied in that country with a valuable technical literature. The authors of the manual before us, being both skillful and learned in the metallurgy of iron, have undertaken to present, in a concise form, the information most frequently required by chemists in iron works, for whom this book is specially intended. But, as the editor justly remarks, it is a work, from the careful study of which, accompanied by the self-instruction derivable from a repetitive course of the operations described, any tolerably intelligent man, with some preliminary knowledge of organic chemistry and manipulation, might become a practical iron assayer. It is, therefore, particularly well adapted to be useful to American iron masters, many of whom already possess, and all of whom may easily obtain, the prerequisite general acquaintance with chemical principles and processes.

The plan of this manual will appear from a brief recital of its contents. The first part contains a description of the reagents to be employed, and the experiments necessary in order to ascertain their degree of purity ; in the second part are given some practical suggestions relative to the apparatus employed in the laboratories attached to ironworks ; the third part treats of volumetric assaying ; the fourth is devoted to the analysis of iron ores, slags, and scoriæ, by the wet method ; the fifth part treats of the assay of the same ores by the dry or docimastic method proper ; the sixth gives the methods of analysis of malleable iron, cast iron, and steel ; and the examination of fuels forms the seventh and last part. Since zinc and lead ores are occasionally found more or less in company with ores of iron, so as to complicate the analysis of the latter, the treatise is completed by a brief indication of methods generally used in analyzing them.

We have examined with interest the different sections of the book, with the view of ascertaining how clearly, and with how much detail, the processes involved are described, and to what extent the latest improvements in laboratory practice are included. In both respects we are able to commend the book heartily. Yet, excellent as was the treatment bestowed upon it by its authors, the admirable notes added by Mr. MALLET have, in our opinion, greatly augmented its practical value. They refer mainly to topics connected with actual practice in the laboratory, and contain a great number of useful suggestions, such as an accomplished teacher might drop for the benefit of his pupils in the familiarity of daily association.

The employment, in this manual, of modern chemical formulæ and atomic weights may prove at first somewhat inconvenient to those who have been brought up under the old-fashioned nomenclature ; but, after all, there is no doubt that the new theories and arrangements of symbols will ultimately replace the old, and whoever intends to keep pace with the progress of technical literature must make up his mind, whether he likes it or not, to master its language. From this point of view, it is a great advantage to possess a text book, by the aid of which modern treatises can be interpreted.

We notice that in the account of the colorimetric method of determining combined carbon in cast iron or steel, the very convenient apparatus devised by Mr. BRITTON is not described. This apparatus is specially adapted for use in large establishments, when frequent assays are required.

At the end of the book are several tables, giving the chemical equivalents, stoichometric coefficients, and comparative weights and measures. The latter table enables a student to turn metric weights into British grains, but unfortunately does not facilitate the reverse calculation.

A SELF-MADE WOMAN ; or, *Mary Idyl's Trials and Triumphs.* By EMMA MAY BUCKINGHAM. New York, S. R. Wells, Publisher, Price $1 50.

THIS is a sentimental story about a young woman, who succeeded, notwithstanding poverty, illness, disappointments and discouragements at home and abroad, in educating not only her head but her heart, and not only her heart but some of her limbs (which were originally crooked) to beauty, symmetry, intelligence, taste, culture, fame, wealth, love, and luxuriant ease. That these phrases are all correct we know, because we got them from the preface. MISS BUCKINGHAM and MR. WELLS must excuse us from any analysis of the romantic or literary merits of the book, as these subjects are evidently not in our line. We recognize, however, as in our line, the suggestion of the heroine that "immense" fossil "bird tracks," which she observed in her lover's geological cabinet, along with petrifactions of rattle-snakes, frogs, etc., were perhaps imprinted in soft clay, originally, and, by the action of water or heat, may have expanded to twice their natural area, like impressions on wax, which, when subjected to heat, will become enlarged, you know, This we did not know, being under the impression ourselves that impressions upon wax, when subjected to heat, go away entirely. It is not surprising that this paleontological young lady subsequently discovers, by the aid of a celebrated mineralogist, that the entire four hundred acre tract of sterile land which she owns at Daisydell, covers a rich vein of coal—one of the best coal mines in the Keystone State. This discovery brings her, of course, abundant wealth—mines in books always do that ; but it does not happen until after she has made her fortune by writing powerful stories, anonymously, "as much for the elevation of her sex as for mammon or fame's unsatisfying chaplets." The moral of the book, from an exclusively engineering stand-point is, therefore, heartily to be commended—namely, No one should undertake to get rich by mining, until he has got rich in some other way.

The Mechanical Equivalent of Heat.

REV. ARTHUR RIGG, who has been delivering in England some interesting lectures on the "Energies of the Imponderables," gave the following description of the apparatus with which JOULE experimented on the mechanical equivalent of heat.

He took a vessel which had brass plates in it, and brass bars fixed to the inside of the vessel, and running across, so that paddles could rotate between the bars. The vessel was filled with water, and therefore, when the paddles rotated, the fixed bars stopped the whirl of the water, and heat was developed. The sea, as those who are accustomed to bathe know very well, is warmer on a windy day than on a calm day, simply because the motion of the water caused by the wind is converted into that motion of the molecules of the water which we call heat. So in the experiments with this apparatus, the motion of the water in the vessel is converted into the motion called heat. Of course all possible means were adopted to prevent heat passing by radiation from the exterior of the vessel. Hence the vessel was enclosed in another, and that again in another. The contrivances for ascertaining a measure of the mechanical effort made to keep the paddles rotating at a uniform rate were very simple.

The little vertical shaft on which the paddles were fixed was prolonged upwards, being divided across and re-connected in line by a piece of vulcanite, which, in common phraseology, would be called a non-conductor of heat. Wound round the upper part of this shaft were two cords, the ends of which passed over two pulleys on opposite sides. To these cords were fixed weights, by the descent of which motion could be given to the paddles. The cords were two in number, and on opposite sides, in order to obviate as far as possible the heating effect of rubbing friction on the shaft journals. With this apparatus, and others constructed upon similar principles, a series of experiments enabled him to arrive at certain definite conclusions.

In a research of this kind, made with apparatus contrived as new thoughts and new experiments suggested, it was not to be expected that the tabulated results should speak with one consenting voice. They did, however, seem to proclaim this—that the mechanical equivalent of heat competent to give an increase of temperature of 1° Fahrenheit to 1 lb. of water, was between 500 and 800 foot pounds. Detecting and eliminating those elements which seemed to affect the accuracy of the results, he was enabled at last to come to this conclusion, that 772 lb. was the exact number which was the mechanical measure, or, as it is commonly called, the mechanical equivalent of heat. That means this—he found how much a known quantity of water was raised in temperature by a recorded mechanical exertion, and he deduced the measure of that exertion needful to raise 1 lb. of water 1° on Fahrenheit's thermometer. Thus he found that that heat, applied to raise weights, would lift 772 lb. through one foot ; that is, if you had 772 lb. weights here, and lifted them a foot high, it would be the same thing exactly as applying the same force to 1 lb. of water, and raising the temperature 1° Fahrenheit.

The title of this lecture includes the words measurement and utilization. The utilization of heat is so important a commercial as well as scientific question, that there are one or two matters bearing upon it which may be worth present attention and much future thought from all. That we do not obtain in a steam-engine more than a quarter of the heat we expend in the furnace is now generally recognized. There is a table here, based upon Mr. JOULE's calculations, which gives the number of horse-power—a technical term, meaning 33,000 units of work—which could be obtained by utilizing the heat required for passing nine pounds of ice through its physical and chemical changes. If we have 9 lb. weight of ice, and attempt to melt and convert them into liquid, a certain amount of heat is absorbed or rendered "latent," as it is called. At any rate there is a quantity of heat that does not show itself upon the thermometer. Then, after it is converted to water, if we gradually raise the temperature to 212°, there is another large quantity of heat rendered "latent" in the conversion of this water into vapor, and if we then convert that vapor which comes from the water into its elemental gases, viz., oxygen and hydrogen, another large quantity of heat is absorbed or rendered "latent." Now take that process backwards; assume we can take this 9 lb. of oxygen and hydrogen and re-convert them back again into ice, and that it was in our power to use the heat which had been given off, then we get the quantity shown in the table. If we burn a quantity of hydrogen in oxygen it is converted into water; if one part of hydrogen and eight parts of oxygen are combined by an electric spark or other means, and converted into water at 212°, a number of units of heat equal to 1451 horse-power are obtained. If, then, we pass it still further into the form of water at 32° we should obtain 38 horse-power more; and if we then pass it from the form of water into the form of ice, we should obtain 30 horse-power. Therefore, if in obtaining 9 lb. of ice from its primeval elements, viz., 1 lb. of hydrogen and 8 lb. of oxygen, we could utilize as a mechanical agent all the heat set free, then from the data given we see that there would be obtained 1519 horse-power of work. But we cannot obtain this. What becomes of the heat, where it goes, and why we cannot contrive to utilize it, are inquiries which yet perplex scientific students. Various surmises have been made, but none of them been accepted, except as the vague guesses of an unsolved riddle, the best of which are taken, though there remains a lurking feeling that none of them are right.

There is another table bearing on this question, viz., the advantage of using steam at a higher pressure than what is called low-pressure steam. If we take water at 33°, that is just above the temperature of ice, and that be warmed until it attains the temperature 213°, it would occupy a bulk 1669 times as large as it was in the form of water. There is a relation between the pressures and temperatures which must be maintained, in order to preserve the whole of the water in the form of steam. These relations are expressed in the first two columns in the following table. The third column expresses the resulting volumes of steam. The fourth column is the product of the pressure and the volume, and, therefore, represents the mechanical value of our unit of water. How much and at what rate this value or power increases with an increase of heat, and a correspondent increase of pressure, may be known by considering the figures in this fourth column. These figures represent the advantage of using steam at high pressures, and, therefore, high temperatures:

STEAM FROM WATER.

Pressures. Pounds.	Temperatures. Deg. F.	Volumes.	Pressure multiplied by volume.
15	33	1	
15	213	1669	25,035
25	240	1042	26,050
35	260	765	26,775
45	275	608	27,360
55	288	506	27,830
65	299	434	28,210
75	308	381	28,575
85	317	340	28,900
95	325	307	29,165

The reason why we cannot work steam at some of these very high temperatures is this, that when we superheat it, we thereby prevent any of it being converted into vapor, and if it is not so converted into vapor we have no means of lubricating the faces of our slide valves, and the consequence is, the metals being heated, they soften, then scratch and tear each other's faces, and the engine is soon destroyed. As soon as we can get slide-valves made of some material which will bear this higher temperature without abrasion or scratching, then, probably, we shall be able to work superheated steam economically.

The Preparation of Mint Standards.

IT has been necessary to prepare a new trial plate for the British Mint, and Mr. CHANDLER ROBERTS gave the Chemical Society an account of the difficulties encountered in the work. He gave a table of the composition of the five gold and silver trial-plates since 1660, showing that they sometimes varied considerably from the standard of 916·66 for gold and 925·0 for silver. The alloy in the last gold trial plate, that of 1829, consisted of equal parts of copper and silver, but since 1837 the coin itself has been alloyed with copper alone. The new trial-plate has been prepared by melting together pure gold and copper, the purity of which was guaranteed by its high electric conductivity; of course, repeated meltings were necessary before the proportions of the metals had been correctly adjusted. Assays of pieces taken from various parts of the plate showed that it was homogeneous. Much difficulty, however, was experienced in preparing the silver trial-plate, owing to the tendency which the alloy, when cast into bars, has to be richer in silver in the interior than on the exterior, as shown by the experiments of LEVOL. In order to overcome this, it was necessary to resort to an artifice—casting the metal in the form of a hollow cylinder, which was then cut open and rolled; this did not succeed, the upper and lower portions of the casting possessing different compositions. One thousand ounces of standard silver were therefore cast into a plate 30 centim. long, 25 wide, and 5 thick, the surface to the depth of 4 m.m. being subsequently planed off. This was then rolled out, and portions of metal removed from all parts of the sheet for assay. By this means it was found that a comparatively small portion along one edge of the plate was homogeneous and to have the required composition; the rest of the sheet was removed, and this portion is reserved as the standard trial-plate. Owing to the impossibility of obtaining plates of alloys which shall be absolutely homogeneous, the author suggested to the Lords of the Treasury to supplement the standard plates by plates of perfectly pure gold and silver. The gold plate was precipitated from more than 100 gallons of solution of auric chloride by means of oxalic acid, and the silver plate was prepared by STAS's process of reducing an ammoniacal solution of argentic nitrate by ammoniacal cuprous sulphite.

Coinage of the San Francisco Mint.

Coinage for December, 1873—Double eagles, $3,520,000; trade dollars, $200,000. Total, $3,720,000.

Coinage for six months ending December 31, 1873:

GOLD.		
Double eagles	$12,900,000	
Eagles	120,000	
Half-eagles	155,000	
Quarter-eagles	67,500—	$13,242,500
SILVER.		
Trade dollars	$703,000	
Half-dollars	98,000	
Quarter-dollars	31,000	
Dimes	35,500—	867,500
Total coinage for six months		$14,110,000

This month's coinage is the largest ever made in the United States Mint at San Francisco.—*Alta California.*

English Mining in 1872.

ON the 19th of December, 1873, Mr. ROBERT HUNT, keeper of the Mining Records for Great Britain, was able to make a complete return of the business done in the previous year. His table reads as follows:

No. of Mines.	Minerals.	Quantities. Tons.	cwts.	Value. £
3,001	Coal	123,497,316	0	46,311,133
266	Iron ore	16,584,857	0	7,774,874
117	Copper ore	91,183	0	443,738
162	Tin ore	14.266	0	1,246,135
455	Lead ore	83,968	3	1,146,165
63	Zinc ore	18,542	12	73,951
35	Iron pyrites (sulphur ores)	65,916	3	39,470
15	Arsenic	5,171	15	17,964
3	Wolfram	88	5	993
1	Cobalt	1	0	20
3	Manganese	7,773	0	38,865
1	Fluor spar	80	12	40
5	Ochres, umbers, etc	3,326	15	8,227
1	Bismuth ore	2	0	—
1	Chloride of Barium	65	0	130
25	Barytes	9,092	17	7,078
	Clays, fine and fire (estimated.	1,200,000	0	450,000
	Other earthy minerals (estimated)	—		650,000
	Salt	1,309,497	10	654,748
	Coprolites (estimated)	35,000	0	50,000

Total value of the minerals produced in the United Kingdom in 1872 .... £58,913,541

Metals obtained from the ores enumerated, etc., in the United Kingdom in the year 1872:

Description of Metal.	Quantities.	Value.
Pig iron, tons	6,741,929	£18,540,304
Copper "	5,703	583,232
Tin, "	9,560	1,459,990
Lead, "	69,455	1,209,115
Silver, ounces	628,920	147,230
Zinc, tons	5,191	118,076
Other metals, (estimated)	—	2,500

Total value of metals produced from the ores of the United Kingdom in the year 1872 .... £22,070,143

The total value of the metals produced, coal and other minerals raised, in the year 1872: Metal, value of, as above, £22,070,447; coal, ditto, £46,311,447.; minerals, earthy, etc., £1,811,826; total, £70,193,416. The increase in total value, amounting to £12,871,523, is chiefly due to the additional cost of "getting" each ton of coal. To the 3001 coal mines should be added the product of 150 others not included.

From the remarks that accompany the table we learn that "a computation of the coal used in our metallurgies, which is based upon information received directly from the smelters and ironmasters, shows that in that direction the increase in consumption has been very small Of coal used in smelting, refining, desilverizing, etc., of metals in the United Kingdom, during the years 1871 and 1872 there is a total increase of 371,605 tons, and a decrease of 365,532 tons. The actual increase in the coal consumed in the above metallurgies in 1872 was 6073 tons. The consumption of coal in the iron manufacture is computed, upon the information furnished to the Royal Commission, at the rate of three tons of coal used for all purposes, to each ton of pig iron produced. For the year 1872, as will be seen in the 'Pig Iron Manufacture Return,' the Mining Record Office has sought and obtained, for the first time, returns of the coal used from nearly all the blast-furnace establishments. As the result of the economy which has been rigidly pursued since the advance in the price of coal, we have only 51 cwt. of coal given as used for each ton of pig iron produced. This will give the quantity used in 1872 as 17,191,918 tons only."

The following is given as a close approximation to the increase in coal consumption, over that for 1871: Railways and canals, 1872, increase 4,600,000 tons, exports, 1872, increase 450,505 tons; iron and other metallurgies 1872, increase, 6073 tons; the quantities used at collieries and in mines, estimated increase, 10,000 tons; coal carted or sent by private rail or tramroads to ironworks, manufacturers, and towns, which does not appear in the above returns, estimated increase, 250,000 tons; total, 5,316,578 tons. Coastwise shipments, decrease, 300,214 tons. Actual estimated increase, 5,016,364 tons. This leaves about 1,000,000 tons of coal to be accounted for, which, out of the large quantity which we are now producing, may appear to be but a small amount.

Engineering and Mechanical Notes.

The Big Lick Tunnel, Dauphin County, Pennsylvania, driven under the instructions of Daniel Hoffman & Son, is finished. It is three-fourths of a mile long (next to the longest in the State), and made for a double track of four foot gauge. The strata cut are red shale, slate, coal and conglomerate; the latter being very hard. The south end was ventilated by the aid of an air-course, driven to the surface, from a point 1,300 feet from the south portal, and the north end in the same manner, by an air-course, about 300 feet from the north portal, the natural draft being assisted by a small fan. At the north end the tunnel is arched until the solid rock is reached, and the approaches are secured by first class mason work. The tunnel was driven by the Summit Branch Railroad Company, to secure an outlet to the rich coal fields in Bear Valley. It was commenced in May, 1870, and completed December 15, 1873. It was driven from each end, and at the point of intersection the lines were found to be exact.

Engineering, of December 5, contains a drawing and description of a cupola furnace built in the Broadway Foundry, St. Louis, by Mr. W. B. Cogswell, now of the Franklin Furnace, Oneida County, New York. The furnace was built with a large wind box placed immediately upon the bottom plate, the object being to form a bosh and reduce the size of the hearth. Another noticeable addition was a forehearth, which was placed in front of the cupola, on an independent support, and connected only by a spout for the metal and slag. In this reservoir the products of the fusion can collect and will separate very clean, and in case of an accident to the mould, the cupola can go on melting until the reservoir is full. Both the cupola and reservoir are provided with movable bottoms, and when the melting is finished the bottom of the furnace is dropped; but the bottom of the reservoir is not dropped until the next morning when the cinder breaks away easily. This form of separate forehearth is the patent of Mr. MacFarland.

M. Martin, Member of the French Council for the Administration of Forests, in a work on the destruction of forests, says that railroads are one of the greatest consumers of wood in the world. At first only oak ties were used. Then the use of the oak was succeeded by the beech, and that again by resinous wood. Subsequently, to make these less solid kinds of wood more durable, they were infiltrated with metallic salts, and protected by other means of preservation. These woods are grown only in northern countries, and the consequence is that the importation of wood is a very important item in the economy of some nations. France imported $28,000,000 worth of wood in 1865, which increased to $34,800,000 in 1869. England took $60,000,000 worth in 1865, and $52,750,000 in 1869.

It is not often that coal mines are lighted by their own gas, but this is done, to a small extent, at the Bölhorst mine, near Minden, in Westphalia. In that mine is a gallery cut through a layer of clay slates, and at one spot, about two hundred feet from the shaft, a large quantity of gas was observed to issue from a cleft under the water surface. It burned freely and was collected by placing two gas holders of sixty-five to seventy gallons capacity over the crevice, which was previously enlarged. Pipes were laid to two points in the shaft and to two others above ground. The gas burned well and gave a good light, but it was found that the pressure was not sufficient to keep all four burners supplied, and the burners choked quickly. The fact that a brilliant flame was obtained, was proof that the gas had a different composition from ordinary mine gas.

MINING SUMMARY.

California.

THE JAPA MINES.

The San Diego *Union* of the 21st ult. has the following intelligence from the Japa mines:

The mines are supposed to be in the summit of the range of mountains extending southeast from Julian, in this county, into Lower California, and the altitude of the camp is estimated to be about 5,000 feet above the level of the sea. Japa is distant about 100 miles from San Diego, a little south of east. The road diverges from the Yuma Stage road, about sixty miles from this city, and from that point there is a continuous ascent into the mountains. The first diggings were struck at the point known as "Japa," but better placers were found at "Tres Pinos," three miles distant, and the entire population is now concentrated at the latter point. There is a smal running stream at Japa, and dirt has been hauled thither to be washed, but the expense of hauling takes the bulk of the profits. These mines are as near to Julian City as to San Diego. They are forty miles southeast of Milquatay, and forty miles north of San Rafael, in Lower California. A large gulch runs through the mining section, and into this *debouche* several smaller gulches. In these latter the gold is found. In the big gulch, wells have been sunk to obtain water for washing in the rockers. The gold-bearing soil is red sand and gravel. The whole face of the country is covered with decomposed quartz, but no gold bearing quartz has yet been found. Preparations are being made for a more extended exploration of the country. There are two men in the camp who were with a surveying expedition into the section inhabited by the Cocopah Indians. One of the Cocopah chiefs was lately in camp and said there was plenty of gold quartz in his country, but that the white men must keep out of there. The Governor of the frontier, Villagana, was at the mines recently and said that the troops would soon be sent into the Cocopah country to remove the Indians, (who number about five hundred), when prospecting could go forward without danger. Mr. Nichols thinks that for the next two years, industrious men can earn fair wages at these placers. All the washing must be done by rockers, as there is not water enough to run sluices or toms. The water is hoisted from wells. Two men are required for each rocker, one to hoist water and one to rock and feed dirt. The Mexicans are making from one dollar to a dollar and a half a day by their process of working. The Americans have made reservoirs on the small gulches, and are now waiting for more rain to give water for washing. It costs $1.50 per load to haul dirt two or three miles to water. The best diggings in the whole of that section have been found on the *mesa* three or four miles above the gulches. Four men have taken up claims there, and have a bed of red sand four feet in depth to operate upon. They have sunk a well, and have obtained four feet of water at a depth of fourteen feet; this gives them all they want to wash. A prospect shaft was sunk at Tres Pinos to the bed rock, which was reached in twenty-two feet, when large boulders were struck; on the bed rock a prospect of two or three cents to the pan was obtained. The water came in so fast that operations were abandoned. In the small gulches, when the bed rock is reached, small crevices are found full of a very tenacious grayish-colored clay, and these crevices are always rich—real "pockets." Beyond these "pockets," the average of the diggings would be from one to three dollars a day to the man. The country is well wooded, pine predominating. Game is plenty, deer being abundant and venison cheap. Beef is also very cheap, selling at eight cents a pound. There are three stores at the camp, and another is going up. Louis Bronson came into camp on Tuesday night from Julian, which place he left on Monday last, 15th inst. He passed through three feet of snow in some places. He reported that several mines had caved badly. There are now about twenty Americans and one hundred Mexicans at the mines. The weather is very cold. The late storm continued in that section during ten days. On one day over three inches of snow fell. It freezes every night to the depth of half an inch to an inch in large bodies of water and from one to two inches in thickness in a bucket. The people live in brush huts.

THE PANAMINT MINES.

From the *Havilah Miner*:

So little is known respecting the Panamint mines, their location, mode of reaching them, or their immense extent and richness, that the writer, one of the discoverers of the district, offers the following to interest your readers. Panamint district is situated nearly due east from Langunita, P. O., and stage station on the Owens River road from Havilah, distant from Langunita 60 miles, and from Los Angeles 215 miles; from Independence, the county seat, say 100 miles. It was formerly known as the Telescope district, in 1861 and 1862, and is a lofty, bold range of mountains, lying between Panamint and Death Valleys—the main peak called "Chiombe" in the native vernacular, rises to the probable altitude of 12,000 feet. The point of export and import for the mines will be Los Angeles, until the Southern Pacific Railroad has climbed Tehatchepa range and crossed the present Owens River road. Inside of sixty days there will be a good wagon road diverging from the present main Owens River road at Desert Springs, and thence by the old Slate Range road, it will pass west of the large borax deposits, and crossing the low divide at the head of the valley by a recently discovered pass, it will reach within three miles of the mines, when more formidable difficulties will be met with in Surprise Canyon. These will soon be surmounted, however, by a toll road, the company for which is now in course of formation, and the Panamint mines will have a good wagon road by the opening of spring, and the borax companies at Slate Range and Desert Spring marshes a good means of export for their borax. But little work has been accomplished during the summer just past, except a vigorous prospect of the district, the result of which has been the discovery and location of over 160 claims, and building by the miners of suitable winter quarters and roads to the mines. Now, however, vigorous work has been commenced by the owners, on the "Steward's Wonder" claim, and by the Wyoming Company, by tunnel mining on the lodes. Both the lodes mentioned above are considered first class, the ores assaying from $200 to $1,500 per ton, and averaging from 5 to 15 feet wide. A 15 foot shaft has been sunk on the Esperanza, and developed a very rich stratum of ore about 18 inches wide, which probably will pay $600 or $700 per ton. The Steward's Wonder claim changed hands a few days ago at the figure of $20,000, without a pick having penetrated it six inches. Mr. A. P. Raines and partner, of San Francisco, are the purchasers, being men who mean business now, and a mill in the spring. Nature has, in the Panamint District, saved the great expense and labor of prospecting by the usual slow and toilsome process of sinking shafts and running tunnels; a deep canyon from 400 to 600 feet in depth, with an almost perpendicular wall, bisecting at right angles these wonderful silver leads for many miles. The miner can stand at the bottom of the canyon and see his mine as well and clearly defined, as well as its body of carrying ore, for 500 feet in depth (from the top where it is cut by the canyon) as he could if he had a shaft to that depth on his mine. No mining expert has yet visited this mining district (and there have been many sent by mining speculators) who has not expressed wonder and astonishment at the immense amount of silver ore in sight; and several who have mined for years in the State of Nevada, have expressed that Panamint is certain in a few years, to eclipse, in the amount of silver yield per annum the famous Comstock lode of that State.