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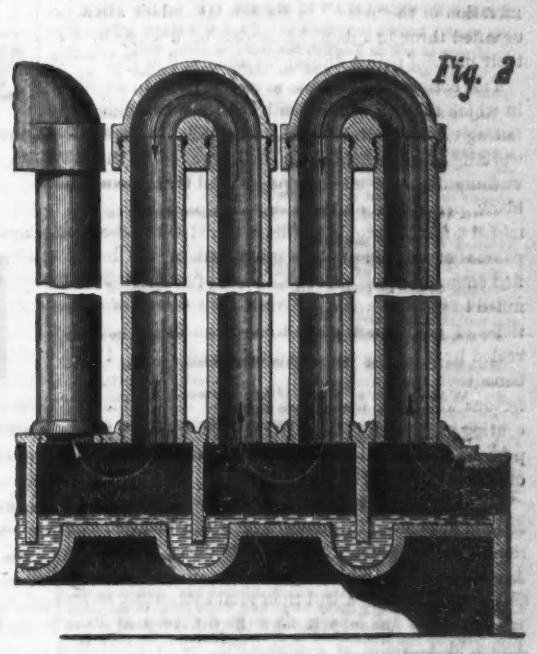
Carr's Vertical Tube Radiator.

WHEN U tubes are set in a straight pipe or main, through which steam or any similar gas flows it is evident that there is no immediate replacement of the air by the gas in the vertical tubes; for the steam flowing through the main cannot rise into the upright tubes except by the slowly acting force of diffusion. Radiation and diffusion will sooner or later raise the uprights to an elevated temperature, but this process is necessarily hastened by any device that causes the steam to flow through the pipes instead of being merely diffused through them. This Mr. A. CARR accomplishes by placing diaphragms in the main pipe in such a way as to form a dividing wall between the legs of each U shaped tube. By this means the main pipe is divided into a number of chambers which have no communication except through the upright tubes and these in consequence receive at once the full effect of the steam. The diaphragms do not, however, completely close the main tube, but the bottom of the latter is formed into small cup-shaped depressions, as shown in the section, Fig. 2. In these the water of condensation gathers, forming a close joint and offering at the same time a reservoir for the condensed steam which finally escapes through the discharge pipe.

Fig. 1

Fig. 2



CARR'S VERTICAL TUBE RADIATOR.

Mr. CARR, who is the manufacturer of the Selden Steam Pump, informs us that he is about supplying the New Brunswick Water Works with one of his pumps. It will have a 36 inch steam cylinder, 22 inch plunger, and 6 feet stroke. The contract time for delivery is November 1, and the price $15,000. Mr. CARR's address is 43 Cortlandt street, New York.

Granulated Pig for the Danks Furnace.

What appears to be an important improvement in the manipulation of the Danks furnace has been made in England. It is to granulate the pig iron, the granulation being effected in the same machine which granulates slag at the Tees Iron Works, and which is the invention of Mr. WOOD. One of the greatest drawbacks to the success of the Danks puddler has been the cost of melting the iron when the charge consists of pigs. The pigs are charged on, say 1 ton at a time, and lay like a dead mass upon the bottom, impenetrable to the heat. These cannot without difficulty be turned over without damaging the lining of the furnace, and also, containing a large quantity of silica, the damage to the fettling and puddling process is very great. To overcome this, cupolas have been erected for supplying the Danks with *molten* iron; but this is expensive, in addition to the inconvenience of having molten iron moving about the works. This granulated iron, made by running the iron direct from the blast furnace by Mr. WOOD's system will, it is hoped, overcome all the difficulties, and also supply a better quality of iron, free from silica, and enable the puddling machine to rotate as soon as charged, and thus expose the whole surface of the iron to heat, while the metal, being in such small pieces, will melt in a very short time. Mr. DANKS, who has seen the iron produced, quite approves of the system, and believes it will effect a saving of six to eight shillings per ton.

Studies in the Metallurgy of Gold.

By WM. MAIN, JR., Columbia, S. C.

Among the multiplicity of contrivances for securing gold by amalgamation, the gold particles themselves have been insufficiently studied. In the roasting of auriferous sulphurets a more critical and intelligent use of the pan and microscope would have taught experimenters lessons which would have saved much useless expenditure.

The idea was but too common that ore need only be "thoroughly desulphurized" in order to leave the gold free to amalgamate. The failures of innumerable patent roasting furnaces have convinced gold-mining communities that something more than mere desulphurization is needed; that the gold is not left "bright," or is not economically secured by the most elaborate grinding and amalgamating arrangements. To gain any clear idea of this subject, we must consider closely chemical changes which take place in nature, and in the operation of roasting.

While it is doubtless true that gold, like many other metals, has, under some conditions, the power of absorbing certain gases, it is not necessary to resort to this explanation to account for most, if not all, of the phenomena observed in practical metallurgy. The student of chemical geology need not be reminded of the slow but certain action produced on many silicates by surface water containing carbonic acid, nor of the more rapid effect of heated waters rising from great depths.

Water which has, among other things, taken iron into solution, will, by the absorption of oxygen, tend continually to deposit it as peroxide. At every iron spring this precipitate forms an adherent coating on objects immersed in the

water.—A similar precipitate takes place when iron solutions soak through porous rocks or gravelly deposits, or run in fissures and crevices. It would be singular if gold particles exposed to such action escaped altogether untarnished, and it can therefore be a matter of no surprise that "rusty" gold should be formed by natural agencies and be, as it is, a source of considerable loss to miners and millmen.

It is, however, commonly supposed that if gold is at all rusty it will appear more or less brown or reddish in color.

It frequently happens in the laboratory that solutions of iron salts that have been allowed to stand for some time in clean glass vessels, will deposit over the entire surface of the glass a uniform film of exceeding thinness and transparency. A coating formed in this way will be strong enough to resist ordinary washing and yet may be so very thin that it can only be seen in certain positions in a good light. Such a coating would be entirely invisible on the surface of a yellow metal, more particularly if the metal were in minute rounded particles.

We already find in nature gold particles coated with iron oxide in all degrees, from those which are so completely covered as to be detected only by their behaviour in the pan, to those whose color differs but slightly from that of pure gold. This being the case, it would be strange if some particles were not coated with still thinner films, like those we may produce artificially in the laboratory.

Under the artificial conditions of a roasting furnace rusty gold is formed in two ways: first, by the action of *sulphides* of iron; second, by the decomposition of *sulphate* of iron.

It is well known that iron pyrites, if heated suddenly before a portion of the sulphur has been expelled, will become softened or fused, producing a "clotting" or caking in the calcining furnace. Minute particles of gold are chemically acted upon at this temperature by the sulphide of iron with which they are inclosed, or in contact. The gold and iron sulphide are soldered together, and no amount of subsequent roasting, however completely it may remove the sulphur, will leave the gold with a bright surface. Inexperienced students of chemistry who have heated metallic sulphides too strongly in platinum crucibles may have occasion to remember their action on a metal less easily affected than gold. Individual particles of ore may be fused or softened without causing an agglomeration of the mass. This will take place when finely pulverized ore is blown or sifted through a flame or current of hot gases. Fine particles are raised to their melting points almost instantly and as quickly cooled.

This action took place to a large extent in an arrangement, used at one time, in which the ore was driven by a blast through the flame of a small wood fire, falling on an inclined plane immediately beyond. Although in the ordinary working of this machine the ore, scorched in this way, did not stick together, a washing dish and microscope showed that a considerable part of it consisted of black, perfectly round and shot-like particles. The last residue in the pan contained a few clean gold particles mixed with others on which could be seen black patches of sulphide. The great bulk of the heavy residue consisted of grains fine enough to pass through a sieve of 80 meshes to the linear inch. When magnified to the appearance of buck shot many of these were seen to contain particles of gold which peeped out from their black surfaces, while others only revealed by crushing the metal they contained. Particles in this state could not be benefitted, for amalgamating purposes, by prolonged roasting. The coating of ferrous sulphide would be changed into a more porous but equally adherent coating of sesquioxide. In fact, the whole "process," both theoretically and practically, yielded no better results than can be obtained by any amalgamation of equally well pulverized raw ore.

This way of working may be taken as an example of the effects of extremely sudden heat, even in presence of a considerable excess of oxygen. Many other roasting arrangements produced an effect that was practically but little different. A somewhat less sudden application of heat will oxidize the outside of the particle of pyrites, which will then retain its shape, or at least not present an external appearance of fusion, although the interior may be in a melted or softened state. Any gold particles it contains will be so affected as to remain rusty however thorough may be the final expulsion of sulphur. The small particle passes through stages similar to those seen in lumps which have been roasted in a heap.

This action takes place largely when auriferous sulphurets are roasted in revolving cylinders heated by a current of gases passing through the center. The sides of the cylinder are much cooler than the gases which pass through it, and this difference is greatest at the beginning of the operation. The pulverized ore is carried up by shelves or similar contrivances, and, as the cylinder revolves, it sifts down through the hot current from the fire-box, being suddenly heated and again cooled as it reaches the lower side of the cylinder. If the fire is properly managed particles are at first partially oxidized (Fe_3O_4) on the outside, while the inside is still a combination of sulphur and iron. The heat may be high enough to soften the more sulphurous inside while the oxidation of the outside prevents adhesion.

A revolving cylinder, while it promotes uniform oxidation and prevents caking, is especially calculated to overheat the particles when they are carried up in the manner described. The heat generated by the oxidation of the particle itself in addition to that of the furnace is almost certain to produce this effect. In this way the minute specks of gold enclosed in larger pyritous particles, constituting in some ores the greater part of the precious metal, are so acted on by the heated sulphide as to leave them at the end of the operation in a hopelessly rusty condition. Such very small rusty particles are not secured by ordinary skill in panning, and even if they were, are certain to be overlooked unless patient examination is made with the microscope.

The continual rolling action of a cylinder has a compacting effect on the roasting grains of pyrites leaving them finally, even though thoroughly roasted, with a hard granular appearance like sand or gunpowder. A slow roasting with minimum disturbance allows the natural swelling of the ore to leave it in a more porous and friable condition. It may be considered as practicably impossible, where the products of combustion come in direct contact with the ore, to regulate the heat with such nicety that there will be no combining or tarnishing action of the metallic sulphides on the gold. Particles of the coarser gold may be seen so covered with iron oxide that they can with difficulty be recognized. When this is the case with a portion of the coarse gold, it may be considered as certain that nearly the whole of the very fine gold which mostly escapes the pan, is in the same condition.

We will suppose, however, that the roasting process has been conducted in such an apparatus, or with such good fortune, that none of the gold, however fine, has been acted on in this way. Experiment and observation will show another source of loss if amalgamation is to be used.

During the roasting of pyrites sulphate of iron is formed in considerable quantities; as the heat rises and oxidation continues various basic ferric sulphates are formed ending finally with the total expulsion of sulphuric acid from its combination with iron, leaving the latter as a sesquioxide. The iron sulphate pervades the whole mass of roasting ore not in particles or small crystals, but with perfect uniformity, as much so as if it moistened the ore in a state of solution. As the heat rises, peroxide of iron is uniformly deposited in the pores and on the surface of each particle of the charge.

It has already been shown that remarkably thin coatings of iron oxide may be formed in the wet way, and nothing would be more likely than that similar coatings should be formed by similar decompositions of iron salts in the furnace.

It is, of course, difficult, sometimes impossible, to reproduce on a small scale chemical actions which will progress and result in exactly the same manner as those which take place when large quantities are operated upon. Close observation of working results is the best criterion, yet it is easily found by experiment that oxide of iron formed by calcining the sulphate in contact with gold has a strong tendency to adhere to the metal.

In examining the gold particles in a charge that has been roasted in a common calcining furnace we will find some with corroded surfaces and so heavily coated with firmly adhering iron oxide that prolonged boiling with hydrochloric acid is needed to give them anything like a metallic appearance. Other particles have more or less of a reddish look, though with smooth surfaces, some of them being so slightly colored that it is barely noticeable, others still have the color of fine gold but persistently refuse to amalgamate. In examining some ore rich in very fine gold which had been roasted in a revolving iron cylinder heated from the outside I noticed among the gold particles obtained by panning some which were irregular in shape and apparently lighter than others of equal size. These would not amalgamate with clean mercury even in presence of chemicals which usually assist that action. Under the microscope these particles were seen to consist of many smaller ones, presenting, when strongly magnified, the appearance of coarse gold dust with the grains irregularly stuck together. Here was evidently a thin coating which did not affect the color in a manner perceptible to the naked eye. The heat of the roasting cylinder was so low as to exclude the idea of metallic fusion. Theory and experience unite in telling us that it is impossible by simple roasting to leave gold in an untarnished condition. Whether heat and air act fast or slowly, metallic sulphides in most cases, and iron sulphate in all cases, will leave a large proportion of rusty gold. The result will be the same into whatever form of patent "desulphurizer" brick, iron and mortar may be put together. It remains to be considered whether mechanical means *after* the roasting, or chemical action either *during* or *after* the roasting, can be used to remove the rusty coating.

The iron pan in some one of its many improved forms, is the most efficient grinding machine that can be used. If the visible gold is rusted to any extent it must be remembered that this action has affected still more the impalpably fine gold which the prospecting pan fails to show, and that the grinding, to act upon this portion of the gold, must reduce the whole bulk of the ore as well as most of the coarser gold to a state of flour-like fineness. In this mechanical reduction chemical changes are unavoidable, no matter how carefully the ore may have been previously leached. The tendency of all such changes is to form a galvanic deposit of base metals upon the gold particles, and in this condition they are less readily absorbed by quicksilver. The progress of this action may be seen by washing samples taken from the pulp while the pan is in motion.

The amalgamation of gold in pans presents greater obstacles to high percentage results than are encountered in the treatment of silver ores. A given amount of loss in weight represents a sixteen fold greater loss in value. Greater attention must be paid to the purity of the quicksilver, as the amalgamation of gold is more injuriously affected by the presence of base metals than is the case with silver. In the amalgamation of a single pan charge, even where ore is well roasted and leached, sufficient base metal will be absorbed to materially lower the affinity of quicksilver for gold. It cannot be a matter of surprise that the results of pan amalgamation applied to roasted auriferous pyrites have been uniformly unfavorable.

The grinding of raw surface ores containing *coarse* rusty gold has a favorable effect by the scouring action independently of the mechanical comminution of

the gangue. In treating roasted ore the case is very different. The useful effect of grinding or rubbing is confined to the disintegration of the soft and friable particles of sesquioxide of iron which may contain specks of gold. These specks should be liberated in a bright and clean condition; if, however, there is an adhesion of the iron oxide to the metallic surfaces of these minute particles, grinding will be of little use as it must then be carried to an extent that, in addition to the expense, will cause great mechanical and chemical obstacles to amalgamation.

(TO BE CONTINUED.)

Reaping Trials at Vienna.

THE great expectations originally created by the liberal programme prepared by the Committee of the Agricultural Department at the Vienna Exhibition have been doomed to disappointment. The determination at which the English makers had arrived, to decline entering into competition, entirely ended all chances of any valuable trials, and the only part of the programme which has been even partially carried out are the reaping and mowing trials at Siebenbrunn, which took place on Wednesday, the 9th inst. Of course, English implements were entirely absent; and, with the exception of a few German "improved" copies, the reapers and mowers on the ground were American. Altogether there were eighteen reapers ready for competition, single and combined; sixteen mowing machines, including nine of the combined implements, were tried. The site selected was upon the estate of a local proprietor, Herr Schwartz, at Siebenbrunn, about twenty miles from Vienna; and the ground, which was good and almost level throughout, improved from the stations occupied by No. 1 machine to the lots numbered 15 to 18, that lay on the opposite side of a small stream which divided the ground. Everything was so consistently favorable, that the operations scarcely constituted a trial at all; the weather was dry and hot, the crop allotted to the reapers was a thin growth of rye, every stalk of which was set bolt upright in the field, whilst the mowers operated upon a mixture of peas, grass, oats, &c., which might have sprung from an autumn sweeping of a barn floor, and, though close lying, was soft and moist in the stalk. An acre and fourtenth of each crop were allotted to the reapers and mowers, the lots being of course divided by clearings made for the implements to take their first cut.

As we have said, eighteen reapers were entered for trial, but only seventeen competed, the missing one being the chain-rake reaper, manufactured by WALTER A. WOOD, of Hoosick Falls, New York. Of the German implements, one was an "improved" Samuelson, by Messrs. HOPHERR & Co., of Vienna; and two by Messrs. SIEDERSLEBEN & Co., of Bernburg, Anhalt; one of these machines was also an improved Samuelson, and the other, in which were combined selections from details of the leading English makers, broke down from some cause or another.

The American manufacturers were admirably represented, and their presence at Vienna in such force shows how successfully they compete with English makers, especially in the corn-growing districts of east Europe.

As we shall devote considerable space to a description of the agricultural implements exhibited at the Vienna Exhibition, it is not necessary to enter here into any detailed notice of the different reapers, mowers, or combined implements experimented with, the other day, at Siebenbrunn. It will be sufficient for the present briefly to review the list of competitors. One of the striking features of the American implements is the Johnston rake, of which many different varieties are used, the leading principle of course being the same in all, namely, the means of controlling the action of the rakes, and causing them in each revolution to follow the platform closely, and so clear off the grain continuously, or to throw one or more rakes up after they have passed the cutters, and then allow the grain to accumulate upon the platform till a sheaf of the desired size is obtained.

In most of the competing implements, the same general features presented themselves, namely, the revolving rakes, or rake and reel, and the side delivery, leaving a clear track for the horses. There was only one exception in this latter point, found in the "Excelsior" of the J. F. SEIBERLING Company, Akron, Ohio, which delivers straight behind itself, and involves the necessity of field hands to follow up the machine, and bind the sheaves as fast as they are cut. There being no rake, the driver has to clear the platform by lowering it as soon as he considers the sheaf is of sufficient size. Whilst this implement appears but ill-adapted even for such light work as it had to do the other day, it would, we should imagine, be altogether unfit to cut heavy or laid crops.

An ingenious arrangement of throwing off was exhibited by Messrs. AULTMAN, MILLAR & Co., of Akron, Ohio. This is a Buckeye implement, with a circular throwing-off table mounted upon the platform, and carrying a short vertical rake; the table receives a slow rotary motion, and the grain, which is received upon the front of the platform, is swept round by the rake and table, and delivered at the side. The performance of this implement at the trial was fair, and the sheaves were deposited sometimes exceedingly well, at others in a very straggling style, so that even with such a light standing crop, the action was uncertain, and would probably be entirely unreliable under unfavorable circumstances. The last of the exceptional deliveries to be named is the chain rake implement of Messrs. W. A. WOOD, of Hoosick Falls, New York. In this implement one short rake is employed, which is attached at one end to a chain running entirely round the platform, and hinged at the other end to the frame of the implement, there being an intermediate hinged joint in the arm of the rake to give it the necessary motion by which it is swept over the table constantly and slowly, but at a uniform rate, so that the sheaves delivered are of uniform size. The Johnston Harvester Company, of Brockport, New York, who are doing a very large business in Russia, were represented by two implements, a reaper and a combined machine. This is, to our mind, the most useful implement that competed, although, where the shades of difference are so fine, it is difficult to draw a clear distinction, especially after so poor a trial. This Johnston implement, however, has horizontal gearing throughout, and is actuated with a bevel pinion from the highest point of the bevelled driving wheel; by this arrangement the gearing is far less liable to become clogged; a vertical instead of a horizontal crank is used for driving the cutter bar, and an under as well as an upper bearing is given it, so that considerable steadiness is secured. The arrangement for throwing up the rakes is also extremely ingenious and practical. The Buckeye combined implement of ADRIANCE, PLATT, & Co., New York, is an excellent one, and shows good work, with high ingenuity in design. The Champion of WARDER, MITCHELL, & Co., of Springfield, Ohio, also fitted with the Johnston rake, is full of good details and excellent workmanship; this implement was sold on the ground to Prince SCHWARZENBERG. Wood's New Champion, from the makers of the chain rake, also did good work. It is a well-designed, well-made implement, with four rakes coupled togther in pairs, and which can be arranged at will to be thrown out of gear in pairs. The rakes are mounted on a revolving bonnet, which is driven by gearing, and beneath which is a fixed cam, against which the end rollers of the rakes take their bearing and direction. The MACCORMICK implement was on the field, and worked well, but the pattern, so long and so deservedly celebrated, now looks very antique when compared with many of the later patterns.

Of the German competitors but little is to be said; HOPHERR's copy of Samuelson's reaper made fair time on the ground, but it was very heavy, and open to the objection common to the type of implement, that there is no seat for the driver, who must therefore walk—a very wearying operation. Neither do the Siedersleben implements call for any special remark.

The chief points upon which the jury were to decide concerning the merits of the implements were, the time occupied, the length of stubble, and the throwing off of the sheaves. As we have already said, the conditions under which the reapers, and equally the mowers, were tried, were such as to make a proper comparison of merit quite impossible, but it was evident, with the exception of the German Samuelson, which being a copy, could scarcely be considered in the decision, that the trial, such as it was, was purely American. Of these implements we should, judging from the performance, place that of the Johnston Harvester Company first, the Wood New Champion second, and the Warder, Mitchell, and Company's Champion, and Buckeye (Adriance, Platt and Company), third and fourth.

The mowing trial may be dismissed in a few words. There were altogether sixteen competitors, of which seven were simple mowers, and nine combined machines. Of the whole number there appeared little doubt that Wood's so-called combined, but really single, mower did the best work. The question was discussed how great an alteration in the combined implements to render them suitable for mowers should be admitted, as practically the whole of the working parts may be shifted so as to obtain the higher speed suitable for cutting grass. Why there should be any objection to this, provided the manufacturer and purchaser can agree upon the price of the implement, we do not know, but the fact is an illustration of the objections which exist against the use of combined machines. No good reaper can be converted into a good mower, unless all the parts are changed, and this must add materially to the cost of the machine. Of course it is a temptation to the farmer, especially to the small holders, to be able to purchase a so-called combined machine at a much lower cost than that of two separate implements, but this saving in first outlay is the only apparant advantage gained. On the other hand are the disadvantages of greater weight when used as a reaper, of inferior utility both for mowing and reaping, and of a less desirable and more easily damaged implement. The life of a good reaper is about ten years, that of an average mower six or seven, and the duration of the combined implement must be taken at the shorter period. The price of a reaper is about 32*l.*, of a mower 20*l.*, and of a combined machine 35*l.*, so that the actual total cost is but little greater whether two separate implements be purchased or only one combined. The farmer, with a combined machine, must let one kind of crop stand until the other is finished; often a source of inconvenience and loss, his expenses are naturally increased with the delay in getting in his crops, and the danger of their being damaged is greater. Moreover, the chances of the implement being damaged or rendered imperfect in the hands of the laborer, who has to change it from a mower to a reaper, or *vice versa*, are considerable, and a loss of this kind would of itself soon counterbalance the comparatively small saving in cost. Manufacturers are almost without exception opposed to the combined machine, and nothing but a spirit of false economy maintains the demand, which, however, must gradually decrease.

Returning for a moment to the trials at Siebenbrunn, we learn from them, incomplete and imperfect as they are, that German manufacturers will have to make great changes before they can compete with the American trade. How far this can compare with English productions, the absence of the latter from the trial prevents us from forming any conclusion.—*Engineering.*

The Removal of Furnace Slag.

AMONG the novelties to be seen at the Lucy furnace, Pittsburgh, is a very simple and practical machine for cooling slag, invented by Mr. ANDREW KLOMAN, one of the proprietors. Its object is merely to cool the slag quickly, in blocks of convenient size for removal, thereby saving both time and labor. It consists of an annular water trough, with supply and waste pipes, in which, by suitable ap-

pliances, a series of cinder boxes are caused to rotate, so that they may be brought successively under the slag spout. The boxes taper slightly toward the bottom, so as to admit of the easy withdrawal of the slag cakes when sufficiently cool. On the bottom of each box is placed an iron wedge, with a broad flat head, upon which it stands upright, and with a hole in the taper end by which it may be lifted out. The slag runs in around these wedges, which stand up in the middle of the boxes and project for some inches above the upper crust. Around, under, and between the boxes water flows continuously, and their inner surfaces are kept so cool that in a few minutes the slag is sufficiently solid to be removed in carts. The transfer is effected by means of a small hydraulic crane. The hook at the end of the chain is fastened in the hole in the taper end of the wedge, and the cake is lifted out of the box and deposited on the floor of a cart, which has a square hole in its bottom to facilitate the recovery of the wedge. The slag cake is so placed that the head of the wedge comes over the hole, and a smart blow with a hammer causes it to drop out upon the ground. The cake is then carried off and dumped. In construction and operation this machine is perfectly simple, and it may be worked so rapidly as to dispose of slag as fast as it can be run in from a spout. There are seventeen cinder boxes, and by the time the last has been filled the slag cake in the first is ready to be lifted out and removed. The proprietors of the Lucy furnace consider it altogether the cheapest and best method of disposing of the cinder they have ever tried, and we have no hesitation in pronouncing it the most practical device of its kind we have ever seen in use.

The Temperatures which Man can Endure.

THE English Commissioners who fixed upon 4000 feet as the lowest depth at which coal mines can be considered workable, were led to this conclusion by a consideration of the extremest heat which man can safely labor in, and the increasing temperature of the earth as it is penetrated. The temperature of the blood is about 98 degs. Fahr., above which limit is the condition of fever, and this latter reaches its maximum at about 112 degs. Labor can take place at heats even higher than this in very dry air, on account of the evaporation from the body which cools it. Considering the fact that coal mines are not among the dry variety, they concluded that calculations could not safely be based upon a higher temperature than the natural blood heat. They took the rather high rate of one degree of increase for every 60 feet of depth, starting from a depth of 50 feet from the surface where the temperature is, in England, constant at 50 degs. in all seasons. With this as a starting point they say :

"The depth at which the temperature of the earth would amount to 98 degs., would be about 3000 ft. Under the Longwall system of working, a difference of about 7 degs. appears to exist between the temperature of the air and of the strata at the working faces ; and this difference represents a further depth of 420 feet, so that the depth at which the temperature of the air would, under present conditions, become equal to the heat of the blood would be about 3420 ft. Beyond this point the considerations affecting increase of depth become so speculative, that the Committee must leave the question in uncertainty ; but they consider that it may be fairly assumed that a depth of about 4000 ft. could be reached."

A writer in the British *Journal of Science*, however, takes exception to this conclusion, and adduces some facts in relation to the heats which the human frame can bear which are worth noting. We will give them in numerical order.

1. Laborers in metallurgical works are subjected to heats far above those which scientific investigators have fixed as the extreme limit of endurance when vigorous labor is necessary. Workers at iron furnaces, for instance, puddlers, Bessemer converter-men, and others, remain and work in air which is at a very high temperature, and they are further subjected to the radiation from the intensely hot furnaces. The writer says : "During the hottest days of the summer of 1868, I was engaged in making some experiments in the re-heating of furnaces at Sir JOHN BROWN and Co.'s works, Sheffield, and carried a thermometer about with me, which I suspended in various places where the men were working. At the place where I was chiefly engaged (a corner between two sets of furnaces), the thermometer, suspended in a position where it was not affected by direct radiations from the open furnaces, stood at 120 degs. while the furnace doors were shut. The *radiant* heat to which the men themselves were exposed while making their greatest efforts in placing and removing the piles, was far higher than this, but I cannot state it, not having placed the thermometer in the position of the men. In one of the Bessemer pits the thermometer reached 140 degs., and men worked there at a kind of labor demanding great muscular effort. It is true that during this same week the puddlers were compelled to leave their work ; but the tremendous amount of concentrated exertion demanded of the puddler in front of a furnace, which, during the time of removing the balls, radiates a degree of heat quite sufficient to roast a sirloin of beef if placed in the position of the puddler's hands, is beyond comparison with that which would be demanded of a collier working even at a depth giving a theoretical rock temperature of 212 degs." [We can add the testimony of Mr. HOWE of Troy, given at the last meeting of the American Institute of Mining Engineers, who said that in the Bessemer Works he had measured a temperature, with men at work five minutes at a time, of 255 degs,, and men were at work for 15 or 20 seconds at a temperature of 327 degs.]

2. In some of the operations of glass-making, the ordinary summer working temperature is considerably above 100 degs., and the radiant heat to which the workmen are subjected far exceeds 212 degs. This is the case during a "pot-setting," and in the ordinary work of flashing crown glass.

3. Mr. TYNDALL the proprietor of some Turkish Baths in England, testifies that his shampooers work four or five hours at a time in a *moist* atmosphere, at temperatures ranging from 105 to 110 degs. He has worked 20 hours in one day in a room where the thermometer was above 110 degs., and once shampooed for half an hour at 185 degs. He further says : "At the enamel works, in Pimlico, belonging to Mr. MACKENZIE, men work daily in a heat of over 300 degs. I painted my skylights, taking me about four hours, at a temperature of about 145 degs.; also the hottest room skylights, which took me one hour, coming out at intervals for a cooler, at a temperature of 180 degs. I may add in conclusion, that a man can work well in a moist temperature of 110 degs. if he perspires freely."

5. On the Red Sea Steamers the temperature of the Stoke-hole is 145 deg., and at this temperature some men will work half an hour without a drop of perspiration on them, while others are carried out fainting.

Here, then, are examples of continuous work at 110 degs., 120 degs., 140 degs. and 145 degs. These correspond to depths of 3650 ft., 4250 ft., 5450 ft., and 5750 ft. The 185 degs. at which Mr. TYNDALL shampooed in a *moist* atmosphere, correspond to 8150 ft. The question now is, can the conditions be so controlled as to enable men to work at these depths? The author, whose conclusions we are quoting, leaves out of consideration the radiation from the walls of the mine, for the reason that it cannot possibly compare with that from a puddling furnace for instance. If dry air and plenty of it can be supplied, he thinks the problem is solved. First of all, he says, it must be noted that very deep mines are usually dry ; and there is good reason to believe that, before reaching the Commissioners' limit of 4000 ft., dry mining would be the common, and at and below 4000 ft. the universal case. He would cool the deep workings by running in water from the upper measures, and a moderate use of this means might be possible. It could, however, be only a restricted source of cooling, for the *sine qua non* of the problem is dry air.

From these considerations our author concludes that the Coal Commissioners could safely have fixed their limit of depth much below 4000 ft. He says : "Given a sufficiently high price for coal at the pit's mouth to pay wages and supply the necessary fixed capital, I see no insuperable difficulty, so far as mere temperature is concerned, in working coal at double the depth of the Royal Commissioners' limit of possibility. At such a depth of 8000 ft. the theoretical rock-temperature is 183 degs. By the means above indicated, I have no doubt that this could be reduced to an *air* temperature below 110 degs.—that at which Mr. TYNDALL's shampooers ordinarily work. Of course the newly-exposed face of the coal would have its initial temperature of 183 degs.; but this is a trivial heat compared to the red-hot radiant surfaces to which puddlers, shinglers, glassmakers, etc., are commonly exposed." We should add that he does not present these views as applicable to the present day, but to some future period when coal will be so scarce as to bear any expense for getting.

The question, though largely speculative, is not without interest. At the meeting of our Mining Engineers' Institute before referred to, Prof. ROCKWELL spoke of a Cornish mine visited by him, the temperature of which was 120 degs., the levels being about 105—106 degs. The men worked almost naked, and only for about fifteen minutes at a time. This unusual temperature was due to decomposition of minerals in the rock. Parts of the Comstock lode bear a temperature as high as 128 degs., the cause here being hot springs. Of course the atmosphere is very moist and the work is very exhausting. This is perhaps one of the best known cases of work in a very hot mine, and we will quote from the remarks of the President :

"This was in a blind drift, run for an air connection ; the great heat was not the ordinary temperature of the mine. The heat rapidly declined after the air connection was established, and some degree of ventilation was obtained, although very imperfectly. The men who were obliged to carry forward that drift were supplied with air by a tin pipe, through which it was forced by a fan. The result was, that at the working face of the drift the air was not so bad as elsewhere. It was very hot, because there was a good deal of radiated heat ; but if you put your face within six or eight inches of the pipe, you could get cool air, while a few feet off the air was banked up, and when you got half way into it you met a volume of heated air coming out like a flood, driven out by the fresh air. It was almost intolerable, not so much to the skin as to the lungs. The men worked in that temperature a very few minutes at a time. They were naked, or nearly so, and ran into the drift and worked at the end of it until overpowered. Old hands did not really faint away, but new hands frequently did. They took men that had been in the mine a good while, and promoted them by degrees to the hottest place. They perspired enormously, and I presume the perspiration weakened them as much as work. They would rush out of this drift into the main drift outside, where there was more air, and there, after sometimes washing themselves, and especially wiping off the perspiration, they remained a short time—not long enough to be chilled—before returning to work. I think the lower stopes generally had a temperature near 90 degs. The trouble to me in the stopes was not the heat, but the foulness of the air, from animal exhalation and candle smoke."

This subject is one which deserves to be followed up, not so much in the way of speculation, but by recording instances of hot mines. What is desired is not the temperature at which some one thinks men can work, but the temperature which they really do bear successfully.

THE COAL TRADE.

NEW YORK, August 14, 1873.

There is nothing new in the anthracite trade, which continues to enjoy a brisk demand. The great attention called to the trade by the comments of the eastern press under the leadership of the New York daily papers, undoubtedly helps this demand and awakens private purchasers to the advisability of taking their winter coal now. In this way the papers have really done the country a service in lessening the risk of an oversharp demand in the Fall.

Bituminous.

But, while the anthracite men are pursuing their way in the consciousness that their hard pinch is over, the bituminous trade was never flatter than now. There is absolutely nothing doing. Prices cannot be quoted, for there are no sales, and were dealers to go down to the lowest possible point they would hardly catch a customer. It is natural for the trade to be dull at this season, but it is undeniably much duller now than the usual exigencies of the season warrant. All the avenues of consumption seem to be choked up. Industrial branches have been dull all the year and now manufacturers are taking advantage of the general inactivity to close their works altogether. It is a golden time for repairs, and in many towns agreements have been entered into by rival makers to shut down for a fortnight or a month. This has been done so much as to seriously affect the demand from the railways which are running much less freight than usual. It has also been a general subject of remark by the residents along the railroads leading out of New York that the passenger trains are remarkably small for the season. There seem to be fewer travellers. This falling off in passenger and freight traffic makes a decided difference in the amount of coal burned. Finally, the great steamship lines are bringing hardly any freight to this country. Their ships come here in ballast or bring coal for ballast. Railroads and steamships draw their business from so many sources that it is rare to see their demand fall off so decidedly. They have become standard customers of the most persistent kind and their present inactivity cuts into the foundations of the bituminous trade. Add to these elements the overselling of the market, which took place in the spring, and we have reasons enough why soft coal should not be in demand.

The failure of the demand in each of these various quarters reacts upon others so that the dullness is an increasing one, and trade in soft coal is fairly at a standstill, while anthracite is going steadily upward on a market which, while it supports the monthly increase, contains no elements that press for it. Bituminous coal is within 15 cents of the lowest it has ever reached. Certainly it is a good time to buy. The fall trade will necessarily be brisk, prices will then be stiff, and the rising tide in the anthracite business is more than likely to produce high water in its sister trade.

Anthracite Coal Trade for 1872 and 1873.

The following table exhibits the quantity of Anthracite Coal passing over the following routes of transportation for the week ending, 1873, August 9, compared with the week ending August 10, 1872.

COMPANIES.	1872. WEEK.	1872. TOTAL.	1873. WEEK.	1873. TOTAL.
Phila & Reading R.R†	106,017	2,831,157	119,516	2,139,874
Schuylkill Canal	22,214	487,174	16,779	402,089
Lehigh Valley R. R.	59,513	2,098 5-8	74,106	2,146 918
Lehigh & Sus. R. R.	35,773	1,011,263	55,146	1,170,268
" " Canal	22 723	410 715	12,394	3 6 061
Scranton North	15 544	424,972	26,740	515,306
" South	41,344	1,316 880	27,137	1,310,382
Penn. Coal Co., rail	28,263	706,733	26,676	724,363
" " canal	217	3,235	119	4 476
Del. & Hud C.Co. Canal	43,681	773 778	46,227	783,345
" " East	8,033	345,940	9 8 4	237,754
" " West	8 7 1	23 ,611	12,976	3 2,612
" " South	7,648	222,968	1,485	131,920
Shamokin	11,534	32 ,537	14,464	365,381
Tiewrton	....	....	....	....
Lykens Valley Coal Co.	....	....	....	....
Wyoming North	....	....	....	....
Wyoming South	....	....	....	....
P. N. Y. C. & R. R. Co.	13,252	336,974	17,311	451,765
Williamstown Col'y	....	....	....	....
Big Lick Col	....	....	....	....
Total	424 417	11,577,534	4 9 910	12,(50,397
1872			424,417	11,577,534
Increase			38 493	472,863
Decrease				

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

† Less coal transported for Company's use and Bituminous coal.

Pennsylvania Coal Company.

Shipments of Pittston Coal for the week ending August 9, 1873.

	1873. WEEK.	1873. YEAR.	1873. WEEK.	1873. YEAR.
By Railway	26 6 5 18	724 363 02	28,298 17	706,732 17
" Canal	119 06	4,575 11	237 03	3,235 09
	26,775 03	728,938 13	28,506 00	706,968 06
Increase, 1873	18,970 07			

Bituminous Coal Trade, 1872 and 1873.

The following table exhibits the quantity of Bituminous Coal passing over the following routes of Transportation for the week ending August 9, 1873, compared with week ending August 10, 1872.

COMPANIES.	1872. Week.	1872. Year.	1873 Week.	1873 Year.
C. & O. Canal	17,994	369,513	15 711	372,735
B. & O. R. R.	24,360	756,524	32,112	858,975
Penn. S. Line	....	.....	1,342	49,179
H. & B. T. R. R.	5,8 2	174 496	7,754	263,242
*Harrisburg & D.	7,004	295,353	5,407	212,178
*L. V. R. R.	267	19 005	640	19,530
P. & N.Y.C. & R. Co.	6,701	234,814	5,655	198,887
Cumberl'd Branch Canal.	6,583	124,061	4,645	72,560
" Railroad	674	11,515	644	57,706
Total	68,925	1,985,761	73 910	2,105,042
			68,925	1,985,781
Decrease				
Increase	....		4,985	119,221

Report of Coal Transported over Lehigh Valley Railroad

Report of coal tonnage for the week ending August 9, 1873, with Totals to date, compared with same time last year.

WHERE SHIPPED FROM.	WEEK. Tons. Cwt.	TOTAL. Tons. Cwt.
Total Wyoming	16,408 14	56 ,898 03
" Hazleton	48,463 09	1,410,619 17
" Upper Lehigh		2,099 09
" Beaver Meadow	14,420 18	436 607 04
" Mahanoy	12,641 14	344,418 02
" Mauch Chunk	60 11	2 4 2 15
Total	91,995 06	2,736 125 10
Same time last year	82 810 13	2,633,650 03
Increase	9,184 13	102,474 17
Decrease	.....	.....
Forwarded East from Mauch Chunk by rail	74,106 07	2,176 918 05
Same time last year	59,543 13	2,098,598 10
Increase		38,319 15
Decrease	14,562 14	

DISTRIBUTED AS FOLLOWS.

Local East of Mauch Chunk	1,386 09	50,917 15
Forwarded East for use L. V. R.	85 17	26,291 15
Delivered to Furnaces and Manufacturing Companies	13,379 15	470,848 13
Delivered to Cat & Fog R. R.	143 19	4,09 1 0
" " East Penn R. R.	79 08	6,489 08
" " North Pennsylvania Railroad	7,007 03	214 2 6 10
" " Port Del.	7 428 03	114,774 19
" " East' Amboy Railroad		
" " Morris and Essex Railroad	5,793 03	193,367 01
" " Bel Del Railroad	25 971 19	667 269 13
" " Central Railroad	12,0 0 03	378,742 06
Delivered at and above Mauch Chunk for use of L. V. R.R.	764 09	46 483 18
To P. & N. Y. R. R.	12,7 4 0	3 3,725 17
To North'n Central R. R.	642 09	11,174 13
To D. H. & W. R. R.	751 16	23 115 15
To L. & S. R. R. at Packerton for rail	569 07	9,1 8 18
To Individuals at Mauch Chunk	10 06	1 8 9 15
To Individuals above Mauch Chunk	175 10	9 7 9 01
To L &S.R.R., at Penn Hav., for railroad		1 541 10
Do for canal	1,262 06	105 168 10
To Lehigh Canal Mauch Chunk	927 14	40,749 10
To Catawissa Railroad		50 00
To L. & B. R.R. at Lack. June	29 01	49 9 9 18
Total	91,995 06	2,736,125 10

Penn. and N. Y. R. R.—Coxton, Pa.

Coal tonnage for week ending August 9, 1873.

	Week. Tons. Cwt.	Total. Tons. Cwt.
Anthracite received:		
From Lehigh Valley R. R.	12 754 02	300,525 17
" Lack. & B. R. R.	1,557 17	20,133 05
" Pleasant Valley R. R.	2,465 06	106,877 00
" Sul. & Erie R. R.	583 08	23 029 10
Total	17,360 13	450,764 12
Same time last year	13,251 18	396,973 15
Increase	4,108 15	53,790 17
Decrease		
Distributed:		
To Lehigh Valley R. R.		23,568 01
To Lack. & B. R. R.	53 17	954 05
To S. Central R. R.	2,960 17	97,844 01
To Ithaca & A. R. R.	4,192 02	88,127 04
To Erie R. W. Pockets for shipm't.	8,302 13	161,920 07
To Erie R illway, Watkins direct.	573 12	4,913 13
To individuals on line of road	285 17	18,662 14
To points at & above Coxton for use of Co.	629 18	13,201 19
To points between Waverley and Elmira	361 17	36 532 08
Total	17,360 13	450,764 12
Bituminous received from BARCLAY R. R.		
Shipped north from Towanda	5,800 10	197,3 4 08
Shipped south from Towanda	142 19	1,469 06
Northern Central R. R.	11 10	103 04
Total	5,654 19	198,883 18
Same time last year	6,700 11	234 814 00
Increase	1,045 12	
Decrease		35,927 02
Distributed:		
To Erie Railway	5,482 07	177,33 19
To So. Central R. R	18 03	19,585 06
To Ithaca Valley R. R.	.....	351 06
Lehigh Valley, R. R.	105 19	704 15
To individuals on line of Railroad.	48 10	795 03
To points on line of road for use of Company	....	118 04
Total	5,654 13	198,886 18
Grand totals transported		
Anthracite	17,360 13	450,764 12
Bituminous	5,654 19	198,886 18
Total	23,015 12	649,651 10
Same time last year	19,952 09	631,787 15
Increase	3,063 03	17,863 15
Decrease	.....	

Philadelphia & Reading Railroad and Branches.

COAL TONNAGE

For the Week ending Saturday, August 9, 1873.

BY RAILROAD.—ANTHRACITE.

PASSING OVER MAIN LINE AND LEB. VAL. BRANCH.

	Tons. Cwt.
From St. Clair	31,826 10
" Port Carbon	8,811 10
" Pottsville	814 06
" Schuylkill Haven	30,368 09
" Pine Grove	6,449 07
" Tamaqua	12,702 19
" Harrisburg	....
" Dauphin	7,720 19
Total	92,890 09

FOR SHIPMENT BY CANAL.

Passing Frackville Scales	5 005 05
" Mill Creek "	1,613 15
" Schuylkill Valley Scales	237 15
" Mt. Carbon "	1,104 08
" Oreasona "	7,945 05
" Pine Grove "	362 11
" Tamaqua "	2,161 03
Total	18,187 17

SHIPPED WESTWARD VIA CATAWISSA AND WILLIAMSPORT BRANCH AND NORTHERN CENTRAL RAILROAD.

Via Catawissa & Williamsport Br.	325 04
" N. C. R. R. passing Locust Gap	2,915 10
" " " Shamokin	5,532 00
" " " Herndon	....
Total	8,773 04

SHIPPED WEST OR SOUTH FROM PINE GROVE.

Via Schuylkill & Susquehanna R. R.	1,332 11
" Lebanon & Pine Grove Branch	1,274 11
Total	2,607 03

CONSUMED ON LATERALS.

From Frackville Scales	994 17
" Mill Creek "	94 01
" Schuylkill Valley Scales	1,023 18
" Mt. Carbon "	549 01
" Oreasona "	290 13
" Pine Grove "	28 15
" Tamaqua "	104 14
Total	3,794 19

LEHIGH AND WYOMING COAL.

Received via Silverbrook Junction, Sent East	10,579 08
Cat. & Wpt. Br. Sent West	....
" " Rupert, Cat. & Wpt. Br.	....
" " Allentown, R. Penn'a Br.	19 08
" " Alburtis, "	....
" " Oreland, G. & N. Br.	932 13
" " Willow Street R. R.	506 16
Total	11,050 19

BITUMINOUS.

From Harrisburg	5,457 10
" Connecting R. R., G. & N. Br.	....
" Junction R. R.	....
Total	5,457 10

COAL FOR COMPANY'S USE.

Anthracite	7,784 17
Bituminous	249 01
Total	7,033 19

RECAPITULATION.

	Total for Week.	Corres-p'g week last year.	Increase and Decrease.
Passing over Main Line and Leh. Val. Branch	92,890 02	92,027 07	I 862 15
For Shipment by Canal	19,157 17	21,243 02	d 2,085 05
Shipped Westward via Northern Central R. R.	8,773 02	8,030 06	I 743 13
Shipped West or South from Pine Grove	2,607 02	2,167 06	I 443 16
Consumed on Laterals	3 3 4 19	2,685 14	I 8 9 05
Lehigh and Wyoming Coal	11,050 19	1,2 1 08	I 10 6 9 12
Total Anthracite paying freig't	1 8,674 01	127,240 19	I 1,4 3 05
Bituminous	5 6 7 10	7,,04 08	d 1,396 18
Total of all kinds paying freig't	144,081 11	134,245 07	I 9,836 04
Coal for Company's use	7 603 18	5,481 15	I 2,122 03
Total Tonnage for Week	151,685 09	1 9,727 02	I 11,9 8 07
Previously this year	3899 48 07	3 53421 04	I 145 8 7 13
Total to date	4051434 16	393,149 06	I 156,285 10

SHIPPED BY CANAL.

From Schuylkill Haven	14,449 00	15,816 00	d 1,367 00
" Port Clinton	2,330 00	1,589 00	I 741 00
Total Tonnage per Week	16,779 00	21,405 00	d 4,6 6 00
Previously this year	385 310 00	464,262 05	d 78,952 05
Total to date	402,089 00	485,667 05	d 83,578 05

Delaware and Hudson Canal Company.

Coal mined and forwarded by the Delaware and Hudson Canal Company for the week ending Saturday, August 9, 1873.

	WEEK.	SEASON.
By Delaware and Hudson Canal	46,227	783,345
By Railroad, East	9,824	237,754
" West	12,976	302,612
" South	1,485	131,920
Total 1873	70,462	1,456,631
Corresponding time in 1872:		
By Delaware and Hudson Canal	43,681	788,777
By Railroad, East	8,033	346,960
" West	8,701	280,601
" South	7,648	222,963
Total	67 963	1,676,306
Decrease	120,675	

Delaware Lackawanna & Western Rail Road Company.

Coal transported on the Delaware, Lackawanna, & Western Railroad for the week ending Saturday, August 9, 1873.

	WEEK. Tons. Cwt.	YEAR. Tons. Cwt.
Shipped North	26,730 09	515 306 07
Shipped South	27,137 10	1,311,392 00
	53,867 19	
Total		1,826,698 07
For the Corresponding time last Year:		
Shipped North	15,544 04	422,971 14
Shipped South	41,348 10	1,306,879 15
Total	56,892 14	1,729,851 09
Increase	.....	96,836 18
Decrease	3,024 15	

Report of Coal Transported over the Lehigh Canal

For the week ending August 9, 1873.

REGIONS SHIPPED FROM	TIDE. tons. ct.	LOCAL tons, ct.	TL WEEK tons cwt.	TL. DATE tons, cwt.
Mauch Chunk Region	1,143 00	3,989 18	5,131 18	117,663 19
Mauch Chunk Region Hazardville		8 3 11	329 11	10,0 8 00
Beaver Meadow Region	475 19	2,565 19	3,041 18	64,840 05
Mahanoy Region		532 09	532 09	11,789 01
Hazleton Region	199 14	1,069 12	1,262 01	105,368 16
Upper Lehigh Region		449 15	449 15	15,093 02
Wyoming Region	251 16	598 01	1,146 17	51,059 12
Wyoming Region, Hazardville				738 03
Total	2 362 09	10,031 05	12,393 14	376,060 17
Previously reported	132814 06	229852 17	362,667 03	
Total to date	135176 15	240884 02	376,060 17	
Corresponding week last year	157163 12	253551 13	410,715 05	
Increase				
Decrease	21,986 17	12,667 11	34,654 08	

DISTRIBUTION.	WEEK 1873.	WEEK 1872.	YEAR. 1873.	YEAR. 1872.
Consumed on line of Lehigh Canal	3,686 03	2,124 13	29,783 10	40,308 01
Passed into Morris Canal to Tidal Points	411 14	65 02	1,959 10	2,981 10
Passed into Morris Canal to Local Points	1,807 00	795 06	15,085 00	12,158 15
Passed into Del. & Rar. Canal to Tidal Points	1,960 15	7,026 19	133,417 05	154,182 02
Passed into Del & Rar. Canal to L cal Points		574 17	6,452 02	8,725 00
Consumed on line Delaware Div. Canal	1,452 09	1,975 17	21,763 01	28,528 08
Passed through to Bristol	3 087 13	10,130 15	167,180 09	165,831 09
	12,303 14	22,7.3 09	376,060 17	410,715 05

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

Week ending August 9—Compared with same time last year

REGION SHIPPED FROM.	TIDE. tons ct.	LOCAL. tons ct.	CANAL. tons ct.	TL WEEK tons cwt.	TL. DATE tons, cwt.
Wyoming	29097 05	8287 02	1681 09	39065 16	1060128 18
Upper Lehigh		4113 01	732 14	5145 15	114587 07
Beaver Meadow	7412 10	2811 05	3145 16	13390 11	166010 00
Hazleton		769 15	1262 06	2032 01	112412 13
Mauch Chunk	4709 08	4855 10	742 08	10.76 14	323076 16
Total	41219 03	20846 03	14485 11	76310 17	1,780955 14
Prev'ly reported	04175 17	982 51 10	3145 7 10	1704644 17	
Total to date	845395 00	606797 13	328763 01	17909 5 14	
Same time .1872	716586 05	501154 14	282650 15	1480.91 14	
Increase	128808 15	105642 19	66112 06	300364 00	
Decrease					

DISTRIBUTION.	WEEK 1873.	WEEK 1872.	YEAR 1873	YEAR 1872.
Forwarded East by Rail to Tidal points	41219 03	27255 17	845395 00	716586 05
Forwarded East by Rail to Local points	11392 13	10775 15	263019 13	242469 18
Forwarded East by Rail use Central Division	2306 19	1528 02	54532 01	46975 02
Forwarded East by Rail use L. & B.	267 07	213 05	7321 07	5231 17
Delivered all and above Mauch Chunk	1791 13	1091 10	46901 17	3274 16
Delivered at Coalport & Hazard for Canal	14472 08	18413 15	362850 04	294618 01
Delivered to L. V. R. R. at Packerton	441 06	235 09	15284 16	8721 03
Delivered to L. V. R. Rd. at Sugar Notch	1415 11		61410 13	
Delivered to L. & B. R. R.at Plymouth Bridge	2973 19	4708 04	123940 03	133040 12
Total	76310 17	60285 17	1780955 14	148 331 14

Statement of Coal Transported over Cumberland and Pennsylvania Railroad

During the Week ending Saturday August 9. and during the year 1873, compared with the corresponding period of 1872.

WEEK.

	C. & O. C'l Tons. Cwt	B. & O. R. R. Tons. Cwt.	Pa. S. Line Tons. Cwt.	Total. Tons. Cwt.
1873	15,711 01	22,111 16	1,342 09	49,165 06
1872	17,938 13	24 350 14	....	42,299 07
Increase		7,761 02	1,342 09	6,865 13
Decrease	2,227 12	....	....	

YEAR.

1873	372,734 09	858,974 16	49,178 11	1,280,887 16
1872	339,512 11	756,524 06	....	1,126,036 17
Increase	3,221 18	122,450 10	49,178 11	154,850 19
Decrease	....	....	....	....

Cumberland Branch R. R.

WEEK.

	To C. & O. Canal. Tons. Cwt.	To B. & O. R. R. Co. Tons. Cwt.	Total. Tons. Cwt.
1873	4,644 13	644 06	5,284 19
1872	6,583 08	673 15	7,257 03
Increase			
Decrease	1,938 15	29 09	1,968 04

YEAR.

1873	72 560 09	57,706 05	130,267 13
1872	124,061 06	11,514 14	135,576 00
Increase		46,191 11	
Decrease	51,500 18		5,309 07

Northern Central Railway, Shamokin Division.

Below is the return of Coal sent over the Shamokin Division of the N. C. R. W., for the 7 days ending August 9, 1873.

		Tons. Cwt.
East	125 18	
West	14,338 09	
		14,464 07
Same time last year		11,534 02
Increase		
Decrease		2,930 04
Total amount shipped to date		363,163 11
Same time last year		325,513 16
Increase		37,602 15
Decrease		

Delaware and Hudson Canal Company.

Coal mined and forwarded by the Delaware and Hudson Canal Company for the week ending Saturday, August 9, 1873.

	WEEK.	SEASON.
North	52,527 07	1,589,108 03
South	1,435 08	131,920 09
Total 1873	53,962 15	1,721,028 12
Corresponding time in 1872 :		
North	46,584 15	1,554,919 13
South	7,647 15	222,967 15
Total. 1872	54,232 10	1,777,887 08
Increase North	5,942 12	34,188 10
Decrease North		
Increase South		
Decrease South	6,212 07	91,017 06
Increase		
Decrease	269 15	56,758 16

Prices of Coal by the Cargo.

(CORRECTED WEEKLY.)

	AT NEW YORK R. A.	AT NEW YORK W. A	AT PHILADELPHIA. R. A.	AT PHILADELPHIA. W. A.
SCHUYLKILL.				
Lump	— —	$5 45	— —	4 10
Steamer	— —	5 45	— —	4 10
Broken	5 70	5 45	4 35	4 10
Egg	5 85	5 60	4 50	4 25
Stove	6 05	5 75	4 70	4 40
Chestnut	5 20	5 95	3 85	3 60
Pea	— —	— —	— —	— —
LEHIGH.				
Freight to New York 50 cents.			— —	— —
Lump, (on board)	— —	— —	— —	— —
Broken	— —	— —	— —	— —
Egg	— —	— —	— —	— —
Stove	— —	— —	— —	— —
Chestnut	— —	— —	— —	— —
Pea	— —	— —		
SPECIAL COALS *				
Honey Brook, Le'h W. A.	4 85@5 55		— —	— —
Spring Mountain " "	5 00@— —		— —	— —
Sugar Loaf " "	4 90@5 70		— —	— —
Room Run " "	4 70@5 55		— —	— —
Hill & Harris " "	4 70@5 60		— —	— —
Shamokin " "	4 70@5 60		— —	— —
Lykens Valley " "	4 85@6 10		— —	— —
Broad Top " "	6 00@— 10		5 85	— —

Company Coals.

August, 1873.

	L.	Bkr.	Grs.	Egg.	Sto.	Chest
*Scranton at E. Port	— —	— —	— —	— —	— —	— —
†Pittston at Newburgh	5 00	5 00	5 10	5 20	5 50	5 00
†Lackawana at Rondout	5 95	5 15	5 25	5 20	5 60	5 00
Wilk'b're at Pt. John's	4 85	4 95	5 05	5 20	5 40	4 85
Old Co. Lehigh at Pt. John's	5 80	—	5 85	5 85	5 70	5 00
New York Coal Exchange	5 65	—	5 50	5 50	5 65	4 95

For freights to different points see "Freights"
*To contractors only.

Prices at Baltimore—August, 1873.

Wholesale Prices to Trade.

Wilkesbarre, by cargo or car load	$5 50@5 75
Pittston and Plymouth, do	5 35@5 50
Shamokin Red or White Ash, do	5 35@5 75
*Lykens Valley Red Ash, do	@6 00
By retail, all kinds per ton of 2,240 lbs	7 00@8 00
*George's Creek and Cumberland f. o. b. at Locust Point for cargoes	4 85@5 00
West Va. and Youghigheny gas f. o. b. at L. Point	6 50
Kanawha Cannel, coarse	@12 00

*Freight to New York $2 15.

BITUMINOUS COALS.

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

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

August, 1873.

George's Creek and Cumberland f. o. b. for shipping $4 65@4 75

Prices at Havre de Grace, Md.

August, 1873.

Wilkesbarre and other White Ash for Cargoes	$5 00@5 25
Lykens Valley	5 25@5 50
Shamokin Red or White Ash	5 75@6 00

Bituminous Coals (Cumberland).

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

Prices of Foreign Coals.

August, 1873.

Duty 75 c. per ton.

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

Liverpool Gas Caking	— —@— —
" " Cannel	17 00@— —
" House "	20 00@22 00
" Orrel	20 00@— —

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

PRICES FROM YARD.

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

Per ton 2,000 lbs. delivered.

Prices of Gas Coals.

August, 1873.

PROVINCIAL.

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

	Coarse	Slack
Block House, f. o. b. at Cow Bay	$2 50	$1 25
Gowrie	2 00	0 00

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

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

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

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

AT PHILADELPHIA.

Westmoreland "	7 50 @8 00

Rates of Transportation to Tide Water.

BY RAILROAD.

TO PORT RICHMOND, PHILADELPHIA.

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

MAUCH CHUNK TO ELIZABETHPORT.

L. V. Railroad from Mauch Chunk to Phillipsburgh	$0 72
C. R. R., N. J., Phillipsburgh to Elizabethport	63
Shipping expenses at Elizabethport	35
Wharfage	10
Total	$2 23

MAUCH CHUNK TO PORT JOHNSTON.

L. V. R. R., or L. & S. R. R. from M. C. to Phillipsb'g	$0 72
C. R. R., of N. J., Phillipsburgh to Pt. Johnson	1 06
Shipping expenses	15
Wharfage	10
Total	$2 23

TO HOBOKEN

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

TO SOUTH AMBOY.

L. V. R. R.	
S. & D. R. R.	$1
Cam. & Am R. R.	
Shipping Expenses	35
Total	$2 23

PENN HAVEN TO ELIZABETHPORT.

L. V. R R. Penn Haven to Phillipsburgh	54
C. RR. of N. J. Phillipsburgh to Elizabethport	1 06
Shipping expenses	15
Wharfage	20
Total	$2 35

Freights.—August, 1873

TO EASTERN PORTS.	Cumberland. From Georgetown.	Cumberland. From Baltimore	Anthracite. From Philad'a.	Anthracite. From Kingston, Port Johnston, Weehawken, and Hoboken.	Anthracite. From Newburgh.	Anthracite. From Boston...
Amesbury	3 75	—			—	—
Bangor	3 25	—		1 75	—	2 90
Bath	3 00	3 00		—	—	—
Boston	2 90	3 00		1 85*	2 25	1 95
Bridgeport	2 40	2 50		1 00	—	1 25
Bristol				1 25	—	1 45
Cohasset Nar'ows	3 10	—		—	—	—
Derby	3 00	—		1 45†	—	—
Dighton	2 6.	—		—	—	—
East Cambridge	2 75	—		—	2 25	—
Fall River	2 50	3 00		1 25	1 80	1 45
Hackensack		—		—	—	—
Hartford	3 00	3 25		1 80	—	1 70
Hoboken	2 0.	—		50	—	65
Jersey City	2 05	—		50	—	60
Lynn	—	—		—	—	—
Middletown	—	—		1 25	—	1 45
Mystic	—	—		1 25	—	—
New Bedford	2 60	2 85		1 30	—	1 55
Newburyport	3 25	3 25		2 00	—	2 10
New Haven	2 50	2 50		1 00	1 20	1 25
New London	2 80	2 60		1 15	1 40	1 45
Newport	2 60	—		1 25	1 60	1 45
New York	2 25	2 15		50	—	—
Norwalk	2 57	2 60		1 00	—	—
Norwich	2 60	2 60		1 20	1 80	1 60
Pawtucket	1 50	2 87		1 35‡	—*	—
Portland	2 95	3 00		1 60	—	—
Portsmouth, N. H	3 15	3 25		1 90	—	—
Providence	2 40	2 60		1 25	1 60	1 45
Rockport	—	—		1 95	—	—
Saco	—	—		—	—	—
Sag Harbor	—	—		1 15	—	—
Salem	3 20	3 00		1 85	—	—
Stamford	—	—		1 00	1 20	1 25
Stonington	—	—		1 20	—	—
Taunton	—	—		1 65	—	—
Warren	—	—		1 35	—	—
TO RIVER PORTS						
Albany	2 50					55
Catskill	—					50
Cocksackie	—					50
Coeyman's	—					65
Cold Spring	—					20
Fishkill	—					20
Haverstraw	—					40
Hudson	2 40					65
New York vessels	2 00					45
Nyack	—					50
Poughkeepsie	2 40					50
Rhinebeck	—					—
Rondout	—					40
Saugerties	—					50
Sing Sing	—					35
Stuyvesant	—					50
Tarrytown	—					40
Troy	—					20
West Point	—					50
Youkers	—					

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

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

Foreign and Provincial Freight

August, 1873.

Foreign.

Newcastle and Ports on Tyne, per keel of 21 1-5 tons 2
Liverpool, 5 per cent primage

TO NEW YORK.

Provincial

Sydney	
Lingan	$3 5
Cow Bay	4 00
Port Caledonia	4 00
Little Glace Bay	4 00

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

MARKET REVIEW.

NEW YORK, Aug 13, 1873.

IRON.—Scotch Pig is without further movement; prices show no improvement, and there is but little doing, except to meet the light wants of the Trade; the present prices ruling here have caused larger shipments to be made from the other side than for some time previous, and we hear that Glengarnock is being offered for sale to arrive to a considerable extent; the shipments we believe are composed principally of this brand; we have no sales to report. American Pig tends to buyers' favor; $45 is now about the outside figure for No. 1 brands, excepting some occasional brands, deliveries of which are still behind hand; stocks in the meantime are accumulating, and with a light demand, holders are more anxious to sell, and prices tend downward; 200 tons No. 2 X sold at full prices; we quote No. 1 $44@45, No. 2 X $40@$42, and Gray Forge $33@$34. Rails are quiet since the sales noted in our last. Scrap is steady; stocks are not large, and with little on the way, holders look for better figures; sales are reported of 350 tons No. 1 Wrought, at $47.50; and 50 do., $45, three months, interest added. Refined Bar from store, is dull, and rather nominal at our quotations.

LEAD.—Pig is steady, with a moderate demand, mostly for small parcels; sales have been made of 300 tons, in lots, at 6¼@6¾ cents for Ordinary Foreign and 6¼ for Domestic, all gold. Bar 9½ cents, Sheet and Pipe 10½, and Tin-lined Pipe 16½, all less ten per cent to the Trade.

Withdrawals from bond for consumption 8th, 9th and 11th August—

Lead, Germany ..... pigs 4,302

COPPER.—New Sheathing is still quoted 38 cents, and Bolts and Braziers 40, and Bronze and Yellow Metal Sheathing 27, and Y. M. Bolts 32, net cash. Ingot remains quiet, but prices are unchanged; the transactions embrace 150,000 lb. Lake, at 27@27¼ cents; for forward delivery, 28 cents is still the quotation.

REGULUS ANTIMONY.—We note sales of a few casks at 13½ cents gold.

SPELTER.—Silesian is dull; nominal price 7¼@7¼ cents, gold.

STEEL.—Continues steady at old prices, with a good demand.

TIN.—The demand for Pig is still very limited, but holders are generally firm at 31½ cents gold for Straits and 29 for English on the spot; 10 tons English, half to arrive, sold at 28¾ cents; and 5 do. to arrive, August shipment, 28½ gold. A Singapore telegram, under date of 9th inst., quotes Tin $34,62½ per picul. Plates are dull and rather depressed; sales have been made of 800 bxs. Charcoal Tin, good brands, $11a11.12½; 500 Charcoal Terne, $10.12½; and250 do. Coke Terne, $8.75, all gold.

ZINC.—We note a sale of 100 casks Mosselmann for arrival the agent's price is still ten cents, less four per cent gold. American oxide dry 8½@9; Metallic 10¼@10½; Manganese black oxide crude 4; do. powd. 5.

METALS.

NEW YORK, August 13, 1873.

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

	Store Price.	
Pig, Scotch—Coltness ₩ ton	51 50	@52 00
Gartsherrie	47 75	@48 00
Glengarnock	48 00	@— —
Eglinton	45 00	@— —
Pig, American, No. 1	44 00	@45 00
Pig, American, No. 2	40 00	@42 00
Pig, American, Forge	33 00	@34 00
Bar Refined, English and American	— —	@— —
Bar Swedes, assorted sizes gold	— —	@137 50

	Store Prices, Cash.	
Bar, Swedes, 1¾ to 5 x ⅜ & ⅞ 2 sq. & 6 to 12 x ⅜ & ½	175 00	@180 00
Bar, Refined, ¾ to 2 in. rd. & sq. 1 to 6 in. x ⅜ to 1 in.	92 50	@— —
Bar, Refined, 1¼ to 6 by ¼	97 50	@— —
Bar, Refined, 2½ to 2⅞ round 1 & 1¼ by ¼ & 5-16	1 00 00	@— —
Large Rounds	104 50	@117 50
Scroll	112 50	@145 00
Ovals and half-round	120 00	@140 00
Band	110 00	@112 50
Horse Shoe	120 00	@122 50
Rods, ⅜ to 2-16 inch	97 50	@140 00
Hoop	120 00	@137 00
Nailrod	9¼	@ 9½
Sheet, Russia, as to assortment (gold)	17	@ 18
Sheet, Singles, D. and T. Common	—5¾	@— 7
Sheet, D. and T. Charcoal	—7	@— 8¼
Sheet, Galv'd, flat 10 per cent, discount	— —	@— —
Rails, English (gold), ₩ ton	66 00	@ 70 00
Rails, American, at Works in Pennsylvania, currency	77 50	@— —

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

	All Cash.	
Copper, New Sheathing, ₩ lb	—	@— 38
Copper Bolts	—	@— 40
Copper Braziers, 16oz. and over	—	@— 40
Copper Nails	—	@— 45
Copper, Old Sheathing, &c. mixed lots	26	@— 27
Copper, Old, for chemical purposes, 14@16 oz.	—	@— —
Copper, American Ingot	27	@ —27¼
Copper English Pig	—	@— —
Yellow Metal, New Sheathing & Bronze	—	@— 27
Yellow Metal Bolts	—	@— 32
Yellow Metal Nails, Sheathing and Slat'g	27	@— 30

LEAD.—Duty: Pig, $2 ₩ 100 lbs.; old Lead, 1½ cents ₩ lb Pipe and Sheet, 2¾ cents ₩ lb.

Spanish (gold)	6 50	@6 62½
German, do.	6 50	@6 62½
English do.	6 62½	@7 00
Domestic do.	6 00	@— —
Foreign, Refined	7 25	@— —
Bar (net)	9 25	@ —
Pipe (net)	— —	@10 50
Sheet	— —	@10 50

STEEL.—Duty: Bars and ingots, valued at 7 cents ₩ lb or under 2¼ cents; over 7 cents and not above 11, 3 cents ₩ lb; over 11 cents, 3½ cents ₩ lb, and 10 ₩ cent ad val. Store prices.

English Cast (2d and 1st quality) ₩ lb	— 18½	@— 23
English Spring (2d and 1st quality)	— 9½	@— 10½
English Blister (2d and 1st quality)	— 14	@— 18½
English Machinery	— 14½	@— —
English German (2d an 1st quality)	— 12½	@— 14½
American Blister "Black Diamond"	— —	@— 11½
American, Cast, Tool do.	— —	@— 17
American, Spring, do.	— —	@— 11
American Machinery do.	— 11½	@— 12
American German, do	— 9	@— —

TIN.—Duty: Pig, Bars, and Blocks, 15 ₩ cent. ad val.; Plate and Sheets and Terne Plates, 25 ₩ cent.; Roofing 45, ad val.

	Gold ₩ lb.	
Banca	35	@—
Straits	31½	@32
English	29	@30

PLATES.

Fair to Good Brands.	Gold.	Currency	
I. C. Charcoal, ₩ box	$11 00	@11 25	$13 00 @13 25
I. C. Coke	8 75	@ 9 25	10 50 @11 00
Coke Terne	8 00	@ 8 75	9 50 @10 25
Charcoal Terne	9 75	@10 50	11 50 @12 00

SPELTER—Duty: In Pigs, Bars & Plates, $1.50 p. 100lb.

Plates, Foreign (gold) p. 100 lb.	7 37½	@7 62½
Plates, Domestic p lb.	8¾	@—11

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

Sheet per lb.	—10¾	@10¾

San Francisco Stock Market.

BY TELEGRAPH.

NEW YORK, Aug. 13, 1873.

The following report from the San Francisco Stock Board is dated the 12th inst. The market is very irregular, with light transactions; Yellow Jacket has advanced $9 per share since our last. Raymond & Ely is also $8 higher. The Crown Point Mining Company have declared a dividend of $4 per share, payable on the 12th of August.

			Aug. 12.
Savage	—	—	40
Crown Point	—	—	80
Yellow Jacket	—	—	51
Kentuck, "New Issue"	—	—	7¾
Chollar Potosi	—	—	38
Gould & Curry "New Issue"	—	—	12½
Belcher "New Issue"	—	—	08
Imperial	—	—	4¾
Raymond & Ely	—	—	72
Meadow Valley	—	—	21¾
Eureka G. V.	—	—	18 Bid.
Ophir	—	—	—
Hale and Nororosa	—	—	—

American Institute of Mining Engineers.

OFFICIAL BULLETIN.

Announcements to Members and Associates.

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

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

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

IV. General meetings are held on the fourth Tuesday of February, May and October. Authors of papers are requested to notify the Secretary, in advance of meetings, of the subject and length of their papers.

THOMAS M. DROWN, Secretary.

1123 Girard street, Philadelphia, Pa.

THE ENGINEERING AND MINING JOURNAL.

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

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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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THE SCIENTIFIC PUBLISHING COMPANY.

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P. O. Box 4404.

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IF English papers are to be trusted, the Welsh mines which have been so loudly cried up as superior to anything in the American market, are under a pretty thick cloud. *Iron* says: "Copper and tin may be dismissed with the brief remark that our worst anticipations have been realized by a farther reduction of the standards. Tin standards are now £22 below those of a year ago. A tremendous depreciation has taken place in mining property, and it is probable that many tin mines will shortly be closed.

THE introduction of pure water from mountain sources into Virginia City, Nevada, is an event of so much novelty in the history of mining towns that the citizens may fairly be allowed to celebrate the occasion jubilantly. Few mining towns raised by the restless population of the West have permanence enough, or opportunity, to introduce public water works, though there is probably no other class of towns built by white hands that so much needs them. When each man is a sovereign in his disregard of municipal regulations and his adherence to private rights, a reckless disposal of garbage and entire neglect of sanitary laws is almost certain to ensue. The healthful influences of even the most bracing mountain air, and of the clearest streams, are destroyed by foul odors and by the more fatal infiltration of refuse into the open running stream, the banks of which are necessarily chosen for the seat of the town. These great evils have been largely overcome in Virginia by a good police, because the town was rich enough to support one, and the introduction of good water ought to make the most important mining town in this country also its healthfullest city.

THE Paris School of Mines receives and analyses without charge mineral specimens of all kinds, from soils to metal works of art. In five years, from 1868 to 1872, the number of such analyses was 2916, or an average of 583 each year. A government can undertake a work like this but it is almost beyond the powers of a school maintained by receipts from private sources. The New York School of Mines had a similar practice when it began its existence, and many hundred specimens were received for gratuitous analysis. But in this country the 583 analyses made each year by the Paris School would represent a gift of not less than $20,000 to $30,000 dollars. The specimens received in New York were, to a great extent, totally uninteresting, and probably many of them were drawn from old collections and represented stones which some ignorant person had just enough curiosity about to secure an analysis of, when he could get it free. The attempt had to be given up, but it is one that we would like to see revived if it can be done under conditions that will secure really valuable results, and not suffer the work to become too onerous to the schools which undertake it.

THE letter of a correspondent in England, an extract from which we published last week, was dated in the latter part of June. The events of another month seem to bear out the views we have always expressed upon the future of the American iron industry. The trade report of *Iron*, from South Staffordshire, published in its issue of July 26, reads as follows: "Fuel still maintains its high price at the principal collieries of the district, but some of the smaller coal-masters, not in association, are selling at a reduction of 3s. to 4s per ton. Those by whom this concession is declared, experience a very fair demand; but where the maximum standard is persistently maintained, the business doing does not suffice to keep the colliers more than half occupied. The demand for ironstone is well sustained, and prices are firm. The iron trade of the district remains in a very languid and unsatisfactory state, no new transactions of any extent being recorded either in the pig or finished iron departments. Pigs, all mine, remain on the basis of £7 for hot, and £8 for cold blast, with proportionate rates for part mine and cinder. A few of the leading producers are trying to raise the standard for the best pig to £7 10s., seeing that the demand has not been benefitted by the late reduction, but it is unlikely that the effort will succeed, as any increase in the cost of producing finished iron would result in the closing of many of the mills and forges throughout the district. Bars remain on the standard of £14 for marked, the rate being proportionate for all other descriptions of finished iron. The current demand is very slack, and the intense heat of the weather is this week farther restricting operations at the works. In Sheffield some large firms are beginning to work half time, and our contemporary says, editorially: "The effect of a strong fuel market, and a general dullness in the iron trade, is to produce, among makers, a feeling of depression and downright apathy. They do not care whether their works stand still or go on. Birmingham is complaining bitterly of American competition, and at Sheffield the condition of the steel trade is peculiarly unsatisfactory. It would be vain to attribute the dullness of trade in these two great industrial centers entirely to high prices. Primarily, perhaps, high prices may have been the cause of the present depression, but the falling off in orders—in consequence of foreign competition, is exceedingly serious—in fact, it is difficult to do business in steel at all."

The Meaning of Steel.

METALLURGICAL writers have long been exercising their wits over the task of defining the word *steel*. In fact it has extraordinary difficulties. The definition must include a reference to the chemical composition of steel, that is, it must state that it is an alloy. This can be easily managed, but now comes the dilemma. There are varieties of iron possessing some of the qualities which have long been considered distinctive of steel, but which do not contain enough of any foreign element to warrant the reference of their especial qualities to the presence of that element. The very mild steels, "homogeneous metal," and cast-wrought-iron belong to this category, and it is tolerably well agreed that they owe their superiority to the fact that they are cast. There is no cinder in them, and no weld. To include them the definition must express the fact that they are cast. But although these metals possess some of the qualities of steel they do not possess all of them. They are free from lamination under pressure, or concussion, and they have an exceptional tenacity. But their ability to take a temper is either very low or altogether absent. In fact they have rivals which are not made by casting, but which present in very much higher degree that property which is distinctive of steel, as it has always been known, and which is not possessed by any other metal or combination of metals yet discovered—they have the power of taking a "temper." Puddled steel, though not homogeneous, though liable to lamination, containing slag and made up by welding, is a better temperer than cast-wrought-iron which has none of these defects. Shear steel is another case in point. It is welded, and any one acquainted with the uncertainty of the weld in steel knows that this fact presents a marked distinction between it and cast steel.

The definition of steel, which so long maintained itself, was given at a time when all steel was welded. The early methods of steel making consisted in such processes as cementing a bar of wrought iron by immersing it in a bath of cast iron; manufacture of steel in the German finery fire, whether from iron or from ores, or from both together; and similar processes, all of them demanding the operation of welding. When cementation of wrought iron by means of charcoal powder, and cementation of cast iron by means of quartz sand or oxides, were invented welding was not supplanted. Steel was sometimes cast, but it was ordinary welding steel remelted in a pot. It differed in no way from the ordinary steel except in possessing the distinctive features of steel in a superior degree.

The difficulty which now confronts the definition of a term which for many hundred years served its purpose without any confusion, arises not from the new methods of making steel but from the new requirements of that kind of metal. Formerly the ability to take a temper was undoubtedly the most valued characteristic of steel. Casting added strength to temper, but the cost of the operation confined the use of the product to small articles, and even these were of a kind in which temper was still the ruling consideration. In later times the methods for cheapening the manufacture of steel have so greatly widened the uses as to give unexpected prominence to those steels which owe their value to the fact that they are cast, and which hardly partake of the qualities that once exclusively governed the meaning of the word. They have no temper and they need none.

These common uses of steel so greatly exceed in importance the older and higher uses, as to give the leading position, in the estimation of manufacturers and engineers, to the untempered steels. But the definition steel still means that

alloy of iron which will temper, and the question is how to retain the one word steel and give it a definition that shall cover the whole ground. We take it that the definition must be simple, for if it requires a twenty line paragraph to define one word we had better find a new word for each clause in the definition.

It would hardly be mannerly to introduce a question which is puzzling so many brains, and do nothing to increase or diminish the general obscurity which prevails on the subject. It seems to us that the efforts which are making in so many quarters to describe the meaning of steel are based on an impossibilty. The qualities which are to be defined are opposite in their nature. The definition must show that steel means something that can be tempered and which cannot be tempered; that it is a cast and that it is a welded product; that it is homogeneous and that it is not homogeneous; that a certain proportion of carbon is necessary to it, and that all proportions of carbon below a certain limit will make steel. We are using no exaggeration. We have read a great many definitions of the word, and, without exception, they choose between these opposite qualities and accepting one, exclude the other. The fact that nearly all of them adhere to the requirements of a *cast* metal proves that the real difficulty is to express the new conditions and requirements of steel. One of the first suggestions in this direction came from our gifted countryman, the late ZERAH COLBURN, then editor of *Engineering*. He made that proposition which in one form or another seems to be the one idea of the definers of "steel." He proposed to call every *cast* alloy of iron by the name of *steel*. Pig iron, according to him, would be steel. Subsequent inventors have added what is probably an improvement to this definition by confining its scope to cast *malleable* alloys of iron. Some, as GREINER, include all cast metals!

It seems to us that the defect which ruins all these definitions is that they try to cover three distinct metallurgical and engineering products by the use of two words. Cast steels are to be called steel whether they will temper or not. Welded products are to be called iron whether they will temper or not. This does not seem to us a sound course, for it is throwing overboard the practice of centuries, and we doubt if such an innovation can be successfully carried out. That immemorial practice is to disregard the mode of manufacture and make the terms used indicative of the qualities of the finished product. It was the difference *in use* between iron and steel that was the very origin of the word *steel*, and that difference is as marked to-day as ever. What government would venture to publish proposals for iron swords? Under the above definition what government could safely contract for steel swords? On the one hand it would have to add an explanation that it did not want untemperable iron, and on the other that it did not want untemperable steel. Nothing is gained by such a definition, in point of exactness, and as this is the only possible advantage to be attained by a new definition it seems to us that the previous attempts are all failures.

We are of opinion that what is wanted is not a new definition but a new word. Iron we have, and we understand fully what is meant by it. Steel can mean that alloy of iron which will take a temper, as it has always meant it. For the new alloys let us have a new word. Just as we have wrought iron and cast iron, we might have temper steel and —— some other kind of steel. Numerous words have been proposed to distinguish the new products. Soft, mild and homogeneous are some of them. The difficulty with the former is that they have both been used to express kinds of temper steel. It seems to us better to take a new word, and such terms as homogeneous metal are too long to be acceptable. What that word is to be we cannot say, but if the present generation has genius enough to invent a new article we don't see why it cannot manage to find a name for it without seizing upon terms which have the vested rights incident upon immemorial use.

The Strikes of Petroleum.

THE striking of three new flowing wells in the Pennsylvania oil region is reported, one being a 1500 barrel well, named the Thompson; another, a 1300 barrel, the Satterlee, and a third flowing about 1000 barrels. Prices of raw oil at Parkers Landing are said to have fallen in one day from $1.47 to $1.10 a barrel, with good prospects of a further fall to $1.00. Strikes of this kind are sad news to oil operators, and we confess that, much as we desire to see the great American illuminator sold at low rates, we cannot fail to sympathize with a business which sees itself thrown into disaster by a temporary surplus of production, occurring under circumstances which probably prevent any general advantage to the people. But these new wells illustrate one thing which it is well for the people of this country to keep in mind, and that is the exhaustless character of nature's stores. When petroleum first began to be an article of great importance, it was considered an ephemeral thing that providentially came to light up our houses, at a time when war prevented our whaling ships from reaping their usual harvest from the sea. Although the supply has not failed to this day, there are probably few persons who do not look to see the supply of oil gradually diminish until it will become a luxury. People are frequently heard to say that when oil is gone something new will be found. But there is no need of finding anything new, for petroleum, or its equivalent, kerosene, never will be gone. Its sources are exhaustless, and there are probably few nations that do not possess them. It is not every nation that has a natural oil distillery specially fitted up, like that which has been established an eighth of a mile deep under Oil Creek, but the bituminous shale which is the raw material worked up in that laboratory, exists in vast and solid sheets over a great extent of territory. Prof. NEWBERRY tells us in his Report on the geology of Ohio that the Huron shale, 300 feet thick, covers the greater part of that State. It contains 15 per cent. of carbonaceous matter, a great part of which can be converted into oil by artificial distillation and at a very low cost. Many other States contains similar deposits, and though it is possible that nature's stills may become empty, no calculation which is within the bounds of probability can point to the day when the oil-giving materials of this country will come to a end.

The day that oil was first struck in Pennsylvania, is one worthy of commemoration by the whole human race, for it was then lifted out of its old dependence upon the scattered and lessening whale-fishery, and placed upon unending stores of illuminating material which one hundred years hence, or two or five hundred, will still be capable of a vast supply at low cost,

The Centennial Building Plans.

THE committee on the selection of plans for the Centennial Building in Philadelphia have made their choice of the ten plans which receive an award of $1,000 each. These plans are to be returned to their authors for revision and then exposed for public criticism. Forty-four plans were sent in and those chosen are briefly described in the New York *Times* as follows. These descriptions, it should be said, were published some days before the decision of the committee was made known. Each plan was accompanied by a sealed envelope containing the name of the designer, and addressed by a key word, which in the following is printed in quotations.

No. 9, "Americanus,"—architect, SAMUEL SLOAN, No. 152 South Fourth street, Philadelphia; Vienna plan, with galleries; memorial building in center in French style; remainder of building resembles exhibition of 1851.

No. 11. "Lexington, Yorktown,"—architects, JOHN MCARTHUR, Jr., No. 1,334 Chestnut street, and JOSEPH M. WILSON, No. 233 South Fourth street, Philadelphia; places the memorial building in the center elevation, well got up, with numerous towers, spires, and other Gothic features.

No. 15, "G. L. R."—architect, JOHN C. SIDNEY, No. 204 South Fifth street, Philadelphia; a square block in center for memorial building, inclosing eight courts, and connecting on two sides with other blocks also inclosing courts, and having galleries. The elevation mediæval.

No. 20, "M. U."—architect, I. S. FAIRFAX, Wheeling, W. Va.; a cruciform building for the exhibition, having galleries, with the memorial building detached, forming a base to the cross, and pretty well designed in French style.

No. 21, "Pavilion Plan,"—architect, CALVERT VAUX, No. 110 Broadway, New York. This design is accompanied by a model, showing the method of construction, and affording a clear insight in the modes of lighting and ventilation, and of the interior effects and vistas.

In my opinion, says the correspondent of the *Times*, this is the only design that can claim to be considered as an original and practical combination of the elements of other exhibition buildings, or that meets the wants of the present occasion in a satisfactory manner, and I will endeavor to describe its features, as set forth in the pamphlet appended to the design. The plan of the building is that of a parallelogram, about 1,500 feet long and 700 feet wide, made up of twenty-one so-called pavilions, which are practically square, arranged in three rows of seven each. These pavilions are composed of arched frames or trusses, 240 feet span at the four corners, springing from the ground and intersecting in the crown at right angles, so that they support each other. Other arches of 154 feet span and 120 feet high, make up the four sides of square, and connect the pavilion together. The corners of the pavilion are cut off, so as to form twelve interior octagonal courts of 60 feet in diameter, furnished with fountains, flower-gardens, &c., and twenty semi-octagonal courts or indentations in the exterior lines of the building. The whole interior of the building is thus open and free, every part is in direct communication with the rest, and every one is placed on the same footing for the purposes of exhibition or inspection. The great height and width of the arches and the arrangement of the courts allow of magnificent vistas in all directions, and nearly the whole of the building can be seen from the central point. The lighting is intended to be mainly from the courts and exterior gables, so as to secure vertical, or side lighting, for which the provision seems ample, and in addition skylights are introduced in the roof to light the upper part of the building, as may be found necessary, with arrangements for toning down the sun's rays, and securing thorough and ample ventilation. There being no flat roof or ridge and valley construction, and each pavilion having its own court from which its arches spring, rain-storms or snow will be rapidly discharged and disposed of. The courts will give opportunities for escape from the bustle and life of the exhibition, and if furnished, as we presume they would be, with fountains, flower-beds, seats, &c., and decorated probably in the styles of the different countries, would prove very attractive and favorite places of resort. The interior is proposed to be lined with material similar to that used at Vienna, so that any amount of decorative effect can be produced, and, if found advisable, each nation could have a distinctive style in its pavilion. The exterior does not seek to follow any particular style of architecture, the grand gable ends of the pavilions which form the outer line of the structure are designed to show the lines of construction and not to hide them, and to depend on their size and proportions for effect. This may to some appear tame and without relief. If so, it seems to me that it is a mere question of money to diversify them to any extent, or to raise portions of the building above the general level, without in any way interfering with the plan or general design. The arrangement of the exhibition is shown on the plans by bands of color, the departments being placed in parallel zones running round the building, and the exhibiting nations having as much space allotted them, crossing the zones, as they require. This is substantially

the Paris plan, with the advantage of giving more room for particular exhibits in the corner of the building, where the important nations will probably be located; and it is also possible, although not desirable, to carry out the geographical arrangement of the Vienna plan. Ample and convenient space is afforded in the gables for refreshment buffets, retiring rooms for visitors, offices for administration, &c., with galleries above for convenience of visitors, music, &c. Sites for exterior restaurants are indicated, which are conveniently placed with reference to the building, and ample means of ingress and egress are provided in the twenty gables. Railway accommodation is provided for passengers by means of a branch line from existing railroads, with a high level station located on the north side of Elm avenue, communicating directly with the building by covered ways and bridges; and, for goods, by means of three lines of double track road traversing the building from end to end. Carriages and foot passengers, or by horse-cars, are provided for, and altogether the design is practical and well worked out, and seems thoroughly adapted to what is wanted.

No. 22—architects, Thomas M. Plowman & Co., corner Ninth and D streets, Washington, D. C.; square center, transept ends, grand dome over center part. Memorial building adjoining center square, fronting Elm avenue, designed in French style.

No 23, "Esto Perpetua,"—architects, Collins & Autenrieth, No. 410 Walnut street, Philadelphia. Memorial building, cruciform in shape, with dome; the longest arms having rounded ends, the shorter square. The exhibition building being a half ellipse, with the major axis corresponding with the long arms of the cross. These drawings are well got up, and the architectural details of the memorial building are good.

No. 24, "1876-1976,"—architects, Francis R. Gathel, No. 1,028 Wallace street, and Stephen Rush, Jr., No. 1,308 Green street. A five-pointed star for the memorial building, inclosed in a pentagon.

No. 25, "Carbon"—J. A. Vrydagh, Terre Haute, Ind., and E. T. Heiner, Terre Haute, Ind. A detached memorial building in form of a parallelogram, nicely designed in the French style; surrounded on three sides by a semi-elliptical ring; constructed in the same manner as the Paris building.

No. 32—architects, C. Clark, No. 410 Walnut street, and H. A. & J. P. Sims, No. 426 Walnut street, Philadelphia. A building of 1,000 feet square, forming a combination of a weaving shed and the nave and aisles of a church. With the exception of the nave and aisles, the height of the roof is only forty feet, and the ground plan is divided up into forty-feet squares by columns, so that there is little or no chance of any vista worth mentioning. Galleries in the aisles; low and monotonous exterior.

The Great Steel Works at Essen.

An establishment employing 12,000 workmen, in which 2,000 other workmen are constantly engaged by various contractors, and which has in its dependent establishments 5,000 more laborers, is pretty sure to contain numerous features of interest. Such a workshop is Krupp's, for in the shops, mines and furnaces from 18,000 to 20,000 men are constantly at work. In 1872 the cast-steel articles turned out amounted to 123,315 tons. In the government of this army of men many features which have usually been confined to government mining works have been introduced. The purport of these institutions (says *Engineering*) may be briefly stated to be the supply of good food, clothing and lodging, at the cheapest possible rate, together with hospital and medical attendance whenever necessary. With these objects in view, several large marts, managed by the firm, have been founded, at which all the necessaries of life in the way of food and clothing can be had for cost price. At the present time, the sum taken in monthly at these establishments mounts up to 75,000 thalers, but, owing to their great usefulness and popularity, even this large amount is steadily on the increase. The firm possesses, moreover, one hotel, three bier-hallen, a soda-water factory, and a bakery with two steam-engines, which produces on the average about 85 tons of bread per month.

In the way of house accommodation there are already 206 separate lodgings provided for clerks and other office-holders, and 2,948 for workmen. These are at present inhabited by more than 8,000 human beings; but, owing to the great demand, the building of new houses is being proceeded with as rapidly as possible. There exist, moreover, already rooms and accommodation for 2,500 unmarried workmen, while in a short time provision will be made for 1,600 more.

There exists a hospital with 100 beds, and an epidemic lazaretto with 120 beds, both of which are under the management of physicians and surgeons provided by the firm. By means of a fund supported partly by the workmen, all the subscribers thereto are entitled to free medical attendance for the sum of one thaler a year. There are, moreover, other funds for providing for the sick, for widows, and for all such as have been injured or become unfit for further work in the service of the firm, which latter adds to this fund the half of all the subscriptions of the individual members. The total income in the year 1872 was 105,035 thalers; the outgoings in the same time reached the sum of 82,632 thalers; while the capital on the 1st of January of this year was 128,992 thalers.

The establishments for education, which form such a remarkable feature in the social organization of the Creusot works, have no necessity here, for the national system of education in Prussia is so perfect as to render any further provision unnecessary.

In addition to the cast-steel factory at Essen, the firm of Friedrich Krupp possesses important coal and iron mines and blast furnaces, which render them independent of the state of the market and the conjuncture of events, and insure a steady and regular supply of the best raw material. The coal mines are four in number, and the iron four hundred and fourteen. These latter are found in three districts along the Rhine, and cover in all an area of 49,400 acres.

Lastly, the firm possesses important concessions of excellent iron ore in North Spain. It is intended to import 300,000 tons of ore per annum from this district to convert into cast-steel at Essen, and to facilitate the transport seven-and-a-half miles of railroad in Spain, together with several steamships, are already being built. The blast furnaces, eleven in number, are distributed in five groups along the Rhine. Two are at Oberhammer, which produce twenty tons of spiegeleisen per diem. In connection with these is a foundry, and also a machine shop.

Four more, called the Mülhofer Hütte, are situated on the Rhine, near Engers, and are connected by means of a branch line with the Rhenish Railway. Three of these are built on the newest pattern, and are furnished with pneumatic lifts. They produce forty-five tons per diem of spiegeleisen, and iron suitable for the manufacture of Bessemer steel.

The Hermanns Hütte, also on the Rhine, at Neuwied, has one furnace in work and two others are being built. The Bendorfer Hütte, with one old-fashioned furnace, is at present not in work; while, lastly, the Johannes Hütte, at Duisburg, on the Rhine, produces at present from thirty-five to forty tons per diem, with four blast furnaces. Six others are now being built. The total amount of pig iron produced by these eleven furnaces does not fall short of ten million kilogrammes, or 10,000 tons per month.

The Sierra Madre Tunnel.

The commencement of this enterprise has created less noise than one would expect from such a huge undertaking. Yet, if it should be only partially successful, not reaching the other side of the range for years to come, the tunnel promises to become of the greatest value in the development of the Gilpin County gold veins.

The mouth of the "great bore," has been located about two miles below Black Hawk, on the north branch of Clear Creek, some 7,000 feet above the sea, 1,800 feet above the plains, and nearly 1,200 feet below the level of Central City. Its course is a few degrees north of west, or in a direction that would intersect the Gregory, Fisk, Hunter and other lodes 15° to 20° from a perpendicular. The Bobtail, Mammoth, Winnebago, and other lodes of that system would be cut at a very acute angle.

From the mouth of the tunnel to the Bobtail lode, in a direct line, is 11,000 feet, and from that point on to the Gregory, about 800 more. The course being about 30° north of west, it will run under Central City, almost directly beneath Eureka street, and passing a short distance up that gulch, cut into Gunnell Hill, and pass through it into the main range.

The Bobtail is the first known lode of any prominence that will be intersected. This, as has been said, is 11,000 from the mouth and will be struck about 1,300 feet from the surface. From this point on, the great bore will strike the Gregory, Bates or Hunter, Gunnell, Prize and Winnebago, in the order named. The three latter lodes are about 16,000 feet from the mouth, and will be opened nearly 2,000 feet from their surface out-croppings. Beyond these, if the tunnel ever reaches so far, it is not improbable that other valuable and large veins will be met with. The main divide between Central City and Middle Park is from 11,000 to 12,000 feet high, in places rising to nearly 14,000 feet. In passing through this, the tunnel will reach its greatest depth, viz., from 5,000 to 7,000 feet.—*Mining Review.*

Engineering and Mechanical Notes.

Messrs. John & Henry Gwynne, of Hammersmith, Eng., are making a set of pumps for draining the immense marshes of Ferrara in northern Italy. The tract to be reclaimed extends over an area of nearly two hundred square miles, and the work to be done by the pumps consists in raising a little over two thousand tons per minute for a mean lift of seven feet three inches (the maximum lift being about twelve feet), and delivering it into the River Volano, at Codigoro, where the pumps are to be erected. To perform this work, eight pumps will be used, disposed in pairs, each pair being driven by a compound engine. When working at the mean lift of 7 ft. 3 in., each of the eight pumps is constructed to discharge 57,000 gallons per minute, the aggregate discharge from the eight pumps when working at this lift, being consequently 456,000, or nearly half a million gallons per minute. But 456,000 gallons per minute equals 656,640,000 gallons per day of twenty-four hours, which is six times the daily water supply of London, and about ten times as much as New York uses. Again, 456,000 gallons, or 72,960 cubic feet per minute, would supply a stream over 103 ft. wide and 4 ft. deep, running at a speed of two miles per hour, or 176 ft. per minute, while the delivery for a single day would also suffice to fill a reservoir a mile square to a depth of about 3 ft. 9 in. The Thames river above Hampton was found in 1865 to be running a little over 300,000,000 gallons a day, which is only half the work of the pumps.

Engineering describes a rolling mill engine, exhibited at Vienna, by Messrs. Danek of Prague. It has a pair of cylinders, each 1100 mm. (43.3 in.) in diameter by 1300 mm. (51.18 in.) stroke, and is intended to work with 75 lb. pressure of steam, and at 100 revolutions per minute, which is equal to a piston speed of over 850 ft. The gearing is in the ratio of 3 to 1, but as the engine is not to be set to work, the larger wheels are only made of painted wood. The engine is throughout most massively constructed, and has immense bearing surfaces, which

however, with the proposed pressure and speed, will be no more than is required. The crankshaft, piston and connecting rods, and much of the gearing about the engine are made of steel. The ordinary link motion is fitted with steam reversing gear, and an expansion valve works on the back of the main slide. The cut off are variable at will from 0.15 to 0.5 with the expansion slide, and from this point up to 0.85 with the main slide. The piston rods are produced and guided behind.

Mr. J. B. PARKER, of London, in a lecture upon the Roman aqueducts said, that the opinion commonly entertained that the ancient Romans were ignorant of the fact that water will always rise to its level in closed vessels, is entirely a popular delusion. At every half mile of the aqueducts, on their course to Rome, each aqueduct forms an angle, to break the force of the water, and at that angle a great reservoir is made, with a filtering place at one end. This consists of four vaulted chambers, two above and two below. The water enters into the top of the first upper chamber, it then falls through a hole in the vault into the first lower chamber, then passes through small holes in the intermediate wall into the second lower chamber, then rises through a hole in the vault into the second upper chamber, whence it follows its course at the same level as before. Each filtering bed is therefore built on the principle that water finds its own level. The large stone pipes were used because neither lead nor terra cotta would withstand the force of the water. At the present time, the iron pipes of the new company burst so frequently that they fear having to relay the whole extent.

Furnaces with Bottom to them.

MR. J. J. HAGERMAN, Secretary of the Milwaukie Iron Co., writes to the *Bulletin of the Iron and Steel Association* as follows:

I notice in *The Bulletin* of July 23d the following: "The Clinton Furnace of Graff, Bennett & Co., Pittsburgh, has made 36,000 tons of iron without going out of blast, the blast covering a period of three years, and it is still blowing. Is there another furnace in the country having greater bottom?"

In reply to the above query, I would ask you to insert the following as the yield in tons of 2268 pounds of our two furnaces, either of which has greater bottom than the Clinton Furnace, and both are apparently as good as ever:

No. 1 FURNACE.

Year.	Months.	Tons.
1870	8	11,314
1871	12	15,553
1872	12	16,231
1873	6	8,325
	Total	51,423

An average of over 1,353 tons per month.

No. 2. FURNACE.

Year.	Months.	Tons.
1871	7½	9,448
1872	12	16,614
1873	6	8,674
	Total	34,736

An average of over 1,362 tons per month.

If the best furnace in the Keystone State can make but 1,000 tons per month, had they better not "go west?" Allow me to ask what kind of tons our friends use in giving their yield?

Casualties and Strikes.

A fearful fire-damp explosion occurred August 12, at the central shaft, back of Hyde Park, Pa., by which three men were severely burned. The accident was caused by a miner named EVAN PUGH going into an unoccupied chamber with a naked lamp. An explosion immediately occurred, and he was shockingly burned from the knees upward. WM. BEDDOE was also badly burned; and PATRICK HENNAGHAN, who was in the gang at the time, was blown through a door two inches thick, and fatally injured.

JOHN ROBERTS, a miner, aged sixty years, was killed by a fall of coal, August 12, in Slope No. 4 of the Pennsylvania Coal Company, at Yatesville.

On the same day the heaters employed at Ward's rolling-mill, in Chicago, struck on account of the refusal of their employers to pay them over seventy-five cents per ton for heating, while they demanded eighty-five cents, but were willing to compromise on eighty cents. The strike throws about 1,000 men out of employment.

The various Trades Unions of New York propose to have a mass meeting in September, to discuss, among other things, the tendency among employers to discard the eight hour rule. It appears that many employers are quietly returning to a ten hour day, a fact which causes so much dissatisfaction that some men talk of a strike. There is not much danger of one, however.

MINING SUMMARY.

We copy *in extenso* the following able review of the mining business during the last quarter from the San Francisco *Commercial Herald*.

SHORT WATER SEASON—STOCK GAMBLING—MINING FAIRLY PROSPEROUS.

Without the occurrence of any noteworthy event, the business of mining has been prosecuted with much steadiness and activity during the past quarter, and been attended generally with fair results. While the shortness of the water season has somewhat curtailed the yield of the hydraulic mines, in every other department of this industry a full average success has been reached. Gambling in mining shares has experienced its usual fluctuations, some of which have been sudden, and extreme, resulting in the financial discomfiture of many outsiders. It is not incumbent upon us, however, to go into any detailed account of these stock operations, seeing they are no longer recognized as having any connection with the reputable branches of the business.

That the product of the hydraulic washings should have suffered a reduction at this particular juncture, is unfortunate, inasmuch as a great deal of foreign capital has lately been embarked in this department of mining. The most of these companies, however, have done moderately well, and will be able to declare such dividends as will return a fair interest on the money invested, notwithstanding the water season has been fully one-fourth shorter than usual. These companies have, moreover, secured excellent properties, which, although they may not as yet have achieved all that was at first promised for them, are being gradually worked into a more efficient condition, and will not greatly disappoint the present owners if they be but patient and hold on to them. In every instance these properties, enjoying the benefit of a good local management, have been put in shape to insure for them an economical and increased production, warranting the inference that their net earnings will be augmented hereafter to an extent that will render them an excellent investment. Of late the drift and quartz mines, owned abroad, have nearly all been doing well; and if there are any exceptions, it has been owing to a want of sufficient working capital to place them in a condition to be more effectually operated. In no instance have these shortcomings been due to mismanagement, or lack of merit in the mines themselves.

UTILIZATION OF TAILINGS—IMPORTANT OPERATIONS LATELY SET ON FOOT.

While mining operations have been unusually active, and the bullion product has been large, never in a like period have so many gold and labor-saving improvements been introduced, nor so many important enterprises been set on foot as during the half year just closed. First among these gigantic projects stands that of the Bear River and Chalk Bluff Fluming Ditch and Mining Company, inaugurated in April last, and having for its principal object the removal and utilization of the vast accumulations of tailings lodged in Bear River and its branches; a work of overshadowing magnitude, and of the first importance to a large scope of mining territory lying adjacent to the line of its operations. As a means to the accomplishment of this end, a tunnel, nine by twelve feet, and two and a quarter miles in length, is to be driven through the divide between Bear River and the North Fork of the American, to serve as an adit through which the auriferous contents of the former stream are to be carried and emptied into the latter. For more than twenty years these tailings, poured out from a hundred hydraulic sluices, have been gathering in Bear River, and its numerous tributaries until, having reached a depth ranging from 50 to 120 feet, they have already obstructed the outlet to several valuable mines, and if allowed to go on accumulating will soon close up many others. Years ago this result was foreseen, and the plan of getting rid of this rich gold-bearing debris by the method adopted by this company, has since been much talked of, several parties having caused preliminary surveys to be made, looking to its early prosecution. The cost of the work, before giant powder, and single-hand and machine drilling had been introduced, and while labor and material were still much higher than at present, had the effect, however, to deter the projectors of this scheme from entering upon it practically, though well satisfied that it would have proved a most lucrative enterprise. The time required for the completion of the work is set down by Frederick Mow, the very competent engineer of the company, at two years, and the cost at $500,000; each of these items being less by one-half than in the estimate made a few years ago. Pending the construction of this tunnel, the company will employ a large working-force on their extensive hydraulic and drift mines lying along and adjacent to the streams above, and from which they expect to derive large yearly revenues. Some of the gravel tracts owned by them are, next to the claims of the Dutch Flat Blue Gravel Company, the most valuable in the State; and when their several branches of mining, drift, hydraulic and tail-washing, shall be under way, their annual income will be computed by millions. The properties to be operated by this company cover a linear stretch of more than thirty miles, extending literally into two counties, the most of their estate lying, however, in Little York Township, Nevada County.

On the opposite side of the North Fork, and a little lower down, in Placer County, another important tailing operation has been entered upon by a company, the most of them residents of San Francisco, the object being to wash over and run out the deposits that since the summer of '49, have been collecting in Shirt Tail Canyon. The quantity of auriferous detritus here is small compared with that in Bear River and its feeders, but it is of much greater richness, this canyon having been the receptacle of contributions brought in by ravines famed for their opulence of gold-dust even as early as '48. No costly works are called for here, an open cut a few hundred feet long being all that is required to secure a sufficient passage for running off the contents of the canyon. The profits of this enterprise as compared with the original cost of the property, and the outlay necessary for putting it in working shape, must be enormous; and why a class of deposits so rich and so easily utilized should have been overlooked so long, is one of the many unaccountable things connected with mining. What makes this neglect the more surprising is the fact that only in a few localities can they be extensively availed of, owing to lack of sufficient fall in the vicinity to carry the re-washed mass out of the way. Many of our mountain streams, more especially the lower Feather and Yuba, are choked up with billions of tons of this gold-bearing material, very little of which can ever be worked with profit, owing to a want of an outlet.

Besides these tail-washing operations, many other enterprises of greater or less consequence have lately been projected or started up throughout the mining regions of the extreme West, some of which are of a bold and expensive character, and well calculated to benefit the particular branch of the interest to which they have been directed.

DITCHES AND RESERVOIRS IN PROGRESS OR COMPLETED.

Among the important improvements previously entered upon, some have been brought to completion, while others have been materially advanced during the quarter, the progress made in this respect having been all that could have been reasonably looked for. The North Bloomfield Company have pushed ahead their great shaft and tunnel scheme with industry and vigor. The big bed-rock tunnel of the Gold Run Company, with several other works in the vicinity of a similar kind, but of less magnitude, is making rapid progress, this company being about to set up one of the Burleigh machine drills for hastening forward the work of excavation. The South Yuba Canal Company have just commenced the construction of a monster reservoir at Fordyce Valley, an improvement they have long contemplated, and which, when completed

will add about one-fifth to their present stock of water, enabling them to supply their usual customers with water throughout the entire season. Several reservoirs, some of them of large capacity, have also been commenced by the Gold Run Mining Company, who purpose finishing them before the fall rains set in. The Canal of the Spring Valley Company at Cherokee Flat, and that of the LaGrange Company in Tuolumne County, both capacious and valuable hydraulic works, and not long since brought to completion, open up a considerable area of good gravel land adjacent to to their terminus. The North Fork and Iowa Hill Canal, intended to carry 6,000 inches of water, is being built as rapidly as a large working force and ample capital can put it forward, the work being supervised by W. H. KINDER, an experienced and energetic ditch builder. Several other recently located ditches and reservoirs are in course of construction, all of them likely to be soon completed, and afford the means of washing a large scope of mining ground which otherwise would remain unworked and valueless.

With so much being done to facilitate the working of the mines already found and opened up,

EXPLORATION CONTINUES TO BRING NEW MINERAL DEPOSITS TO LIGHT,

Both in the department of vein and placer mining. A very large and, what appears to be, valuable ledge of gold-bearing quartz was discovered about one month ago, on the easterly slope of Mount St. Helena, Napa County. This lode has a thickness of six feet on the surface, is well-defined and can be traced by a bold line of croppings for a distance of several miles. The whole of it has been taken up, the greater portion by experienced quartz miners, who are proceeding to develop it with thoroughness and vigor. The appearance of ore from this vein is good, while the numerous assays made, denote it to be highly auriferous. Not from the Idaho nor the Hayward mine itself has a better looking ore been taken, and we are strongly in hopes that a valuable mine will be developed at this locality, notwithstanding it lies in a range of mountains where, according to the theories promulgated by some geologists, a gold mine has no business to be.

A considerable scope of good placer diggings was discovered, recently, at a point two miles below Oroville, and which, had they not been monopolized and disposed of in an illegitimate manner, might have afforded profitable employment to several hundred white men. As soon as these placers were found, a few white men, advised of the fact, taking advantage of their proximity to the spot, hastened to locate a large number of claims, taking them up in the names of others, all of which they proceeded to sell for a round price to the Chinese, who were not permitted by the laws of the district to take up any claims themselves. Through this mode of procedure the most of this ground has passed into the hands of these foreigners who are making large wages, and who after having bought their claims should certainly be permitted to hold and work them. No blame attaches to these people, the fault resting on the drones and shysters who have been instrumental in bringing about this condition of things, and who, where they are known, should not be suffered to ever again take up or hold any mining ground.

THE USEFUL METALS,

As well as a variety of mineral substances, continue to receive increased attention; quicksilver, coal, iron, copper, borax, antimony, manganese, etc., having lately become objects of growing interest or active pursuit. The production of quicksilver has been especially stimulated by the excessive rates to which the monopoly, who, in a great measure, controls both the sales and sources of supply, has advanced the price of that commodity.

The following synopsis of operations will serve to show the activity now pervading this branch of mining, and the extent of present and prospective production in what may be termed the new or outside mines.

From the St. John Mine, located a short distance from the town of Vallejo, where some very promising ore developments were made a month or two since, we have now reports of the successful workings of a new furnace, the invention of one of the owners, and recently put up at that mine. We are not advised as to the novel features introduced into this furnace, though its efficiency, judging from the tests lately made, would appear to be pretty well established. If it should be found, after more thorough trial, to be superior, or even equal, to the Knox & Osborne patent, which has grown into rapid and well-deserved popularity, it will be justly entitled to all the merits the inventor claims for it. The owners of the St. John Mine, encouraged by the late discoveries made therein, have increased their facilities for the extraction and removal of the ore, as well as the capacity of their furnace, which now roasts six tons every twenty four hours, accomplishing its task with a very trifling outlay for fuel. After a run of one week this company, lately, cleaned up 50 flasks of metal, valued at $3,825, the Superintendent hoping to make a still better run the following week. They have enough cinnabar in sight to keep their works engaged for six months, and expect to take out 250 flasks worth $15,000 by the first of August.

The Redington Company, at Knoxville, Napa County, are producing about 400 flasks of metal per month, and report a large body of ore on the 190-foot level, extending down to the 210-foot level with considerable ore still in the upper workings in sight. They are now reducing their ore by the old style furnace, used at the New Almaden Mine, but are preparing to build one after the Knox & Osborne pattern, which will be ready to reduce ore in about three months.

The deposits of the California Quicksilver Company, situated two and one-half miles northwest of those of the above company, have, as yet, been but little developed. They are running on surface ore, using the Knox & Osborne furnace and produce from the low grade ores forty flasks of mercury per week, or 160 flasks per month. This mine gives promise of being, when farther developed, a first class property.

The Manhattan Mine is situated about two miles nearly west of Knoxville, and one south of the California Company's works. They are operating entirely in surface ores of low grade, their out-turn being from sixty to seventy flasks per month. This company is sinking a shaft on their mine for the purpose of going down from two to four hundred feet in search of better ore. The outcrop here constitutes one of the most extensive surface deposits yet discovered in the State, there having been taken therefrom nearly 3,000 flasks of mercury, without any ore having been extracted below the water line, or within fifty feet of the crest of the hill. This company use the Knox & Osborne Furnace.

The Phœnix Mine, in Pope Valley, Napa County, has yielded several thousand flasks of quicksilver; over one thousand having been taken out last year. Though not high grade, this mine makes a good ore exhibit, yet it would appear to have been operated more for present advantages than permanent results. The deepest workings here extend to a depth of 150 feet, showing large bodies of low grade ore all the way down. The company run a Knox & Osborne Furnace, and turn out from 100 to 150 flasks of metal per month.

In the Washington Mine, adjoining the Phœnix, there has been opened up the largest body of grain or wash ore yet found in this district. Preparatory to roasting, this material is made up into adobes after which it is treated in a small furnace fashioned somewhat after the style of those at New Almaden. About 100 tons of ore is roasted per month, giving a product of 30 flasks of quicksilver. The ore there is abundant, and extracted at small cost, and it is believed that when this top dirt has been worked off, more valuable deposits of cinnabar will be found below.

From the Valley Mine, situate next the Washington, a good deal of ore has been taken, lying near the surface, the lowest level opened not being over thirty feet deep. But little valuable ore can be taken out here till the shaft, now being sunk, shall have reached a considerable depth. The company have erected one of the Knox & Osborne furnaces, which will, no doubt, be kept fully and profitably employed when deeper developments have been made on their mine.

The owners of the Great Western Mine, situated six miles northwest of the Phœnix, on a spur of St. Helena Mountain, but in Lake County, have uncovered a large body of surface ore with every prospect of developing a valuable deposit of cinnabar at this point. They are now building a furnace after the Riotto & Luckhart plan, and expect soon to put their mercury on the market.

The Napa Company (formerly the Oakville) have produced many hundred flasks from surface ore, never having pushed explorations below the water line. They have several months' work for their furnace out, in low grade ore, and earth containing cinnabar, to be made into adobes with fair prospects of obtaining a larger and better supply when the water level is reached. This company are using two of the Riotto & Luckhart furnaces, and are producing about forty flasks per month.

South of San Francisco the property owned by FLINT, BIXBY & Co., and generally known as the "Sargent Mine," has a large quantity of ore out, and is one of the most promising of our non-producing mines. The company contemplate building reduction works this season.

At the Stayton group of mining claims, lying about twenty miles east of Gilroy, a promising prospect of cinnabar together with an enormous deposit of antimony, the latter the largest yet found on the coast, have recently been discovered. This antimonial ore exists here in such quantity, and is withal so rich in that metal, that it is likely to prove of great commercial value, being not above twelve miles from railroad transportation.

In Santa Barbara and Trinity Counties, deposits of cinnabar are also being worked, those in Trinity being recent discoveries, and affording good evidence of being rich and permanent.

With so much active exertion spread over such a broad and prolific field, it would look as if the business of producing this metal might soon escape from the thraldom to which it has been subjected, thereby relieving the mining interest from the exactions that the present monopoly has so long practiced upon it. With our vast and rich deposits of this ore, quicksilver can be profitably produced at less than one-half the price at which it is now selling in this market; a fact that should soon induce such competition as ought to work a speedy reduction of these unjust and ruinous rates.

The greatly reduced production of the New Almaden Mine would appear to be due, in part, to the restrictive policy under which it is being worked, and in part to the scarcity of medium grade ore, the cinnabar lately extracted there averaging, as it is said, not more than 5½ per cent. of metal. They are making there at present only 1,000 flasks per month, against 2,900 last year, and the outlook is reported to be rather dismal. The crippled resources of this mine should act as an additional incentive to the owners of the several other properties of this kind being opened up elsewhere in the State, as it may be the combination will not have the power to regulate prices much longer even if disposed to do so. The prospects of this branch of mining are certainly very encouraging, as the demand for this article is destined to increase rapidly, and there can be no doubt but it can be profitably produced at much lower figures than those now ruling in this market. Under the arrangement entered into with the Almaden Company by the Redington and the New Idria companies, they stipulated to sell their entire product to that company for a series of years at the rate of forty cents per pound, which it would appear must have still left them a satisfactory margin for profits.

BORAX.

The manufacture of this commodity is being quite largely engaged in, both in California and the neighboring State of Nevada, in both of which immense deposits of the crude borates have been discovered within the past two years. The business, however, in view of the comparatively limited consumption of this article, seems likely to be overdone, the prices here having suffered a reduction of fifteen to twenty per cent. within the last six months; a result due, less, perhaps, to any large actual production than to the apprehension of such an event on the part of extensive dealers and consumers; for, while the price is still pretty well maintained in the English market, it is impossible to negotiate contracts for the delivery of any considerable quantity there at rates now ruling. But with the reduction of the price it is probable that new uses will be found for this salt, thereby increasing its consumption, and creating a demand that will serve to prevent the price falling below such figures as will render its extensive manufacture profitable. The low prices prevailing here at present are likely to open for this material markets in a new quarter, some shipments having lately been made to Australia to fill orders from that country.

COPPER MINING,

After a long season of depression, is also undergoing a revival in California, the center of greatest activity being in Fresno County, where a number of mines are now in course of prosperous development. The ore obtained here is of a good character, assaying from 16 to 35 per cent. of metal. Of the quantity extracted, a portion is smelted on the ground and the regulus sent to San Francisco for a market, the price obtained for it here averaging $725 per ton. Some of the higher grade ore is also shipped to this place where it sells for about $100 per ton, being bought on account of English smelters. The price of this metal having improved abroad, will be likely to revive this branch of mining in other parts of the State, and perhaps continue it in a prosperous condition for some time.

The quantity of coal raised from our various mines, both coastwise and interior, has been large, recent discoveries of promising deposits of this mineral being also reported. Some attention is even being paid to the production of iron on this coast, and it is not improbable that we shall be able in the course of a few years to include this among our staples of home manufacture.

In the department of mining apparatus and processes, we have a gratifying progress to note, some valuable improvements having been invented or perfected and brought into successful use during the past quarter. Among the more important of these are a variety of smelting and roasting furnaces, machine drills, gold saving appliances, concentrators, chlorination processes, new use and more effectual methods for applying giant powder, and other powerful explosives, etc., all denoting a healthy activity and steady progression in all that relates to our mining industries.

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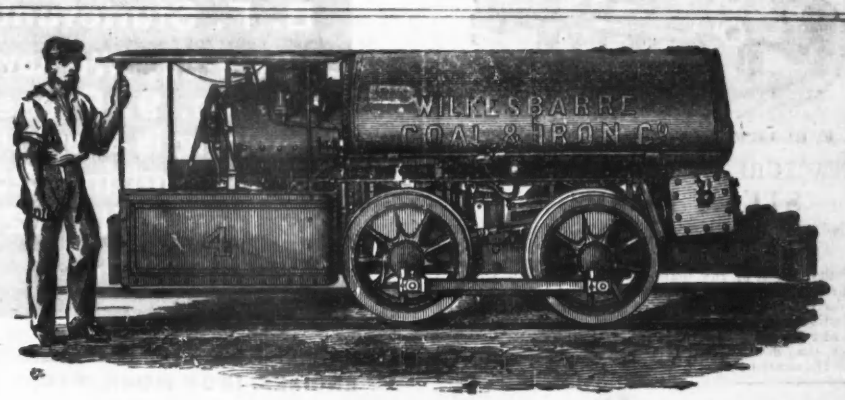

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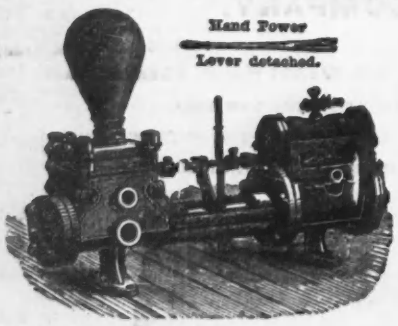

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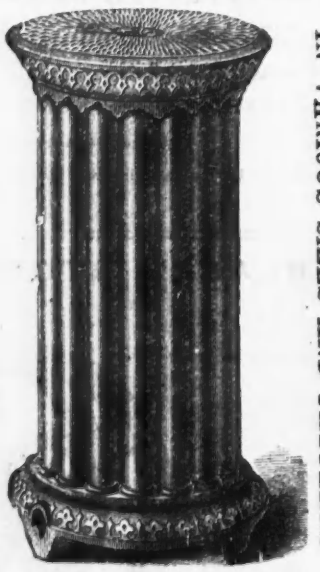

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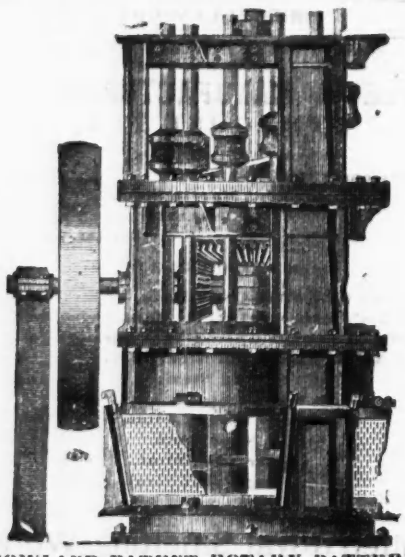

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