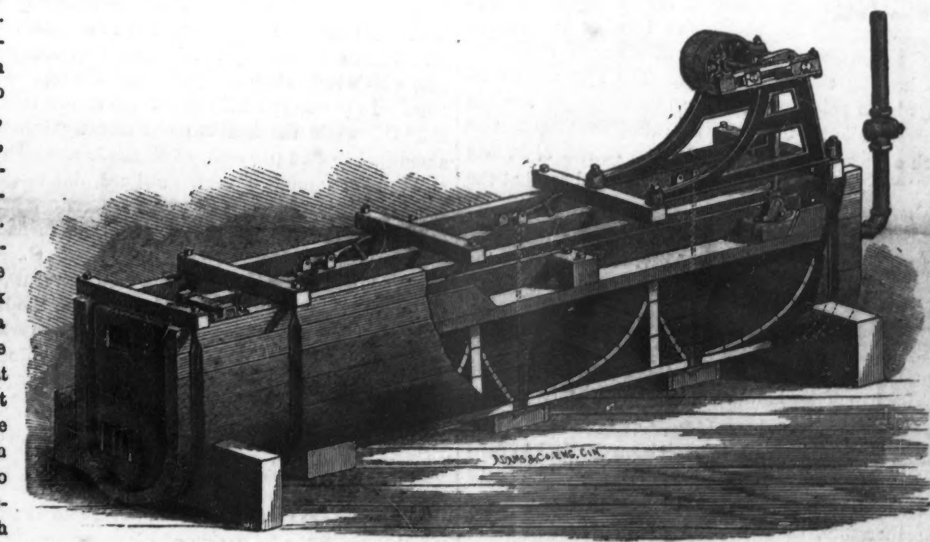
The Engineering and Mining Journal.

Vol. XV.—No. 3.—Fourth Series. NEW YORK, TUESDAY, JANUARY 21, 1873. Price 10 Cents Per Copy.

Cazin's Ore Separator.

This separator consists of three jigs, arranged end to end. It is continuous in its action and has but one piston and piston rod, a disposition which, as all of our readers who have worked the ordinary machines know, saves a great deal of complication and permits a much simpler and cheaper construction than is possible when three separate pistons have to be actuated from a through shaft, or by connecting rods from the first piston. The peculiarity of this machine is that the piston is hinged at one end—opposite the last sieve, and the piston rod is placed, not in the center, but at the other end, opposite the first sieve. It lies the whole length of the machine, and at the side of the sieves. This peculiar arrangement gives each sieve a stroke of its own, entirely different in strength and length from that of the others. The undressed ore is run on the first sieve and receives the longest stroke, that is to say, the most thorough agitation the piston is capable of giving. On this sieve pure mineral and a mixture of middlings and poor are obtained. Of course the middlings will be at or near the top when they arrive on the second sieve. There the action is less energetic; the middlings are taken off and the poor ore passes to the third sieve. This poor ore, though often thrown away, still contains some mineral, adhering in the form of fine particles to larger grains of rock. The difference in gravity between these grains and those which are composed of rock alone is very small, and in a violent stream the two sorts are constantly re-mixed, so that separation is not effected. But a quieter action will separate the absolutely worthless from that which has some value, so that on the third sieve a product which may still be worth re-working, is obtained, while the gangue passes off the tail race.



CAZIN'S ORE SEPARATOR.

Whether the machine will be equally effective in separating an ore containing two or there minerals of different specific gravities, is a question to be decided by trial. Each sieve would certainly afford one mineral separated from the other two, but with the peculiar action of the hinged piston it seems to be reasonable to expect that the pure mineral of each sieve would be mixed with the lighter particles from the sieve above. This, however, could be afterwards separated by a repetition of the process. This is one of the great advantages of the continuous jig. Its work is so rapid that a repetition of the operation, especially when performed on concentrated mineral, does not make the work that a single run through other machines occasions.

F. Cazin M. E., Rose Clare, Hardin Co., Ill., is the inventor, and Morey and Sperry of New York are agents for the separator.

Polytechnic Branch of the American Institute.

Transportation in New York.

By J. K. Fisher.

Mr. Gardner showed that New York is losing trade in consequence of the cost of transportation *in* the city. The transportation *to* the city does not cost more than it costs to other cities that are gaining trade. Among the remedies he advocates is the pier warehouse system, which, for the heavy goods that come and go by ships, would dispense with street cartage; the goods would be hoisted from the importing ships into the warehouses, and lowered thence into the exporting ships. What effect would this have on the traffic that must go through streets? It would cheapen it, because it would quicken it. The high cost of cartage is due to the time lost by crowding, on the piers and in the streets. If the part of the traffic which could be withdrawn from the streets be a fifth, and a thousand carts be employed by it, the other four-fifths would be done by less than four thousand carts; because the crowding is done by the fifth thousand, more than the fourth, and much more than by the third. It is likely that three thousand carts would do four-fifths of the work now done by five thousand. This would be a present relief, but in time trade would so increase that the evil would recur; it is therefore wise to make the remedy as thorough as possible, so as not to need another revolution.

What more can be done? It is proposed to put a railway along the pier-heads. Very well, for the traffic that comes by rail, and goes by ship. But can anything else be done? I answer yes. If we use wagons that will carry twice as much, yet occupy no more room than our old-fashioned vehicles, we may do double work with three thousand, and we may do our present work with less than fifteen hundred or twelve hundred. And if we drive them faster—if we go up hills as fast as we now go on levels—we can still further clear the streets, and we may do with a thousand. And if we drive at the highest speed allowed—six miles per hour—on grades as well as levels, we may do with six hundred for the present traffic, and meet a greatly increased traffic when it comes. I do not pretend that these are estimates; but I present them as conjectures that do not exceed the truth. This avoidance of crowding and delay, and increase of speed, would therefore reduce the cost to three-tenths of what it now is, or 45 cents instead of $1.50 per ton for average distances. But that is not enough; and it is not all that is practicable, even in the present condition of pavements.

Prof. Thurston showed that a road steamer, tested by him, worked at a fourth of the cost of horse power. Put steamers in the streets, and they will save three-fourths of the cost of horses, and part of the cost of drivers; and I venture the opinion that they will reduce the cost of street work to a sixth of what it now is, or 25 cents per ton for average distances.

There is talk of making a water-front street 250 feet wide, and laying rails in it. Without circumlocution I denounce this as superstition. We can do more work in a street half that width if we floor it with cast iron, and use road steamers for all the traffic, except that which comes or goes over the country railways; and for the flanges of the wheels that carry that traffic we may make grooves in the floors. As this denunciation will be regarded as something worse than superstition by those who have implicit faith in the engineering priesthood, I will assign some reasons for it.

First. The force of traction necessary on rails is much greater than on planes. The early railway men, even as late as '34, as may be seen in Pambour's treatise, believed that the wheel resistance was constant at all speeds. Probably they got this belief from the experiments of Coulomb, which showed that cylinders rolling on planes did not change their resistance with their speed. But they did not consider the cones and flanges of railway steels, and the oscillations which rub the flanges against the rails, and make the cones run on different diameters, and therefore slide more or less, as the wheels cannot turn on their axles. Scott Russell and Harding tried experiments to prove or disprove this adopted article of faith, and found that, at a very slow motion, the wheel resistance was 6 lbs. per ton, instead of 8 lbs., as their experiments showed; but the resistance increased with the speed, at the rate of one-third of a pound per ton for each mile per hour; so that at the ordinary speed of thirty miles per hour the wheel resistance was 16 lbs. per ton, instead of 8 lbs., as they had believed. And the resistance of locomotives is much greater. Experiments in France, two years ago, showed that two-driver engines had twice the resistance of carriages; four-coupled drivers had still greater resistance, and six-coupled engines had over 40 lbs. per ton resistance, at their usual speeds. And Mr. EASTMAN, in his treatise on "Horse Railways," estimates their resistance at 18¾ lbs. per ton, due chiefly to the dirt in their grooves.

Were these early railway engineers mistaken in believing that the resistance to cylinders rolling on planes is constant at all speeds? Who can adduce an experiment to prove them mistaken? I have not read or heard of one, and I have read of many to confirm that view; and I believe, and assume, that on an iron floor as level and smooth as rails the wheel resistance, including axle friction, will be 6 lbs. per ton at all speeds, or from half to a third of the resistance on railways.

Second. High average speed on railways is impossible, when stops must be frequent. On the Metropolitan the stops average five-eighths of a mile apart, and the average speed is 12½ miles per hour; and to get this speed they use 42-ton engines to draw 80-ton trains. But in under-grade streets, floored with iron, steam carriages could pass each other; and through carriages could run at forty miles per hour, while way carriages might turn out and stop at pleasure. And on suburban roads generally there would be the same advantage.

Researches on the Consumption of Heat in the Blast-Furnace Process.

By RICHARD AKERMAN.

Translated by Frederick Prime, Professor of Metallurgy in Lafayette College, Easton, Pennsylvania.

CONCLUDED FROM PAGE 4.

XLVII. So long as the blast is heated in cast-iron pipes, the temperature is kept within bounds by the danger of too rapidly destroying the apparatus; in order to avoid which, endeavors have been made, since the use of Siemens' Regenerative Principle, to apply this to heating the furnace-blast. The apparatus constructed of this type must always be in pairs (or threes), so that one (or two) is being heated by the burning gases, while the other one is heating the blast. And when this last has cooled to such a degree that the temperature of the blast has perceptibly decreased, the direction of the blast and gases is changed so that the gases pass into the oven which has just been cooled by the blast, while this last is forced through the apparatus previously heated by the gases.*

[The Author then describes WHITWELL'S Hot-Blast, and gives a drawing of the same. As this has, however, been altered since the article was written, it seems best not to reproduce it.]

[Before closing, I will here condense some of the more important portions of TURNER'S Introduction to the German Translation, it being understood that wherever the First Person is used this is done by TURNER. F. P.]

I believe that I am able to claim, without conceit, to have been the first to controvert the theory, recently prevailing, of the exclusive formation of carbonic acid in the hearth, in the so-called combustion zone of the blast-furnace. The more astonishing does it seem therefore, that I am now compelled to protest against the assumption that only carbonic oxyd, and no carbonic acid, is present in the lower portion of the furnace, as is assumed by BELL, AKERMAN, and others, in their calculations, since they assert that the carbonic acid formed at the first moment is at once and completely decomposed by the surrounding coals, glowing at a white heat, to carbonic oxyd. Nor can I accept the assumption of SCHINZ, that equal portions of carbonic acid and carbonic oxyd are formed.

I am convinced that there is no section of a blast-furnace, nor (to which I call attention) of a cupola-furnace in which only carbonic oxyd or carbonic acid are found, but that both these gases are present in varying proportions, dependent on various conditions, and that usually the upper portions of the furnace contain, as gas analyses show, the greater amount of carbonic acid, due to the commencing reduction of the iron ores.

This very varying proportion between carbonic acid and carbonic oxyd renders it impossible to calculate accurately the temperature produced in the lower portions of the furnace, and I can only in so far recognize this calculation to be correct as the whole temperature produced in the furnace-shaft is based on a reliable determination of the tunnel-head gases and the portion evolved from the fuel and the charge, as BELL has done. The determination of the furnace gases, by calculations based on certain assumptions, is theoretically very interesting and much less troublesome than a reliable determination of the average composition of the gases: but it cannot establish much confidence for the reasons stated.

The carbonic acid evolved from the charge, especially from the lime-stone flux, is calculated in different ways. While BELL assumes that the whole of this carbonic acid is only expelled at a temperature at which it will be converted to carbonic oxyd by the surrounding coal, AKERMAN leaves this influence entirely out of his calculation, as he asserts that it is impossible to state how much of this carbonic acid is changed to carbonic oxyd, and in so far as this does take place it is already contained in the twelve per cent. of coal charged, which has been assumed in his calculations to be altered during the reduction to carbonic oxyd. It seems to me that BELL'S plan is the best one of the two as it gives a more detailed insight, which is the chief aim of the whole calculation, and since, too, if not the whole, certainly by far the greater portion of the carbonic acid is in fact converted to carbonic oxyd. I asserted in 1859, in consequence of experiments I had made, that the carbonic acid expelled in the blast-furnace from uncalcined spathic iron, was almost completely altered to carbonic oxyd at the expense of the surrounding charcoal. If this is the case with spathic iron, so much the more must it be with limestone, since a somewhat higher temperature is required for its perfect decomposition than for that of spathic iron.

AKERMAN has very properly taken into account the heat necessary for the reduction of the silicon. While in the calculation for Swedish furnaces only 15 cal. are consumed, in English furnaces where pig iron is produced containing 2 per cent., and more of silicon, 15×8=120 cal., and more, are rendered latent. It would have been better if the amount of heat consumed by the decomposition of the gasified water, introduced by the blast, had been stated separately instead of subtracting this *together*, with the blast from the heat produced by the combustion of the coal. This is the more to be desired as the ill effects of a moist blast would have been rendered more prominent. The amount of heat carried off by the escaping gases must be considered as a more or less questionable quantity, both with respect to the quality and quantity of the gases as well as the heat brought into the calculation. This must depend on the cooling produced by the sides and bottom of the furnace, the forehearth and tymp, as well as the water used for cooling the tuyeres, although this last could easily be determined by direct experiments. The sum total of heat consumed is too small by several per cent., according to my views, as the whole calculation is based on the production of carbonic oxid alone.

AKERMAN correctly remarks that hitherto in the determination of heat gained by heating the blast, the fact has been entirely left out of account that the heat is brought into the furnace with the blast, to distinguish it from the heat produced in the furnace by burning the coal with the blast, without any increase of gas, which last, when escaping from the top, carries off more heat from the furnace. In paragraph XXXIII. it was shown that with a temperature of blast of 205° C., while the heat brought directly into the furnace by the heated blast amounted to 10.2 per cent. of all the heat which is produced in the furnace, a still further amount of heat is utilized, due to the decreased amount of gases, of 5.67 per cent., or a total of 15.87 per cent. But since in paragraph XXXV. it was shown that the average results of five furnaces in the Norberg district, with a temperature of blast of only 160°—200° C., and an inconsiderable increased capacity, were a saving in fuel of 24.5 per cent., it is evident that the saving in fuel must be due to some other influence of the hot-blast than the one just stated. This influence is the more active combustion which is produced by the heated blast, which AKERMAN does not deny, but does not give the prominence to which his own data actually show.

In my opinion this essential increase in the effect of the heated blast is to be sought for in the circumstance that in the zone of fusion of the blast-furnace, in which the highest temperature is necessary, a considerably higher temperature is actually produced. This increased temperature is not only due to the heat brought into the furnace by the hot blast, but is also a result of the more active combustion, together with the formation of a larger quantity of carbonic acid, which is not so instantaneously and completely again altered to carbonic oxyd, as BELL and AKERMAN appear to assume. It does not necessarily follow from the use of hot-blast that a greater quantity of carbonic acid must be found in the tunnel-head gases, it suffices if this is present in the lower portion of the furnace, where, particularly with refractory charges, it is often difficult to attain the desired temperature, while there is no difficulty in effecting the reduction and carbonization preceding it. The blast-furnaces in the Ural mountains have very recently afforded a proof that by using a hot-blast the temperature is actually more concentrated in the lower portion of the furnaces, since the introduction of hot-blast there has failed, owing to the furnace walls not being refractory enough. In other localities also, the use of a hot-blast has only been attainable by properly cooling portions of the hearth, and in some cases even of the boshes, with water-boxes.

I concur in AKERMAN'S views with respect to the influence of the heated-blast on the quality of pig iron produced; but cannot agree with him in the idea that a higher temperature of blast than that hitherto used is not advisable when making pig metal to be used in puddling or fining. It is indeed true that by increasing the temperature of the blast a pig iron would be produced richer in silicon and less suitable for the finery process, were not care at the same time taken to make the charge more basic, and also to diminish the pressure of the blast, and in some cases to have a greater diameter of hearth. Since it has been possible in Styria and Carinthia, with a temperature of blast of more than 500° C., to produce a very good grade of white to mottled pig, it is evident that this is an assured fact. If the higher temperature of blast is admissible without injuring the quality of pig iron, it appears to be shown that the greatest advantage can be attained by thus economising in fuel.

*I have been informed that the quality of the pig iron, produced in blast-furnaces whose blast is heated by ovens of this type, is very variable, owing to the constantly changing temperature of the blast. No hot-blast ovens of this type have, I believe, as yet been constructed in the United States. F. P.

The Longwall System of Mining.

By J. W. HARDEN, M.E.*

CONCLUDED FROM PAGE 20.

It is not uncommon to speak of longwall as rendering more infrequent the accidents by falls of the roof, but such is not unqualifiedly the case. As, for instance, where in post and stall the workings are divided into panels separated by strong ribs of coal, and an early "robbing" of the pillars takes place, the coal, having sustained no damage by standing, is as easily got and with as great a freedom from accident by falls. It is, moreover, absolutely necessary to the success of longwall work that the supply of prop timber and cordwood for chocks should be *ad libitum*, and that delay never takes place in the setting of it, whereas post and stall, in the nature of the work, is not so looked upon. Scores of accidents have taken place and are taking place daily, which a proper setting of timber at the right time would have prevented. In the mining of a thick seam by whatever method, there will be less accident by falls, if advantage is taken of the partings and it is mined in thin seams, two or more as the case may be, rather than mining it in one whole, and in such case longwall offers the greater facilities.

Owing to some peculiarity in the nature of the coal there are seams which are liable to spontaneous combustion; this in longwall work is the cause of much trouble. Though not common, we know of it in one of the seams of three of the Midland Counties of England. Whether these seams are associated with any particular period affecting them in common, does not appear, but from the local position of each we should think not. The peculiarity is attributed to the presence of iron pyrites contained in each of the seams or their roof, yet there are other seams containing pyrites that do not ignite. In the case of the Two Yard seam given in the section, however, decomposition of the pyrites in the black binds of the roof helping to make up the gob is clearly the cause, absorbing the moisture given off in the pit, and the gob gradually becoming consolidated. At a low temperature, 65 or 70 degrees, decomposition commences, sulphuretted hydrogen gas called by the miners "fire stink" is evolved, and ignition of the coal slack follows. The process is accelerated by a sluggish ventilation and consequent increase of temperature; if after stagnation the ventilation is increased, the ignition of the gob will be correspondingly quickened.

Here, then, in longwall advancing is an element of serious difficulty; once started, the trouble is only overcome by turning out the heated place and filling it up with sand or burnt stuff. Sanding off the gob immediately the "stink" is recognized, while it will not stay decomposition, will yet suffice to keep down actual ignition for a while, but leave only the smallest chink by which air can penetrate and that spot will soon be at a red heat.

In speaking of this condition of things at the Moira Colliery, MAMMATT, in 1834, and again FOWLER, in 1861, tell us, that to prevent the spontaneous ignition of the gob, a wall of well tempered clay, lengthened as the work advanced, was built up on each side the gob roads behind the packs and next to the gob, the object being to prevent the air circulating through the gob. And the purpose would seem to have been answered, as the plan is still followed.

In working the Two Yard coal the writer pursued an opposite course, and with much success. Mining the seam in panels, and aiming to prevent decomposition in the pyrites by keeping the gob dry, it was freely ventilated. This had the effect of reducing the temperature and lessened the local humidity, and, aided by rapidity of mining, enabled a panel to be worked out before any very serious interruption took place. Post and stall work had been made trial of, but without any mitigation of the trouble. Driving out the roads in the solid and mining back to the shaft, "retreating," as of old, where there is nothing to prevent it, is unquestionably the best method of working a seam, the gob of which is liable to spontaneous ignition.

Driving out to the extremity of the property before commencing to work the coal, is often opposed by the pecuniary circumstances of the operator who, if he can not turn out coal for the market immediately he cuts it, has not the means to go further. Even those who have the means, object that the return for capital employed is not rapid enough to meet their views; but for one of moderate expectations there is no reason why this method should not be pursued. If the extent of the property places the boundary several hundred yards away, a panel of work may be set out on either side the slope, after getting far enough away from the shaft, leaving a broad pillar between the slope and the panel, and mining for the market may be going on while the slope is at the same time being extended. Where the area to be mined is not great, the objection bears no comparison to the advantage.

In a dipping seam, with just enough water to be troublesome, but not enough to necessitate a pumping shaft, by driving a slope to the dip boundary, and mining back to the rise, the water is left in a pound behind, when, if from any cause it occasionally rises faster than the mining retreats, a water car may be run into the pound, by the slope, and the water drawn off. Water may be avoided by the same means, as in a case where the dip would have necessitated a shaft 1,670 feet deep, and the tapping and cost of putting back known and heavy feeders; whereas by sinking a shaft 900 feet deep, at the rise 2,700 feet off, those feeders were avoided, and 770 feet of sinking saved. It has its advantages also in the fact of there being no gob roads to maintain.

The more prominent advantages of longwall working are the ability to get out all the coal, and to get it out of a larger size; the reduction of the yardage and in consequence the largest amount of coal for the smallest amount of holing and side cutting, and the more ready and efficient manner by which the workings are ventilated.

With a dipping seam it is not only more advantageous to work to the rise, but absolutely necessary. One of the important features of the system is the continued gliding pressure of the roof on the face, which helps to bring down the coal after it is holed. Labor will also be saved by having a length of face in work, sufficient to let the coal stand two or three hours after holing before breaking up for turning out, as much of the coal will be brought down by that pressure. At the same time it is essential to success that the ground be got over as quickly as possible, particularly where the roof is jointed and tender, or the floor soft. Rapidity of mining will keep down the cost of production, while a halting pace on the contrary, will be productive of contingencies which need not here be enumerated, and increase it.

A hard or a long grained coal is best got out by longwall, while that of a soft prismatic structure is best got out by pillar and stall. The constant weight on the face of such a coal would crush it, and the best roof for either is a tough, broad interlaminated stratum that will bend rather than break, and having reached the gob, will continue to yield as the mining advances.

In pillar and stall work, where the stalls are driven out narrow and the pillars left of such a size that they are of strength sufficient to support the superincumbent weight without crushing, care being taken also to keep up the roof of the stalls, we have in the extra breadth of pillar a variety of longwork, by which the whole of the coal may be gotten and in the best possible condition.

In a seam with a thick and unyielding rock immediately over it, liable to sudden and heavy falls, longwall would be impracticable, except at the cost of all the advantages attributed to it. Neither would it be in place where the surface has to be sustained for the protection of buildings of value. Where the buildings are only secondary, and detached, it is better to mine right under them and let them settle with the surface. Canal and railroad companies find it less costly to raise their roads and banks as the surface settles, than to purchase an area of coal on each side that will keep their properties intact.

Of the relative merits of wood and iron props much has not been urged. In 1861 I heard the lamented PARKIN JEFFCOCK read a paper on the subject at a meeting of the North of England Institute, which paper, however, appeared to lack completeness, and do not think it was ever published. GREENWELL, who gives half a dozen lines to the subject in his second edition (1870) of "Mine Engineering," says, "If, instead of chocks, metal props are used, they may either be set upon the thill, in which case, if any heaving takes place, they require to be drawn by the aid of a powerful lever, or they may be set upon a chock placed upon small rubbish, and drawn as above described. These metal props weigh about half a hundred weight to the four feet length, and will support, without breaking, 60 tons each, if properly formed," and he gives a section, said to be the best. It is in the form of a cross, and has an areal measurement equal to that of a 2-inch square cast bar.

Measured by a comparative standard, the props ordinarily used, varying from 4½ to 7 inches in diameter, and of white oak, will carry 25 to 60 tons. It is not the weight of the whole superincumbent strata that has to be carried, but that part of it next the coal which, by its own weight, detaches itself in the general movement from the more enduring strata above it, and on the character of this, the roof stratum, will depend the strength and number of the props needed; if it is of a jointed and fragile description, a greater number of lighter props will be neccessary, than where of a broad and laminated character, when, while less in number they will need to be stronger, and whether of wood or iron, the same number of props in either case will be needed, and the same removals forward, as the mining advances.

But a timber prop will wear out, and often break, and in either case must be renewed, when an iron one under like circumstances will not. The question of comparative value then will appear to lie in the greater first cost and longer enduring character of the one, as against the lesser cost and less enduring character of the other, with which is associated the cost of labor in renewals, and the haulage of the material to the places of operation, a not unimportant item in a colliery where gang roads and bank faces are measured by miles.

While there is little need of argument at any time in favor of labor saving inventions, still less is there for any on the side of the coal cutting machine. The most irksome and laborious part of coal getting, and that needing most skill in the miner, is the holing, the undermining. This the coal cutting machine will sooner or later entirely supersede. The demand for coal and the scarcity of skilled miners will urge its adoption, and the longwall method of mining being that to which it can be most easily and profitably applied, there is matter for reflection to those about to open new fields of operation, or extending old ones, as to whether they had not better adopt longwall working at once and be prepared for the—most assuredly—coming change.

---

*A Paper read before the American Institute of Mining Engineers, at Pittsburgh, October 17, 1872.

The Milwaukee Iron Company, of Milwaukee, Wis., will turn out this year fully 35,000 tons of railroad iron and 32,000 tons pig iron. They employ about 1,000 men, and pay out every month from $70,000 to $75,000 for labor. The works will use this year 60,000 tons of soft coal, 20,000 tons of hard coal, 20,000 tons of coke, 25,000 tons of lime stone, and 70,000 tons of iron ore, about three-quarters of which is from Iron Ridge, forty-five miles from Milwaukee.

The Paleogeography of the North American Continent.

By T. Sterry Hunt, LL.D., F.R.S.*

(Continued from Page 18.)

The close of the paleozoic age in our Eastern basin was succeeded by movements which raised above the sea the vast accumulations of sediments whose history we have sketched, and exposed them, contorted and dislocated, to that process of erosion which, operating down to our own time, has given its present relief to the continental area now occupying the place of the former paleozoic basin. Unlike the old world, this eastern portion of the new has little to show for the long Mesozoic period during which so much of Western Europe was submerged. Along the Appalachian line, however, were formed in this age the remarkable sandstone deposits, of which those of the Connecticut and the Delaware are samples. The accumulations, many thousand feet in thickness, and made up in great part of the ruins of adjacent rocks, were formed in lakes or estuaries, and exhibit in their character evidences of rapid deposition in subsiding basins, a process which was accompanied by great volcanic activity in and around these areas. Somewhat later the deposits of Cretaceous and Tertiary time were laid down beneath the waters of an ocean which stretched along the eastern, southern and western shores of the now elevated paleozoic area. Sediments of these periods, moreover, occur in Greenland, Spitzbergen, and elsewhere within the Arctic circle, where strata, including coal and the remains of an abundant terrestrial flora, indicate as late as the middle Tertiary a climate in these far northern regions, as mild as that now prevailing in Pennsylvania and Ohio, and a vegetation not dissimilar. Did time permit, we might trace, with Dr. Gray, the probable southward migration of this ancient northern flora into our Appalachian region. That similar climatic conditions had existed in the Arctic zone, at a much earlier time, is apparent from the remains of an abundant vegetation in the carboniferous period; nor is it certain that the present rigorous climate was ever known there until the Miocene age was succeeded by that change which ushered in the present order of things, and, from the great part that ice played therein, is called the glacial period. To explain this changed condition of the arctic climate three classes of agencies have been invoked, viz.: astronomical, chemico-physical, and geographical. While the former are supposed to have produced variations in the amount of heat received from the sun, I have shown that the chemical changes which have been effected in the atmosphere, have served to render it less and less fitted to retain terrestrial and solar heat, and to protect the earth's surface from cooling by radiation, until a point was reached where we may suppose that changes in the areas of sea and land, and consequently in the distribution of warm equatorial currents, would suffice to produce over extreme northern and southern regions a temperature like that which in Greenland succeeded after a considerable but unknown interval to the mild climate of the Miocene time. While these latter are doubtless true causes adequate, either conjointly or separately, to produce a great refrigeration, it is by no means improbable that astronomical agencies may have coöperated. Even with the atmospheric conditions of earlier times, we may conceive glaciers to have existed in elevated regions and at high latitudes, and probable evidences of ice-action have been pointed out in the strata of paleozoic times.

The phenomena which in eastern North America and elsewhere are referred to the glacial period are the erosion of valleys and lake-basins; the rounding, grooving and polishing of rock surfaces; the accumulation of great masses of unstratified clay, sand and pebbles—the so-called boulder-drift—together with the formation of ridges, moraines, etc. To these succeeded the stratified marine clays and sands of what Dana has called the Champlain epoch, containing a fauna identical with that of our present northern seas. That these post-pliocene deposits show a temporary depression of the previously-uplifted continent far below its present level, and that ice in some form played an important part in the phenomena of the period, or of one immediately preceding, are points upon which all are agreed, but beyond this, wide divergences of opinion are met with, which concern primarily the time at which this submergence took place; and secondarily, the mode in which the ice-action was exerted to produce the striation, and the accumulations of unstratified material. On the one hand it is asserted by a large school that these were produced when the region was at its present altitude, or even much higher above the level of the sea, and was exposed to a wide-spread glacier-action. But among this school opinion is again divided. Thus, Agassiz maintains the existence of one immense continental glacier or ice-cap extending over the arctic and a great part of the temperate zone, moving downward from the polar region, and of such immense height as to surround and overflow the summits of our highest hills, which he supposes may have acquired a vertical thickness of two or three miles of solid ice. This great glacier, having its under side filled with fragments of rock, is conceived to have acted like a rasp, cutting, grinding and shaping the underlying rocky surface; and when the period of the gradual melting came, to have left behind it the glacial drift which we now discover. Dana, on the other hand, while maintaining that these phenomena are due to terrestrial glacial action, regards the motion of a central or common glacial source, or, in other words, a universal glacier, as unfounded, but supposes, nevertheless, the existence of distinct glaciers of enormous magnitude. Such a one, according to him, had its origin along the water-shed between the St. Lawrence and Hudson's Bay, but recognizing the necessity of an elevated source to give motion to the glacier, he supposes that this region, which is not more than 1,500 feet above the sea, was then raised many thousand feet above its present level, forming a mountain plateau from which an immense glacier spread southeastward to the ocean, filling the St. Lawrence valley, and covering with its icy mantle both the Green Mountains and the White Mountains, precisely like the continental ice-cap of Agassiz. The movement of such a glacier, however it may serve to explain the southeastward striation of the Ottawa valley and of New England, leaves unaccounted for the not less distinct evidences of glacial action in a transverse direction, which are seen from Labrador up the St. Lawrence valley as far as Lake Erie. These evidences consist alike of the striation everywhere visible, and in the forms of isolated hills of eruptive rocks which, rising from the champaign country in the vicinity of Montreal, have bold and rounded fronts on their northeast sides, while their ruins form a talus to the southwest, and have even been transported long distances in this direction. All of these facts combine to show a long-continued eroding action from the northeast. Prof. Dana would explain this by a supposed southwestward flow of the lower part of the great glacier in this direction, along the St. Lawrence valley, while its upper portion was moving in a transverse course across the mountain ranges of the Appalachians towards the sea. But this, even if we admit its adequacy to explain the phenomena of the St. Lawrence valley, leaves unaccounted for the extension of the same southwestern striation around the basins of the great lakes as far as Michigan and Superior, to explain which would require the creation of another great glacier in the northern regions.

In both of the above theories of glacial action, a great depression of the surface is supposed to have succeeded the glacial period, effacing in the one case the great mountain plateau to the northward, and submerging the glaciated region so as to permit the deposition above its surface of the stratified clays and sands which so often overlie the boulder-drift, from the re-arrangement of which they appear to have been in part derived.

Besides these theories which seek to explain the various glacial phenomena by the action of ice upon solid land, there is a third view which, while maintaining the intervention of local glaciers, supposes that by far the greater part of the results which we have described was produced by sea-borne ice during a period of submergence. This view, which has been advocated by Dawson, endeavors to explain the phenomena in question by causes now in operation rather than by supposing a condition of things which it is at once difficult to conceive and to explain—and is thus more in harmony with the principles of modern geological science. It maintains that at the beginning of the glacial time, whose record is written in such marked lines over the surface of northeastern America, the region was already under water, and was slowly rising, though with minor oscillations of level, from the ocean, the more western portions first.

Along the eastern border of the land, over its still submerged plains, and through its valleys then flowed the arctic current as it now does along the coast of Labrador and the shores of Newfoundland, bearing its great quantities of floating ice, by the combined action of which, with the current, the rocky strata were eroded, and the valleys and lake basins excavated. At an early period in this order of things, the great arctic stream pursuing, in obedience to the force impressed upon it by the earth's rotation, a southwestern course, passed over the region of the lakes and excavated the basins of Superior, Michigan, Huron, and Erie; while at a later time, diverted further eastward by the emergence of the Laurentides, it would pass along the present St. Lawrence valley, and thence southwestward to that of the Mississippi. To quote in this connection the language of Dawson "The prominent southwestern striation, and the cutting of the upper lakes demand an outlet to the west for the arctic current. But both during depression and elevation of the land, there must have been a time when this outlet was obstructed, and when the lower levels of New York, New England, and Canada were still under water. Then the valley of the Ottawa, that of the Mohawk, and the low countries between Lakes Ontario and Huron, and the valleys of Lake Champlain and the Connecticut would be straits or arms of the sea, and the currents obstructed in its direct flow, would set principally among these, and act on the rocks in north and south, and northwest and southwest direction. To this portion of the process I would attribute the northwest and southwest striation."

As the process of elevation proceeded and the northern current found its passage to the sea by channels further and further east, the conditions became such as to permit the deposition from seas comparatively undisturbed, of the stratified clays and sands, which, in many cases, rest directly on the boulder-clay. Such beds, with marine fossils, are found in the St. Lawrence valley, at heights nearly 500 feet above the sea, and others, though without fossil remains, at much higher levels. Portions of floating ice, however, still dropped from time to time the rock-masses with which they were freighted, in the midst of these stratified clays, nor are there wanting evidences in the lower St. Lawrence that a second invasion of icebergs may have given rise to a new accumulation of boulder-drift, after the deposition of the stratified clays which these overlie, at Trois Pistoles, a still older deposit of the same kind, as noticed by Dawson. Such a result might readily follow from a small local and temporary depression of level during the general elevation.

That some oscillations of the kind took place during this period may be inferred from certain facts in the history of the great lakes. The basins of these, according to Dr. Newberry, are so connected with each other and with the sea, by channels now filled with drift deposits, that were these removed and the continent slightly elevated, the waters of the great lakes would be discharged through each other into the ocean by the valleys of the Hudson and the Mississippi. The lake basins of Michigan, Huron, St. Clair and Erie in fact, occupy a great depression which was first excavated in the nearly horizontal paleozoic strata, and then filled up with stratified clays, in which the present basins were subsequently fashioned, so that from alternations of level, the process of lake erosion has been repeated over this region.

TO BE CONTINUED.

* Abstract of an address before the American Geographical Society, New York, November 12, 1872.

THE COAL TRADE.

NEW YORK, Jan. 16th, 1873.

There is no change in the trade, and business is still quiet with little prospect of a change for a month or two. The Reading railroad pool continues to be the absorbing subject of contemplation. The daily papers have been full of it, and Mr. GOWEN has finally explained his purposes in a letter to the *Tribune*. He says:

"In consequence of a combination, or ring, or syndicate (or whatever the modern term for an association to raise prices may be), among the retail coal dealers, the citizens of Philadelphia have been for many years paying from $2 to $3 per ton for their coal more than the price at the mines and the cost of transportation to Philadelphia amounted to. Coal has been selling at retail in Philadelphia at from $7 to $8 per ton, when the entire cost, delivered in the yard of the retailer, was from $4 53 to $5 18 per ton. The consequence was that while the owner of the colliery got but a small price for his coal at the mines, and the miners and laborers who produced it were paid upon a basis by which their wages were regulated by that low price, the consumer had to pay an enormous sum for his coal, and small manufacturing establishments felt the discrimination against them very seriously. Finding it impossible to break up this combination in any other way, the company has opened large retail yards, and is selling coal at from $1 50 to $2 per ton less than the price previously charged, although the rate obtained by the Company affords some profit over and above the wholesale price of coal at the mines, the freight charged for its carriage, and the cost of handling it in the yards.

The great aim of the Company has been to protect the three classes of people who are the most deserving, viz.: The owner of the colliery, whose capital is invested in a precarious business; miners and laborers, whose toil produces the coal and whose wages depend upon its price; and the public who consume it for fuel. By bringing the producer into direct communication with the consumer, the intermediate profits will be saved, and no one injured except the middlemen, who have not a dollar invested in mining coal and whose complaints are echoed in the communication to which I have referred."

The road proposes, according to him, to do the work of the factors for about one-third their charges; and Mr. GOWEN repeats in print the assurances he made personally to the colliery proprietors, that the *status* of those who rejected his offer should be hereafter just what it is now. The dealers do not, so far as we know, deny the truth of what Mr. GOWEN says, and the complaint they make is that he is taking away their business, a fact which he makes plain enough himself. A meeting of the disaffected was held in Philadelphia on Monday, but nothing except organization was effected. It is not expected in this city that anything will be done in a legal way, because the dealers cannot imagine what steps can be taken successfully. Another meeting between Mr. GOWEN and the proprietors is to be held in Philadelphia to-day, and one in this city to-morrow.

It cannot be doubted that the effect, if not the original purpose of the scheme is to increase the price of coal at the mine. If in doing so Mr. GOWEN can still reduce the cost of coal to the consumer, as he says he can in Philadelphia, it would be difficult to find any broad ground of criticism of his measure. Even if that is not done, there can be no reasonable objection to a rise in the price of coal, provided the advance is made in the interest of the producers. A glance at the prices of coal for the last half dozen years will show that the average price for 1872 was at least a dollar below that of previous years. A fall like that is very pleasant to the consumer provided he gets the benefit of it, but it is ruinous to the coal business. Under this view of the circumstances it is quite probable that Mr. GOWEN will find many of the large companies willing to act with him. It is understood that the Scranton Company will not give up its auction sales, and that the Pennsylvania Company will always be independent. But that there is unity of desire to see coal ruling 50 to 70 cents higher this year than last, is undeniable, and the early spring will probably see steps taken to accomplish the advance. Already coal is reported to be 25 cents higher in Philadelphia.

The differences between the operators and miners of Schuylkill County have been settled, the men offering to accept $2 50 minimum for contract work, and $2 75 for days wages, sliding up one cent in three, and the operators agreeing to the arrangement. This settlement is received with satisfaction, and work has already been resumed.

The bituminous trade is very dull, and there is nothing to report but trouble in Ohio. A despatch from Lawrence, in that State, says that the miners in the Tuscarawas Valley threaten to strike on Monday next, on account of the operators deciding on a reduction of twenty cents per ton. The miners offer to accept a reduction of ten cents a ton, and have given the operators until Monday to decide, and if not acceded to they will strike. This will be a serious blow to mining in Ohio, and it is reported that both parties are quite determined.

Anthracite Coal Trade for 1871 and 1872.

The following table exhibits the quantity of Anthracite Coal passing over the following routes of transportation for the week ending July 10, 1873, compared with the week ending Jan. 12, 1872.

COMPANIES.	1872. WEEK.	1872. TOTAL.	1873. WEEK.	1873. TOTAL.
*Phila & Reading R. R†	36,686	316,726	32,500	348,818
*Schuylkill Canal	..	13,356	...	6,591
*Lehigh Valley R. R.	56,633	338,262	48,144	258,033
Lehigh & Sus. R. R.	26,740	43,430	35,676	48,116
Lehigh Canal	....	....	....	....
Scranton North	12,763	23,059	13,001	19,586
" South	48,263	85,196	35,561	54,492
Penn. Coal Co. rail	16,443	29,469	16,575	24,354
" " " canal	....	....	..	....
Del. & Hud. Canal Co.	....	....	....	....
" " East	13,848	24,495	6,938	12,563
" " West	....	5,312	9,351	13,213
" " South	8,564	14,567	7,285	9,542
Shamokin	6,129	8,566	11,731	15,415
Trevorton	....	......	....	....
Lykens Valley Coal Co.	....	....	....	....
Wyoming North	....	......	....	....
Wyoming South	....	......	....	....
P. N. Y. C. & R. R. Co.	....	....	10,727	58,526
Williamstown Col'y	....	....	....	....
Big Lick Col	....	....	....	....
Total	226,129	893,438	227,489	866,752
1870		866,752	226,129	
Increase	....		1,360	
Decrease		26,686		

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

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

Bituminous Coal Trade, 1871 and 1872.

The following table exhibits the quantity of Bituminous Coal passing over the following routes of Transportation for the week ending Jan. 11, 1873, compared with week ending Jan. 30, 1872.

COMPANIES.	1871. Week.	1871. Year.	1872. Week.	1872. Year.
C. & O. Canal	..	....	....	....
B. & O. R. R.	34,069	34,069	31,351	31,351
Penn. S. Line	....	......	3,164	3,164
H. & B. T. R. R.	....	....	....	....
*Harrisburg & D	9,910	53,060	4,480	26,122
*L. V. R. R.	....	....	.270	2,253
P. & N.Y.C. & R. Co.	4,376	32,972	5,186	28,925
Cumberl'd Branch Canal	....	....	....	....
" Railroad	....	....	....	....
Total	48,355	120,101	44,651	91,815
	44,651	91,815		
Decrease	3,704	28,286		
Increase				

Philadelphia & Reading Railroad and Branches.

COAL TONNAGE

For the Week ending Saturday, Jan. 11, 1872.

	Total for Week.	Corres-p'g week last year.	Increase and Decrease.
Passing over Main Line and Leh. Val. Branch	16,892 16	29,169 06	d 12,276 10
For Shipment by Canal			
Shipped Westward via Northern Central R. R.	5,855 11	2,968 19	i 2,886 12
Shipped West or South from Pine Grove	101 06	402 05	d 300 19
Consumed on Laterals	2,035 14	2,773 15	i 261 19
Lehigh and Wyoming Coal	6,614 18	1,371 17	i 5,243 01
Total Anthracite paying freig't	32,500 05	36,686 02	d 4,185 17
Bituminous	4,479 12	9,909 15	d 5,430 03
Total of all kinds paying freig't	36,979 17	46 595 17	d 9,618 00
Coal for Company's use	4,657 08	6,888 14	d 2,231 06
Total Tonnage for Week	41,637 05	53,484 11	d 11,847 06
Previously this year	374,449 19	385.761 08	d 11,311 09
Total to date	416,087 04	439,245 19	d 23,158 15
SHIPPED BY CANAL.			
From Schuylkill Haven			
" Port Clinton			
Total Tonnage per Week			
Previously this year			
Total to date	6.594 00	13,355 19	d 6,761 16

Lehigh Coal and Navigation Company,

Report of Coal transported over the Lehigh Canal and L. & S. Div of Central Railroad of New Jersey for the week ending Jan. 11, 1873, and for the year 1873.

	WEEK.	YEAR.
Forwarded East of M'ch Chunk by Rail	35,675 16	48,115 15
Delivered at and above do.,	2,316 13	3,149 11
Forwarded East of do., by Canal	......	
	37,992 09	51,265 06
Corresponding period last year—		
Forwarded East of M. Chunk by Rail	26,740 04	43,430 04
Delivered at and above do.,	1,727 04	3,065 05
Forwarded East of do., by Canal	......	
	28,467 08	46,495 09
Increase on Railroad	9,525 01	4,769 17
Decrease " "	......	
Increase on Canal	......	
Decrease " "		
Of the above there was transported on account of—		
Lehigh Coal Nav. Co.	13,009 04	16,472 03
Wilkesbarre Coal & Iron Co.	12,905 08	18,546 15
	25,914 12	35,018 19
Corresponding period last year—		
Lehigh Coal & Nav. Co	10,739 06	16,881 13
Wilkesbarre Coal & Iron Co.	11,057 02	17,134 00
	21,796 08	34,015 13
Increase	4,118 04	1,003 06
Decrease		

Pennsylvania Coal Company.

Shipments of Pittston Coal for the week ending January 11, 1872.

	1873. WEEK.	1873. YEAR.	1872. WEEK.	1872. YEAR.
By Railway	16,575 10	24,353 18	16,442 17	29,469 09
" Canal	....		....	
Total				
Increase 1873.	5,115 11			

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

Week ending January 11—Compared with same time last year.

WHERE SHIPPED FROM	WEEK 1872, tons ct	WEEK 1871. tons ct.	YEAR 1872 tons cwt.	YEAR 1871. tons.cwt.
Wyoming Region	27845 08	16874 18	37608 09	26925 05
Upper Lehigh Region	4364 18	3508 06	5950 04	6436 19
Beaver Meadow Region	3769 00	2092 13	5040 13	4647 11
Hazleton Region	298 15	150 10	335 14	278 18
Mauch Chunk Region	6202 09	8226 07	7302 14	14383 08
Tresckow Region				
Mahanoy Region				
Totals	42480 10	31612 02	56237 14	51671 01
Increase	10838 08		4566 13	
Decrease				
DISTRIBUTION.				
Forwarded East of Mch Chunk by Rail	35675 16	26740 04	48115 15	43430 04
Forwarded East of Mch Chunk by Canal				
Delivered at and above Mauch Chunk	2316 13	1727 04	3149 11	3065 05
L. V. R. R at Packer'n	784 05	377 18	979 15	550 04
Delivered to L. & B. R. R. at Plymouth Bridge	3703 16	2796 16	3992 13	4525 06
Totals				
Of the above there was transported on acc'nt of L. C. & N. Co.	13009 04	10739 06	16472 04	16881 13
W.-B. C. & I. Co.	12909 08	11067 02	18546 15	17134 00
Totals	25914 12	21796 08	35018 19	34015 13
Increase	4118 04		1003 06	
Decrease				

Report of Coal Transported over Lehigh Valley Railroad

Report of coal tonnage for the week ending Jan. 11, 1872, with totals to date, compared with same time last year.

WHERE SHIPPED FROM.	WEEK. Tons. Cwt.	TOTAL Tons. Cwt.
Total Wyoming	10,219 09	58,952 16
" Hazleton	31,675 03	157,518 06
" Upper Lehigh	11 11	355 03
" Beaver Meadow	12,479 06	59,586 14
" Mahanoy	3,025 19	31,354 11
" Mauch Chunk	53 03	141 13
Total	57,464 11	307,907 03
Same time last year	62,078 13	378,526 13
Increase		
Decrease	3,614 02	70,619 10
Forwarded East from Mauch Chunk by rail	48,144 13	258,033 02
Same time last year	56,633 08	338,262 10
Increase		
Decrease	8,488 15	80,229 08
DISTRIBUTED AS FOLLOWS.		
Forwarded East from Mauch Chunk by rail	47,244 11	253,008 08
do East for use L. V. R. R	900 02	5,024 14
Delivered at and above Mauch Chunk for use of L. V. R. R.	1,352 08	7,146 04
To P. & N. Y. R. R	5,858 13	33,128 10
To N. C. R. R., at Mount Carmel		959 19
To D. H & W. R. R.	1,230 06	3,211 08
To L. & S. R. R. at Packerton for rail		1,463 11
Delivered at M'h Chunk	443 00	423 03
Delivered on line of road above Mauch Chunk	86 15 316 18	1,975 06
To L. S. & R. R., at Penn Hav., for railroad		1,541 10
Do. for canal	22 00	
To Lehigh Canal Mauch Chunk		
To Catawissa Railroad	10 00	25 00
Total	57,464 11	307,907 03

Delaware Lackawanna & Western Rail Road Company.

Coal transported on the Delaware, Lackawanna, & Western Railroad for the week ending Saturday, Jan. 13, 1873.

	WEEK. Tons. Cwt.	YEAR. Tons. Cwt.
Shipped North	14,001 02	19,586 03
Shipped South	35 561 04	52,492 05
Total	48,562 06	72,078 08
For the Corresponding time last Year:		
Shipped North	12.7 3 05	23,058 16
Shipped South	48,262 13	86,196 02
Total	61,025 18	109,254 18
Increase		37,176 10
Decrease	12,463 12	

Statement of Coal Transported over Cumberland and Pennsylvania Railroad

During the 10 days ending Tuesday Jan 11. 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.
1872	—	31,341 13	3,163 19	34.515 12
1871	—	34,068 12	....	34,068 12
Increase	....	....	3,163 19	447 00
Decrease	—	2,716 19	....	

YEAR.

	C. & O. C'l. Tons. Cwt	B. & O. R R. Tons. Cwt.	Pa. S. Line Tons. Cwt.	Total. Tons. Cwt.
1872	—	31,351 13	3,163 19	31,515 12
1871	—	34,038 12	....	34,068 12
Increase	....	....	3,163 19	447 00
Decrease	—	2,716 19	....	....

Cumberland Branch R. R.

WEEK.

	To C. & O. Canal. Tons. Cwt.	To B. & O. R. R. Co. Tons. Cwt.	Total. Tons. Cwt.
1872	—		
1871	—	302 05	302 05
Increase	—	......	......
Decrease	......	302 05	302 05

YEAR.

	To C. & O. Canal. Tons. Cwt.	To B. & O. R. R. Co. Tons. Cwt.	Total. Tons. Cwt.
1872	203,617 16	26,063 16	229,687 12
1871	194,253 07	71,490 16	265,744 03
Increase	9,364 09		
Decrease		45,421 00	36,056 11

Penn. and N. Y. R. R.—Coxton, Pa.

Coal tonnage for week ending January 4, 1872.

	Week. Tons. Cwt.	Total. Tons. Cwt.
Anthracite received :		
From Lehigh Valley R. R.	5,858 13	33,128 10
" Lack. & B. R. R.	791 00	4,621 09
" Pleasant Valley R. R.	3,315 17	16,546 09
" Sul. & Erie R. R.	761 11	4,229 18
Total	10,727 01	58,526 06
Same time last year	6,771 14	51,949 01
Increase		6,577 75
Decrease	3,995 07	
Distributed :		
To Lehigh Valley R. R.	359 19	5,344 11
To Lack. & B. R. R.	17 13	159 10
To S. Central R. R.	1,423 02	11,498 19
To Ithaca & A. R. R.	1,605 16	7,588 08
To Erie R. W. Pockets for shipm't.	4,224 13	18,102 14
To individuals on line of road	1,002 13	5,984 08
To points at & above Coxton for use of Co.	481 08	2,775 09
To points between Waverley and Elmira	1,541 17	7,162 06
Total	10,727 01	58,526 06
Bituminous received from BARCLAY R. R.		
Shipped north from Towanda	5,173 10	28,770 04
Shipped south from Towanda	13 04	154 15
Northern Central R. R.	....	
Total	5,186 14	28,924 19
Same time last year	4,376 03	32,971 19
Increase		
Decrease	810 11	4,047 00
Distributed :		
To Erie Railway	3,949 12	23,650 19
To So. Central R. R.	1,194 18	5,055 08
To Ithaca Valley R. R.	29 00	59 00
Lehigh Valley, R. R.	....	111 04
To individuals on line of Railroad.	13 04	48 08
To points on line of road for use of Company	......	
Total	5,186 14	28,924 19
Grand totals transported :		
Anthracite	10,727 01	58,526 06
Bituminous	5,286 14	28.924 15
Total	15,913 15	87,451 05
Same time last year	11,147 17	84,921 00
Increase		
Decrease	4,765 18	2,530 05

Productions of Coal in the Blossburg, Ralston and Towanda Coal Regions for the year 1872.

Blossburg Region :		
Fall Brook Coal Company	223,967 00	
Fell Brook at Antrim	9,827 00	
Total Fall Brook	233,694 00	
Morris River Coal Company	318,079 00	
Blossburg Coal Company	297,489 00	
Total	849,262 00	815,079
Ralston Region :		
McIntyre Coal Company	171,427 00	106,180
Towanda Region :		
Towanda Coal Comuany	263,960 00	
Eall Creek B. Coal Company	118,982 00	
		378,335
Total of three Regions	1,403,531 00	1,299,545
Increase		103,987

Prices of Coal by the Cargo.

[CORRECTED WEEKLY.]

	AT NEW YORK. January 10. R. A.	W. A.	AT PHILADELPHIA January 10. R. A.	W. A.
SCHUYLKILL.				
Lump	$- —	$- —	- —	
Steemer	- —	- —	- —	- —
Broken,	- —	- —	- —	
Egg	- —	- —	- —	- —
Stove,	- —	- —	- —	- —
Chestnut,	- —	—	- —	
Pea	- —	- —	- —	- —
LEHIGH.				
Freight to New York 50 cents.			- —	- —
Lump, (on board)	- —	5 00	- —	—
Broken	- —	4 75	- —	- —
Egg	- —	4 75	- —	—
Stove	- —	5 10	- —	- —
Chestnut	- —	4 15	- —	—
Pea	- —	- —		
SPECIAL COALS.*			- —	- —
Honey Brook, Le'h W. A.		4 15@5 10	- —	- —
Spring Mountain " "		- —@- —	- —	- —
Sugar Creek... " "		- —@- —	- —	- —
Sugar Loaf.... " "		- —@- —	- —	- —
Old Compy's... " "		4 15@5 10	- —	- —
Room Run..... " "		4 15@5 00	- —	- —
McNeal....... " "		- —	- —	- —
Girardville.... " "		—	3 10@4 00	-
Hill & Harris.. " "		- —	- —	- —
Shamokin..... " "		- —	- —	- —
Lykens Valley. " "		- —	- —	- —
Broad Top..... " "		- —	3 25@4 25	- —
McMichael.... " "		- —	- —	- —
Henry Clay.... " "		- —	- —	- —

Company Coals.

January, 1873.

	L.	Str.	Gra.	Eg.	Sto.	Chest
*Scranton at E. Port	4 00	3 95	4 10	4 40	5 00	3 90
*Pittston at Weehawken	4 75	4 25	4 40	4 40	4 90	4 25
*Lackawana at Weehawken	4 20	4 30	4 40	4 65	5 10	4 30
Wilk'b're at Hoboken	4 00	4 20	4 40	4 50	5 00	4 00
Old Co. Lehigh at Pt. John'n	5 25	—	4 85	4 90	5 15	4 15
Lehigh at Eliz. Port	5 00	—	4 75	4 75	5 10	4 15

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

Prices at Baltimore—January, 1873.

Wholesale Prices to Trade.

Wilkesbarre, by cargo or car load	$5 35@5 60
Pittston and Plymouth, do.	5 25@5 50
Shamokin Red or White Ash, do	5 50@5 75
Lykens Valley Red Ash, do	6 25@6 50
Zerba Valley	
Treverton	
By retail, all kinds per ton of 2,240 lbs	7 25@7 50
George's Creek and Cumberland f. o. b. at Locust Point for cargoes	@4 75
Fairmont and Clarksburg gas f. o. b. at L. Point	6 00
BITUMINOUS COALS.	
Kittaning Coal Co.'s Phœnix Vein, f. o. b. at Phila.	$
Lemon " " "	
Cumberland Vein Coal	4 75
Consolidation Coal Co.'s on board at Baltimore	4 75
Maryland Coal Co "	4 75

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

January, 1873.

George's Creek and Cumberland f. o. b. for shipping $4 35@4 50 [nominally.

No coal before spring.

Prices at Havre de Grace, Md.

January, 1873.

Wilkesbarre and other White Ash for Cargoes......$	@4 75
Lykens Valley	@5 75
Shamokin Red or White Ash	5 00

Bituminous Coals (Cumberland).

Georgetown, F.o.b.	$
Baltimore "	4.75
New York "	7.50

Prices of Foreign Coals.

January, 1873.

Duty 75 c. per ton.

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

Liverpool Gas Caking	Nominal.
" " Cannel	15 00@16 50
" House "	22 00@23 00
" Orrel.	17 00@18 00

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

PRICES FROM YARD.

Liverpool House Orrel, screened	$20 00@22 00
"Cannel, "	23 00@25 00

Per ton 2.000 lbs. delivered.

Prices of Gas Coals.

January, 1873.

PROVINCIAL.

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

	Coarse	Slack.
Block House	$2 00	$1 00
Gowrie	1 75	— 80

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

	Coarse.	Culm of Coal,
Picton...nett	$2 25	1 25
Sydney	2 25	- 80
Lingan	1 75	- 80
Caledonia	1 75	- 80

A discount from the prices of tne 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	$7 10 @- —
Fairmount Gas Coal Co. of N. Y	7 00 @- —
Despard Coal Co	7 00 @- —
Penn	7 10 @- —
Newburg Orrel Gas	- — @- —
West Fairmount Gas Coal	7 00 @- —
Redbank Cannel, Penn	- — @- —
AT PHILADELPHIA.	
Westmoreland	7 00 @- —

Freights.—January, 1873.

TO EASTERN PORTS.	Cumberland. From Georgetown.	From Baltimore	Anthracite. From Philadel'a.	From Eliz. Port, Port Johnston, and Hoboken.	From Newburgh.	From Rondout...
Amesbury						
Bangor				3 00		
Bath		4 25				
Boston	3 10	4 25	3 00	3 00		
Bridgeport	2 75	3 ½	1 00	1 00		
Bristol			2 00	1 50		
Cohasset Nar'ows	2 25		1 25			
Derby			ice	1 25		
Dighton	2 85		ice			
East Cambridge.			ice	3 20		
Fall River	2 75	3 ½	2 00	1 50		
Hackensack						
Hartford		3 25	ice	ice		
Hoboken	2 10		50	50		
Jersey City	2 10		50	50		
Lynn			1 35			
Middletown			ice	ice		
Mystic			3 25	1 40		
New Bedford.	3 00	3 25	2 00	1 50		
Newburyport	3 10	4 25	3 25	3 25		
New Haven	2 75	3 ½	1 00	1 00		
New London	2 75	3 ½	1 35	1 25		
Newport	2 30		2 00	1 50		
New York	2 25	3 ½	50	50		
Norwalk	2 50	2 ½	1 00	1 00		
Norwich			1 60	ice		
Pawtucket			2 10	ice		
Portland	3 25	4 25	2 70	2 75		
Portsmonth, N.H		4 25	3 15	3 15		
Providence	2 75	3 ½	2 00	2 00		
Rockport			1 35			
Saco			3 00			
Sag Harbor			1 40	1 35		
Salem	2 70	4 25	3 00	3 00		
Stamford			1 00	1 00		
Stonington			1 40	1 35		
Tannton			ice	2 00		
Warren.			2 00	1 50		
TO RIVER PORTS						
Albany						
Catskill						
Cocksackie						
Coeyman's						
Cold Spring	2 30					
Fishkill						
Haverstraw						
Hndson	3 25					
New York						
Nyack	2 25					
Poughkeepsie	2 50					
Rhinebeck						
Rondout						
Sangerties						
Sing Sing						
Stuyvesant						
Tarrytown						
Troy	3 00					
West Point						
Yonkers						

St. Thomas	$5 00 Gold.
Martinique	5 00
Demerara	8 00
New Orleans	6 00
Mobile	6 00

Foreign and Provincial Freight

January, 1873.

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

TO NEW YORK.

Provincial	
Sydney	$3 05
Lingan	3 50
Cow Bay	3 75
Port Caledonia	3 10
Little Glace Bay	3 00

TO BOSTON.

Sydney	3 00
Lingan	3 00
Cow Bay	3 00
Port Caledonia	3 00
Little Glace Bay	2 90

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 Manch Chunk to Phillipsburgh	$0 72
C. R. R., N. J., Phillipsburgh to Elizabethport	1 06
Shipping expenses at Elizabethport	25
Wharfage	10
Total	$2 23

MAUCH CHUNK TO PORT JOHNSTON.

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

TO HOBOKEN

L. V. R. R., Manch Chunk to Phillipsburgh	72
Morris & Essex R. R. Phillipsburgh to Hoboken,	1 06
Shipping expenses	25
Wharfage	10
Total	$2 23

TO SOUTH AMBOY.

L. V. R. R.	72
B. & D. R. R. } Cam. & Am. R. R. }	1 06
Shipping Expenses,	25
Total	$2 23

PENN HAVEN TO ELIZABETHPORT.

L. V. R R. Penn Haven to Phillipsburgh	0 84
C. RR. of N. J. Phillipsburgh to Elizabethport	1 06
Shipping expenses	15
Wharfage	20
Total	$2 35

MARKET REVIEW.

NEW YORK, Jan. 16, 1873.

IRON.—Scotch Pig is in a very qniet sta'e, and the condition of the market, with increased cost of the article on the other side, and little or no demand from consumers here, is far from favorable to all the parties concerned. Consumers continue to buy only for actual wants, and, of the late arrivals, about one-half has been placed in store. The sales are unimportant and confined to small parcels. American Pig is also quiet, but prices generally, though without quotable change, have a tendency upward. Most of the companies having placed nearly all their production at present ruling rates, and, now having light stocks, dislike to make further contracts, and are offering but little at present. We understand that during the past week or ten days there have been nearly 100,000 tons sold for future delivery, including those noted below and in our recent issues. We notice 1000 tons Thomas to a consumer, on private terms; 1000 do. No. 1 Allentown and Coleraine at $46; 15,000 do. best Grey Forge, $40a$42; 6,000 do. Manhattan Nos. 1 and 2 private terms; and 500 do. No. 1 X Crane, deliver up to July, reported at $50. New English Rails are quoted on the other side at £10 15s., and here $74a$75 gold, without business. American are quiet at $80 currency at the mills in Pennsylvania. Old English are quiet and the only demand is from parties to hold for higher rates; a sale of 500 tons D. H. were made at $55 4 mos. and interest, but now generally held at $55a$57,50. Scrap is dull and very quiet, but though there is very little demand, holders show no disposition to sell except at $50a$55 from yard, while from dock there is little or nothing offering; 100 tons No. 1 sold at $55, and mixed lot of 60 tons Scrap and 140 do. old Rails at a private price for the lot. Refined Bar continues firm at our quotations.

PRODUCTION OF AMERICAN IRON.—The National Association of Iron Manufacturers held its annual meeting in Philadelphia last week. Seventy mills were represented and the most confident and hopeful spirit prevailed. The growth of the Iron industry in this country during the last ten years is one of the marvels of the times. It was stated by the secretary that the building of one hundred and five new blast furnaces was begun and completed last year, and it is expected twenty-nine others will be built this year. There were also thirty-five new rolling-mills constructed last year, some of which were of very large size. Besides this, almost all the existing works added improved machinery, or otherwise increased their productive capacity. Ten other rolling-mills are projected. The Iron manufactures, and the large communities which have sprung up wherever they have been established, owe their prosperity primarily to protection, and are perhaps the most striking vindication of the wisdom of that policy.

NORTH OF ENGLAND IRON TRADE.—For delivery next year the price of No. 3 is 100s., and some makers ask more. Considerable uneasiness is manifested on account of the action of the iron-stone miners at the Eston mines. At present there is every reason to believe that the Iron trade next year will be satisfactory.

A late Liverpool paper says Wolverhampton accounts state that the improvement in Iron has been maintained, and some tolerable orders have changed hands at slightly firmer rates. The prospects of trade in the new year are generally hopeful. Pig is fractionally higher, but makers are reluctant to enter into large engagements until the course of the market is more clearly defined.

BIRMINGHAM, Dec. 26.—The improvement noted last week continues to be maintained, and prices tend to a higher range. Best qualities of Pig are worth 10s. per ton more than this day fortnight, and a proportionate advance has been established in most descriptions of finished Iron. The extent of the business done leads to the belief that Bars will shortly be raised to £14. It is said that orders for finished Iron have been booked by the leading firms at an advance of £1. Sheets and Plates are correspondingly firm, singles of good makers being quoted at £15, while in some cases 10s. more is demanded. Some of the chief makers of Pig Metal have booked their whole make for the next three months. The prices obtained vary from 5s. to 10s per ton in advance of a fortnight ago. The intended blowing out of blast furnaces has been postponed, and rumors are afloat that two or three additional furnaces will be put in operation early in the new year.

LEAD—There has been no business in Foreign Pig. Stocks of Ordinary are offered from second hands at 6⅞ cents gold, ⅛ cent below present cost, which suspends all trade with importers. Manufactured is steady at our quotations.

COPPER—New Sheathing is firm at 43 cents, and Bolts and Braziers 45; Bronze and Yellow Metal Sheathing 27, and Y. M. Bolts 32, net cash. Ingot is less active and prices are somewhat irregular, though the general tone of the market is firm, holders looking for a further advance in prices before the opening of navigation. Sales have been made of 100,000 lbs. Lake as 34¾ cents, which is now below the market; 50,000 lbs. do. 34¾; 50,000 lbs. do. 35; and 25 tons best selected English, here and to arrive, 30½a31, 30 days.

SPELTER—Cables are at hand advising an advance in Europe, but this remains very quiet. Silesian is held firmly at 6¾a7 cents gold.

STEEL—The market is firm at our quotations, with a scarcity of all leading sizes of English.

TIN—The demand for Pig is very limited, and we have only to notice the sale of 100 slabs Straits at 31¾ cents; English is held at 31½a31¾, and Banca 36, all gold; cables from Singapore quote $35.74 per picul, which is much above the current rates here. Plates remain very firm, and there is considerable business; sales have been made of 1000 bxs. Charcoal Tin at $11,12½a11,25 for I. C.; 1580 do. Coke Tin, 10 by 14 and 14 by 20, $7,75a987½; and 1000 do. Charcoal Terne, $10,12½, all gold.

ZINC—Sheet is steady and firm at old figures. Ten casks Mosselmann sold from store, at 8¾ cents net gold.

We give below the Annual Review of the *Philadelphia Iron Trade* for the year ending December 31st, 1872. Kindly furnished us by EDWARD SAMUEL, 332 Walnut St., Iron Broker and Commission Merchant:

We closed last year's Review of the Iron Trade predicting increased demand and higher prices for this year, but hardly expecting the anomalous condition that really has taken place. Comparing prices of both raw and manufactured irons with those of preceding years, and taking gold as the purchasing medium instead of currency, it will be seen that there has never been an approach to the high figures reached and maintained throughout some few months of the closing year. Although the rapid rise in value was directly traceable to the overtaking of the supply by the demand, still it was aided considerably by speculation both here and abroad, much to the injury of the trade which would have been in a healthier state had prices ruled lower, and this would undoubtedly have been the case had not outside influences been brought to bear. Below is a table showing the values of No. 1 American Pig Iron, best makes, in this market for the respective months of 1869, '70, '71 and '72:

	Jan.	Feb.	Mar.	April.
1869	$42.18	$40.25	$41.75	$40.00
1870	$35.17	$34 50	$33.95	$32.50
1871	$30.50	$30.91	$34.75	$35.37
1872	$37.50	$40.00	$43.50	$48 50
	May.	June.	July.	Aug.
1869	$39.50	$40.80	$42.00	$41.00
1870	$32.30	$32.50	$32.50	$33.50
1871	$35.50	$35.50	$35.75	$36.25
1872	$49.00	$50.25	$51.60	$52.00
	Sept.	Oct.	Nov.	Dec.
1869	$40 50	$40.00	$38.70	$37.60
1870	$32.69	$31.83	$31.25	$30.50
1871	$37.00	$37.20	$37.50	$37.50
1872	$53.00	$52.50	$50.00	$45.00

By the above it will be noticed that in September, 1872, the price had advanced about $16.00 per ton above the opening figure in January, and that at present writing it has receded to $45, a decrease of some $8 per ton. It must be remembered that our quotations represent the average of the market, and are not a record of the highest and lowest sales of special brands, noted either for superiority or inferiority. At present the market is firm, but with a wide difference in the views of buyers and sellers, preventing business to any extent being done. The general impression seems to prevail, that the market has touched its lowest point for some months to come, and there is a disposition on the part of buyers to make their purchases for the first quarter of the coming year. The high prices have stimulated the production of pig metal, and we hear of about fifty new furnaces completed, or in the course of erection. As it is fair to average these furnaces each, as producing 10,000 tons per annum, this would be equivalent to about 25 per cent. increase on the product of 1871. We think, however, that the full effect will not be felt this year and that the product will be about 2,250,000 tons, an increase of 10½ per cent. on last year.

In old rails the importation for the year will be about 170,000 tons and the domestic supply about 400,000 tons. The demand in the early months of the year was quite brisk and the price advanced rapidly in sympathy with the general market; for the last half of the year prices have been purely nominal, parcels being sold on many occasions at the same time bringing widelydifferent prices, produced generally by the necessities of either buyer or seller. Large quantities have been carried in this country by importers, and judging from present prices, not without considerable loss. From the appearance of the market the price bids fair to advance toward the middle of January, as they are now selling at from $4 to $5 per ton below the actual cost of importation, which is to-day £8.10 c/&i here.

Below is a comparative table of the gold price of D.H.'s for 1871 and '72.

	Jan.	Feb.	Mar.	April.
	$	$	$	$
1871	39.25	39.00	39.25	40.00
1872	42.00	44.50	48.50	52.00
	$	$	$	$
	May.	June.	July.	Aug.
1871	40.25	40.25	39.75	39.75
1872	53.00	50.50	50.50	51.50
	Sept.	Oct.	Nov.	Dec.
	$	$	$	$
1871	39.50	39.50	39.75	40.00
1872	57.00	48.25	46.50	46.50

In wrought scrap-iron the importations for the year have been about 67,000 tons, and the domestic collection is estimated at about 140,000 tons making an aggregate of 217,000 tons, an increase over last year of 67,000 tons; 32,000 tons of foreign and 35,000 tons of domestic. We are inclined to think that the quantity is over-estimated. The demand throughout the year, excepting the months of August, September and October has been active. The market opened at $42 in January, advanced to $58 in May, declined to $50 in August, and is now $46. At this latter figure it cannot be imported at a profit, and with the exception of some small parcels there is at present none afloat. Several large lots were, however, sold direct to consumers for shipment from abroad during 1873, at $45, or thereabouts. Compared with the cost of Lehigh grey irons, for which scrap if cheap, is a substitute, there is room for an advance of some $4 to $5 per ton under an ordinary demand.

In cast scrap iron, as no statistics are kept, it is impossible to make even an estimate of the consumption. The price throughout the year has been about $1 to $2 less than good No. 2 foundry iron, and the demand has been exceedingly active.

In American rails the business has not been as profitable as in many other branches of the trade, excepting of course, for those makers who bought largely ahead of the raw material at low figures, and also for those who made their own pig-iron. Many of the new railroad enterprises were postponed in consequence of the high prices, and from the same cause all the companies withheld from purchasing, except for imperative wants. It is extremely probable, owing to these facts, that many buyers who have withheld from purchasing, will be forced to buy in the coming year, and it is fair to anticipate a brisk trade in this branch for at least the first half of the year. Prices have been as follows:

	Jan.	Feb.	Mar.	April.
	$	$	$	$
1872	71.00	75.00	79.00	84.00
	May.	June.	July.	Aug.
	$	$	$	$
1872	91.00	90.00	89.00	88.00
	Sept.	Oct.	Nov.	Dec.
	$	$	$	$
1873	88.00	89.00	89.00	85.00

In merchant Bar iron the business of the year has been entirely satisfactory with probably greater activity than for some years past. The "Association" which was formed in June, 1871, has been of undoubted benefit to the trade, and although some of the local associations made errors in advancing the card price considerably higher than the actual market rates, thus entailing higher wages with no corresponding profit to the maker, still these errors were speedily seen and corrected. The demand until November was active, and in the early spring months was pressing; since November there has been but little inquiry, and at present the trade is extremely dull. Below are the base prices of the Philadelphia mills for the year:

Jan.	Feb.	Mar.	April.	May.	June.	July.
$87.50	88.75	87.42	102.12	103.04	103.04	105.28

Aug.	Sept.	Oct.	Nov.	Dec.
$112.00	116.48	113.68	106.40	106 80

In plate iron the year has been even better than 1871, which by comparison with previous years was unusually favorable. The mills have all been running to their full capacity, at remunerative figures. At many periods it was extremely difficult to place orders for early delivery. The activity in this branch, apart from the general activity in the market, is attributable to the increase in iron ship-building, the erection of new furnaces, many of which are now built of iron instead of stone.

It is impossible, in so brief a review, to present the many causes affecting the market, or to make any predictions as to the future, especially after a year of such anomalous prices. It is, however, certain that the high prices have considerably curtailed consumption and stimulated production; and this alone under ordinary circumstances would eventually bring prices lower, but how soon it is difficult to foresee. It seems to be the general impression that the first half of '73 will produce an active market for all grades of raw and manufactured iron, consequently enhanced prices; and that the latter half of the year will see a gradually declining market. This, of course, remains to be proved by time. The trade is certainly in an extremely prosperous condition, and the large profits realized in raw irons will no doubt, ere we are called to Review '73, show an even larger increase in our production than has this past year.

EDWARD SAMUEL, under date of January 13th, 1873, says:

In American pig the market is much excited with large sales reported. There is no disposition on the part of the makers to sell far ahead, and with the present demand, from New York and eastward, is is extremely probable that a rapid advance will occur. In Scotch iron there is more enquiry and prices are better—strengthened not only by the local demand, but also by the firm and advancing markets abroad. The demand for wrought scrap is in excess of the supply, and stocks on hand are held firmly at higher figures than our quotations. In old rails the market shows signs of revival—the inquiry being greater than for months past—about $49 gold, however, is necessary to effect business. In merchant bars, the tone is much firmer in sympathy with the general market.

Below are the highest and lowest quotations for different makes:

American No. 1 Foundry Pig, at Furnace, 45a46, do. No. 2, at $43a44; do No. 3, Forge, do., $35a40; No. 4 White and Mottled, do. 32a33; Scotch Pig, (Cargo lots, for shipment,) 47a48; Old Rails, DHs, (for shipment here,) $49a50 gold; do. (on the spot and for arrival,) 49a50, do.; No. 1, Wrought Scrap, (ex. ship,) 46a47 Currency; do. (for shipment here,) 47a49; American Refined Bar, (mill price,) 4½ cents; do. Common, do., $87.50a90; Rails, (at mill,) $82a84 English Rails (ex. ship, N. Y.,) $72½a74, Gold.

San Francisco Stock Market.

BY TELEGRAPH.

NEW YORK, Jan. 16, 1872.

Excepting a slight adavnce in Raymond & Ely and Meadow Valley the San Francisco Stock List is weaker. Gould & Curry is out with a new issue of stock equal to 10 for 1 of the old basis, the new issue is quoted at $17 per share, which is a decline of $12 as compared with our last.

		Jan. 11.
Savage	—	75
Crown Point	—	90
Yellow Jacket	—	75
Kentuck	—	153
Chollar Potosi	—	55
Gould & Curry "New Issue"	—	17
Belcher "New Issue"	—	90
Imperial	—	8⅞
Raymond & Ely	—	92
Meadow Valley	—	19

The Dangers of Steam-Heating Apparatus.

By HENRY F. WORTHINGTON.

The subject of superheated steam as recently presented in the public prints is well calculated to excite alarm in the minds of many people otherwise intelligent, but who are not well informed as to the laws which govern the production of steam or its use as a motive power or for warming buildings. The subject should be presented to their minds in a simple and candid manner. It will not help them to devote an article to the demolition of Fire Marshal McSpedon, whose principal fault is that he has attached to his practice, which has been extensive, a theory not only unnecessary, but incorrect and disturbing. He is not the only man whose observations are more valuable than his theories. Let us, therefore, endeavor to state the facts of the case as generally understood by engineers and experts, always bearing in mind that we are dealing with a subject involving remote laws, and wherein the best authorities may at times find reason to retract or qualify an opinion. The numerous conflicting theories as to the cause of steam boiler explosions should convince us that the subject affords room for disagreement. Superheated steam may be popularly defined as steam containing more heat than it would receive from the water from which it was generated or than is proper to its pressure. A law assumed as safe to depend upon is, that when steam is formed by the application of heat to water it is always at a temperature corresponding to its density or pressure. When water in a boiler boils, the temperature is 212 degrees, and the pressure is atmospheric or practically nothing. Raise the temperature to 216 degrees and we have one pound pressure to the inch; to 225½ degrees, and we have four pounds; to 235 degrees, seven and one-half pounds; to 250 degrees, fourteen pounds; to 300 degrees, forty-eight pounds; to 343 degrees, one hundred pounds, all these numbers being approximate, and so for all intermediate pressures. Thus it will be seen that a thermometer inserted in a boiler making steam under proper conditions would be a reasonably accurate gauge of the pressure within the boiler—in fact, it is oftentimes employed for that purpose. The steam within such a boiler is not superheated, and cannot, so far as the practice of the world bears upon the point, be called dangerous to the woodwork with which the boiler or pipes may come into contact. But now we reach a consideration which should be impressed upon the minds of all who wish to understand the subject, as the one comprehending all the dangerous conditions, at least so far as the communication of fire to the adjacent woodwork is concerned. We have steam within our boiler of more or less pressure, according to its temperature, and lying upon water that is of the same temperature. This steam is a gaseous body, and, when separated from the water and exposed to heat obeys a law entirely different from that under which it was formed—in a word, it is practically like common air. To get even the moderate pressure of fifteen pounds per square inch upon a boiler filled with air would require a temperature of about four hundred and eighty degrees. This temperature of water would give us a pressure of steam of about two hundred pounds. Here, then, is the most important difference—that steam, when heated apart from water, can, like atmospheric air, be brought up to a high and dangerous temperature without a remarkable or perhaps noticeable rise of pressure. And now the question is, under what circumstances can this take place? Not, it may be safely said, by the application of heat to the water which formed the steam, but only when the steam is heated apart from the water or by the direct action of the fire upon the steam itself. We have next to look for the circumstances under which this separate heating of the steam would be likely to take place, to enable us to judge when a steam heating apparatus would be safe or dangerous.

First.—A sufficient quantity of water must be kept in a boiler to entirely cover the surfaces exposed to the action of the fire. If this be neglected the superheating of the steam above the water will take place to a greater or lesser extent, depending upon the quantity of the surface thus bared, the intensity of the fire, and the rapidity with which the steam is drawn off and used.

Second.—A boiler should be constructed so as to allow the water to remain upon the fire surface, no matter how active the boiler may be. To secure this the circulating spaces within the boiler should be large enough to allow for the escape of the steam from the water without such ebullition as would carry the water up with the steam, and thus lay bare a portion of the fire surface. In the present search for active, concentrated and economical boilers, so-called, which generally means a small and cheap boiler for doing the work of a large and expensive one, it is not too much to say that some of their forms in use are liable to this displacement of the water, either from the small tubes of which they are composed or from the circulating spaces around them. A boiler can be made, and indeed has often been made, that would in this way superheat the steam to a greater or lesser extent, even when supplied with the required quantity of water. It may be that Fire Marshal McSpedon has sometimes found a boiler that was dangerous, either from a lack of the required amount of water or from its extremely vicious construction and action. In the pursuit of great economy in steam boilers, especially those used for manufacturing purposes, it is not uncommon to arrange for superheating the steam,* and extreme instances could be cited of the ignition of woodwork about such boilers and steam pipes. If these views be correct, we may conclude that a building can be safely heated by steam if full attention be given to the following simple requirements: Never allow the fire or the hot products of combustion to come into direct contact with the steam after its generation. Use boilers of well-known and improved plans, of ample size, with large steam and water spaces, avoiding concentrated, contracted and complicated forms.

With a good boiler, which carries its water quietly and steadily, used under reasonable pressure and well supplied with water, we may expect to find comfort and safety. The injury done by the excitation of groundless fears in regard to steam as a distributor of warmth in our dwellings is incalculable; while, on the other hand, the suppression of truths in regard to such dangers as may be engendered by carelessness or ignorance, would lead to other results equally disastrous.—*N. Y. Herald.*

* This is done to prevent the condensation of the steam in the pipes, or the cylinder of the engine; or, in other words, the steam is charged with extra heat to warm the colder surfaces with which it comes in contact before and during its work.—ED. E. and M. J.

The Uses of Gas-Wells.

The natural gases given off by the earth in its crevices have been put to many uses. In Germany, white lead is made by their action; in this country, houses are lighted and heated, boilers fired, and pistons moved by natural gas. These are but a few of the applications of an agent which is undoubtedly destined to play a part of increasing importance in industrial economy. One of the latest developments of the possible uses of gas is the manufacture of lamp-black from it.

A few years ago a party of gentlemen started what they intended to be an oil well near Cumberland, Md. They soon, however, were disappointed in their expectation, for instead of striking oil they came upon a gas chamber and penetrated it. A short time afterwards, the emitted gas was accidentally set on fire, and it continued to burn for a period of two years. About a year ago Mr. HAWORTH, a gentleman from Boston, having heard of the burning well, went to Cumberland, tested the quality of the gas, and was satisfied that he could put into operation a scheme or plan of his own for the manufacture of carbon from the gas. Accordingly, the well was leased or purchased by Mr. HAWORTH and others as LAMB & Co., and a patent obtained for the manufacture of carbon, according to the plan of Mr. HAWORTH. A building was constructed and the manufacture of carbon commenced about six months ago. The gas is allowed to burn against soapstone plates, on which the carbon is deposited in the form of soot. By a very neat mechanical arrangement, the soot is scraped off and deposited in large tin boxes about three feet long, and a foot and a half wide, and a foot and a half deep. Scrapers are passed along the soapstone plates every twenty minutes, and the boxes are filled on their fourth passage. There are now in operation six hundred and sixty burners, each burner consuming eight cubic feet per hour. A large building is now in course of construction, twice the size of the present one, which will have in use thirteen hundred and twenty-eight gas burners. The present consumption of gas amounts to about one-twelfth of the whole quantity escaping from the well. When the new building is completed and the new burners put in operation, the total consumption of gas by the burners of both buildings, will be one-fourth of the whole.

The lampblack is used in making printers' ink, and the establishment, so far as known, is positively unique, not only in America but in the world.

Chinese Dates.

One of the most deeply rooted popular fallacies is the belief that the written records of the Chinese people reach back to a period far anterior to the beginning of the Biblical history. Were the half that is asserted of the Chinese dates true, the most authentic accounts, in other countries, of man's existence would be entirely disproved. Prof. KIRKWOOD, of the Indiana State University, has had occasion to deny the statements of a writer in the *Scientific American*, as to the date of the most ancient Chinese astronomical records, which, by the way, is one of the points upon which inexact people most frequently deceive themselves. The Professor's opponent asserted that the "Chinese records in astronomy go back twenty thousand years. The eclipses and conjunctions of planets in the days of Fedo, 10,000 years ago, have been recalculated by BAILY and other astronomers, and they have mathematically demonstrated the truthfulness of the Chinese astronomical records, showing a difference of time of but fifty-one seconds."

This gentleman seems to think that downright assertion and scientific truth are one and the same thing, for no one reading what we have quoted would imagine how far he is from accuracy. Prof. KIRKWOOD answers as follows:

"The earliest eclipse of which the date has been preserved occurred in the twenty-second century before the commencement of our era. This is recorded in the Shoo King, 'which is considered by the Chinese as the most ancient of their books.' See Chalmers' Descriptive Astronomy, page 198, the Memoirs of the Royal Astronomical Society, vol. XI., page 47, and the Monthly Notices of the Royal Astronomical Society, vol. XXIII., page 238.

"The statement quoted in regard to planetary conjunctions is no better sustained. The most ancient account of an occurrence of this kind is found, it is true, in the Chinese annals. Its date, however, was but 2,449 years before the Christian era. See Observations of Comets, extracted from the Chinese Annals, translated by John Williams, F. S. A., one of the Secretaries of the Royal Astronomical Society, and first published during the past year."

The question of the antiquity of man is evidently not complicated by anything in the Chinese records. That must be elucidated by investigations even more difficult than the interminable Chinese vocabulary demands.

THE ENGINEERING AND MINING JOURNAL.

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

PUBLISHERS' ANNOUNCEMENT.

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

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

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

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

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

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

THE SCIENTIFIC PUBLISHING COMPANY.

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

CONTENTS FOR THIS WEEK.

Messrs. PATTERSON BROTHERS, commission hard-ware merchants, of 27 Park Row, have a very complete stock of metal goods, iron, steel, brass, etc., and are able to supply at once the most varied demands in this line. Their stock consists of both imported and home products. Fuller particulars of what they offer can be seen in their advertisement on another page.

Superheated Steam in House-Warming.

FIRE-MARSHAL MCSPEDON having recently expressed the opinion that conflagrations sometimes originate from superheated steam in steam-pipes connected with boilers, and used for warming houses, igniting the wood-work in the neighborhood of the pipes, a lively discussion of the subject has taken place in the newspapers, in which the worthy Marshal's scientific views have been roughly handled. But though the precise conditions of danger which he has imagined do not exist, it does not follow that there is no source of possible danger in the use of steam. The question is really, not whether superheated steam can ignite wood, but whether steam may become so superheated as to do so, in the ordinary warming apparatus. Superheated steam is itself a vague term, so far as the expression of any particular temperature is concerned. It may be red-hot, or it may be but slightly above the so-called boiling-point of water,

From the mass of articles which have appeared on this subject we select a letter, originally written to the New York *Herald*, over the signature of "H. F. W.," which gives a very clear and practical statement of the facts and principles involved. The author is Mr. HENRY F. WORTHINGTON, an intelligent and rising young engineer, at present residing in New Jersey, and, we believe, a member elect of the Legislature of that State. As the son of Mr. H. R. WORTHINGTON, one of our leading steam and hydraulic engineers, this gentleman has had excellent opportunities to master both the theory and the practice of these branches; and we commend his plain and conclusive statement to all whose fears need soothing, or whose notions of the matter under discussion are confused.

To what Mr. WORTHINGTON says we venture to add a word or two, pointing out dangers which the use of steam heating-apparatus may involve, apart from any supposed superheating of the steam. In the first place, it should be borne in mind that such apparatus subjects all the wood-work of a house to a process of kiln-drying, prolonged through years. This is the case whether the steam in the pipes is ever superheated or not. It is the case when hot air is used instead of steam, and particularly and alarmingly when there is any leak in the hot-air conductors, so that the air, hungry for moisture, comes in contact with floors or joists. Mere ventilation dries wood to tinder in the course of time. This was terribly illustrated by the fury with which the timber in the Crown Point, Kentuck, and Yellow Jacket mines at Virginia City, Nevada, burned at the time of the great fire, several years ago. People who prate of the heat obtained from moisture in fuel should study the way in which wood burns when the moisture has been thoroughly dried out of it.

This source of danger is not peculiar to any method of heating houses. It arises from the fact that when we heat wood we expel moisture from it, and when we heat air we increase its capacity to take up moisture. The materials being thus kiln-dried, slight causes will ignite them. Great fires in mines have arisen from the dropping of a candle upon desiccated timber; and the wood-work of our houses may be ignited like shavings by the flame of a lucifer match. We wonder, by the way, how many lucifer matches there are in this community lying along the edges of carpets, or hanging in waistcoat-pockets alongside of the hot-air or steam-pipes in closets, or hidden in the walls, where they have been dragged with other rubbish by the rats! A friend of ours recently made a cruise of exploration in his house, and discovered half-a-dozen unburned matches and match-heads in places where their accidental ignition would have set fire to steam-dried wood-work. Some of them were behind a steam radiator, and a fire resulting from them might well have been charged to the action of "superheated steam." We have heard it said by a shrewd and experienced engineer that if matches were as dear as cigars, so that people would keenly look for them when dropped, or miss them when mislaid, the Fire-Marshal would have little to do.

But another source of danger, peculiar to steam-pipes and hot-water pipes, is the explosion of the boilers. Here it is not superheated steam, but saturated steam, which is a much more terrible agent, with which we have to do. Many boilers used in families for heating water or steam-warming are without safety-valves, and depend on the regulation of pressure which results from the amount, circulation, and head of the water. If the pipes become plugged with ice, on a cold night, the boiler and fire-back may be hermetically closed, and thus may constitute an instrument charged with the greatest danger. An explosion during the recent cold term, reported the other day in the newspapers, illustrates this warning. People should be careful about heating up when they have reason to fear ice in the pipes; and above all, no false economy should cause the omission of safety-valves in any apparatus where steam is generated.

The Bullion Product During 1872.

MR. JOHN J. VALENTINE, General Superintendent of Wells, Fargo & Co.'s Express, has lately published in the *Alta California* a statement of the production of precious metals in the States and Territories west of the Missouri River during the past year. In a letter to the *Alta* he says:

"We have used the utmost care in ascertaining the amount of ore and base bullion carried by freight, and the percentage allowed for gold dust, carried by U. S. Mail, travellers, etc., is, we think, liberal, and at the same time reliable. The product for the year, $62,236,913.89, is $3,952,884.23 in excess of 1871, which was $58,284,029.66. The increase is confined to Utah and Nevada alone, some of the other localities falling off slightly. We can, if you desire, give you comparative tables of the two years. It is proper to state that our Express communication is so limited, and our knowledge so imperfect, of Arizona, that we do not consider the figures given for that Territory as reliable for the product of that section."

Statement of Precious Metals produced in States and Territories west of Missouri River during 1872:

State and Territory.	Gold by Express.	Est. Am't of Gold Carried by other Conveyances.	Silver by Express.	Ores and Base Bullion.
California	16,493,921 76	1,649,392 17	232,668 31	673,116 00
Nevada	225,415 50	....	22,215,653 69	3,107,751 90
Oregon	1,652,378 19	247,856 73	4,800 00	....
Washington	184,604 45	27,605 61	14,101 00	....
Idaho	1,817,808 86	272,671 35	423,609 57	....
Montana	3,609,457 00	721,891 40	110,786 50	....
Utah	415,166 77	....	365,285 32	2,740,568 00
Arizona	69,222 00	34,611 00	14,944 00	25,000 00
Colorado	1,657,952 00	....	279,798 85	1,064,000 00
Mexico (West Coast)	....	....	535,071 80	....
British Columbia	1,227,331 05	122,733 11	....	....
Totals	27,352,957 58	3,076,801 37	24,196,719 04	7,610,435 90

TOTAL.

California	$19,049,098 24	Arizona	$143,777 09
Nevada	25,548,821 09	Colorado	3,001,750 85
Oregon	1,905,034 92	Mexico (West Coast)	535,071 80
Washington	226,011 06	British Columbia	1,350,064 16
Idaho	2,514,089 78		
Montana	4,442,134 90	Grand total	$62,336,873 89
Utah	3,521,020 09		

It is seen that the above total includes $1,885,135.96 of gold and silver from British Columbia and the western coast of Mexico, which must be deducted to arrive at the production of United States territory. On the other hand, Mr. VALENTINE draws attention to the fact that, for reasons given, he cannot consider the figure for Arizona reliable. The product of New Mexico and Wyoming appears to be entirely omitted; and, under the head of "Montana," we notice that the shipment of rich silver ores from that Territory, which, according to good authority, was about one million pounds, has been overlooked.

It is too soon after the close of the year to form an opinion as to the approximate correctness of Mr. VALENTINE's figures, and we shall, at the proper time, return to the subject. Indeed, no one in the country, except Mr. VALENTINE, is in a position to give even approximate estimates of the bullion production within two days of the close of the year. In referring to this fact we desire to express, as we have done heretofore, our sense of the value to the Government of the thoroughness with which the vast business of the great western Express Company is managed. The collection of statistics, which is entirely voluntary, would be nearly impossible, or at least very difficult and imperfect, without the aid of that busy "common carrier," who has a share in the conduct of nearly every mine and works for treating ore, in eleven States and Territories.

Mining in Utah.

UNDER the heading "STATISTICS OF PROGRESS FOR THE YEAR 1872," the *Salt Lake Tribune* has lately published a series of articles, which reflect great credit upon the enterprise of that journal.

The marvellous richness of Utah in minerals is too well known to make it necessary to repeat here the statements in regard to it. But it is interesting in the highest degree to note the progress made during barely two years, in the erection of smelting and amalgamating works, and in the quantity of ore and bullion shipped during the last year. There are now twenty smelting works in the Territory, containing altogether thirty-six blast-furnaces and six reverberatories, and having a capacity of 586 tons of ore in twenty-four hours. There are five amalgamating works, two of which have steam stamps, and a capacity of twenty tons per day. The others have forty-seven stamps, two AIKEN roasting furnaces, and a capacity of seventy-five tons per day. One STETEFELDT furnace is in the course of erection. Besides these smelting works and mills, there is one separating and refining works in the Territory. The latter is described as a very complete establishment, and was finished only a few weeks ago. FLACH's process is employed for the separation of the silver and zinc.

The array of thirty-six blast-furnaces and six reverberatories, with a capacity of 586 tons per day, is a very imposing one; but the total production of only 5,533½ tons of bullion, to which must be added, what little the Germania works have lately bought up, does not speak well for the general success of the smelting business. In the same way it appears strange, that in spite of this large number of furnaces in the Territory, 10,347 tons of lead and silver ore, estimated by the *Tribune* as worth only $70 per ton, should have been permitted to be shipped for treatment elsewhere.

We are aware that in the latter part of the past year the smelting works "at home" have rallied to a great extent from their previous inactivity; but there is evidently no sign yet of that spirit among the smelters, which would not let an ounce of ore go out of the Territory to be treated, but would employ all means to compete with outside works. What reasons are there for this state of affairs? It cannot be for the want of smelting works, for those now in existence can treat over 150,000 tons of ore per year. Neither can it be the price of labor; for this is nearly as cheap in Utah as in the Eastern States. But, it will be said, fluxes and fuel are extremely high. So they are; but it appears that they are not too high for those works which are kept constantly running. There remains only one other reason, which may be brought forward. This is the want of metallurgical skill—the failure to smelt *economically*. The few works kept running have mostly secured professional skill; those lying idle have not.

Utah has advanced wonderfully her mining interests during the last year, but the work is far from complete. Her smelters can double the benefits so far secured to her population by allowing science to work hand-in-hand with practice, and to guide it in technical matters.

We still see too often in western papers the triumphant announcement that such and such works are a great, a perfect success, because they have succeeded in smelting a certain class of ores. And too frequently is this announcement followed, in the brief space of only a few months, by another one, saying that the same works have stopped operations. The simple reason is, that mere smelting of materials is *not* success. To make it such, the total amount of useful metals must be obtained out of the raw material, so far as our present knowledge of metallurgical management and chemical laws renders this possible; and this extraction must be accomplished at the least possible expense.

This, we are sorry to say, is not yet done in the majority of Utah metallurgical establishments, and not even in the greater number of those which are "successful." The first step, to secure real success, is the keeping of full accounts in regard to the raw materials, expenses, and results of every process, and this is only possible by means of daily assays and frequent analyses. Only the superintendent, who has his business in all its phases clearly before him in figures, is able to correct abuses and institute improvements.

Utah has the chance of making her mining industry successful beyond all previous experience in other States and Territories. She has unbounded mineral wealth, and the conditions for utilizing it are in every way more favorable than those of her neighbors have been before. May the good sense of her inhabitants lead them to place her great interests in charge of those who are neither pretentious quacks nor ignorant blunderers. They can obtain skilled labor, and if they will use it, Utah will mark the dawning of a new day in our mining history.

American Society of Civil Engineers.

A regular meeting of this society was held at its rooms, in New York, on Wednesday evening, December 18th.

"A Record of some experiments showing the Character and Position of Neutral Axes, as seen by Polarized Light, by LOUIS NICKERSON, C. E., of St. Louis, Mo., was presented and discussed.

During the researches of EATON HODGKINSON, published in 1842, he took the ground that the neutral axis in a beam shifted as the load was increased, and finally took position where the compressive strength of the materials above it would be equal to the tensile strength of that below it.

He fixed this for a cast iron rectangular beam about to break at one-seventh its depth from the top, because its resistance to tension was one-seventh that to compression, and this was apparently proved by an inspection of the fraction of beams which were broken. In 1855 HENRY BARLOW made experiments to test this theory, in the course of which he claims to have established that the neutral axis of a rectangular beam always lies through the center of gravity of the section, and recognizes, in addition to the tensile and compressive elements of strength in a beam, a third, due to the lateral adhesion of the fibres, and increasing with the deflection.

Each takes the tranverse strength of a cast iron beam at about two and one-half times as great as it should be, according to its tensile and compressive strengths, and records a theory in regard to the character and position of the neutral axis, differing from the other.

The experiments here recorded were made to reconcile the results obtained by Messrs. HODGKINSON and BARLOW, and to discover whether the "Lamination of material in planes normal to the direction of the pressure excited upon it" was due to a periodic action of force, or consequent upon tangential stress, imperfect cohesion of the material, or the running together of internal cells. Polarized light was sent through plates of glass under compression, either as beams or columns.

The difference in the effects caused by similar strains on two materials is relative, and that produced by a force upon glass is like that upon other substances.

The results sought for are from certain general laws of the doctrine of forces, which must be the same for all materials, and modified, not changed, by any particular one. The transparency of glass, and its bi-refractive quality when strained, exhibits them to the eye.

In the experiments structural differences were ignored. Glass, cast iron, and steel are amorphous bodies, yet composed of segregated crystals, and, under pressure, exhibit a similar characteristic fracture. There is also a like ratio between these compressive and tensile strengths—that of glass appearing to be a mean of the other two.

The apparatus used was the one common for experiments with polarized light: a polarizer of glass plates, an analyzer of one plate blackened at the back, and a small brass clamp with thumbscrew, to compress the pieces of glass experimented upon, either as beams or columns.

These pieces, before pressure is applied, appear black in polarized light—glass, in an unstrained or neutral state, being impervious to it.

A slip, representing a beam, placed in the clamp, and the screw slightly tightened, shows at the top and bottom a clear space, enclosing a dark space between, which, under greater pressure, take sharper outlines; and colored curves, distinct and separate, appear, following the lines of strain. These increase in number and brilliancy with the pressure, and always move towards the dark and neutral space.

The experiments were made in consecutive steps, the application of force ranging from proportionately a very small tensile, with a very large compressive strain, to that where the two were nearly alike, and were described at length.

Colored drawings, representing the effects of polarized light upon the various slips of glass experimented with, were exhibited.

The results obtained show that the neutral axis is a flexible line, or plane, truly parallel to the top and bottom sides of the rectangular beam, and passing through the centers of gravity of its sections *only* when the load is evenly distributed from end to end, or when the beam is infinitely long; and that when there is a local pressure, the neutral axis is more or less governed in its direction and form by the strain passing from the point of local pressure towards the points of support.

The beams of Mr. HODGKINSON were broken at the center by a blow, in which the neutral axis was located above the center of gravity of the transverse section. From these experiments it is deduced that this position is due to the application of the force, and not to the ratio of the tensile to compressive resistance.

In comparison with Mr. HODGKINSON's, Mr. BARLOW's beams were, in proportion of length to depth, one-half longer, and he naturally found the neutral axis more nearly horizontal and less distorted.

Glass beams, in length fourteen times the depth, show the neutral axis so nearly horizontal, that he may have overlooked the variation, and it must be almost imperceptible in beams more in length than ten times the depth.

It is claimed that the neutral axis—as exhibited by polarized light, from the cohesion of material or other cause—is extended to a breadth, and cannot become a true line until, in reference to the cohesion, the tensile and compressive forces are infinite. Also, that its longitudinal direction, like the directions of lines of strain, is not an arbitrary one, but resultant from the relative qualities and quantities of all the forces in the beam, its evident place in Physics being that of still water between opposing eddies or vortices.

The pulsations of completely polarized light are confined to two directions—at right angles to each other.

In the drawings are represented two images of the same object, corresponding to these two directions—one being taken, and the analyzer revolved 90° for the other; they, for convenience termed positive and negative images, are pictures of strains in the beam or column normal to each other. In the first tubular bridges a wave of "buckling" always followed a line 45° from the top where the load was placed, even crossing the stiffening plates. Such strains may be called "strut strains," and their resultant in a beam is vertical. The principal strains in an ordinary beam are horizontal or "flange strains," being tension in the bottom and compression in the top; their resultant is also horizontal, and normal to the first.

The drawings show that when the "strut" or "flange" strains increase, correspondingly the negative or positive images, as the case may be, grow brighter.

Many strains may exert in the same beam, crossing and there neutralizing each other, and yet elsewhere be individual and intact.

As glass is pervious to polarized light when strained, and impervious when unstrained, the light parts must be strained in proportion to their brightness and the dark, unstrained or neutral, as bi-refraction is caused by strain, both must be governed by the same laws; further, the resultant angles of the strains and those of polarization are rectangles, and as the strains change in character, so do the polar images change in correspondence; therefore the images are pictures of the strains.

TO BE CONTINUED.

CORRESPONDENCE.

The Iron Works of St. Louis.

ST. LOUIS, Jan. 6th, 1872.

It is not often that the thermometer touches 20° below zero in St. Louis. But it reached that point two nights before Christmas, and continued for several nights to hang below the zero mark. The Mississippi was frozen over, and the city had a bridge for which it did not have to wait three or four years, and about the strength of which there was little doubt. This was a great boon. St. Louis began the winter with a woful lack of coal. Last summer a strike among the miners stopped work for several weeks. That ended, fever and ague became epidemic, and the mines continued to be short-handed. The coal supply was therefore very limited, and the early winter was looked forward to as the time when the deficiency was to be made up. Then came the horse disease, and transportation was stopped. The horses did not recover in any number until just before Christmas, and then Jack Frost had set his seal on the rivers, and had made travel on the roads a slow and difficult matter. Worst of all for the city, the river was covered with ice too thick for the ordinary boats to get through, but not thick enough to bear teams. The result of this remarkable succession of annoyances was, that coal rose to fifty cents a bushel in St. Louis, and enough could not be had even at that price. But the thickening of the ice during Christmas week permitted the passage of loaded teams, and as much as 3,500 to 4,500 tons of freight were carried over in one day, if the newspaper reporters have done their "sums" right.

At one time there was a prospect that even important branches of government, such as the courts, would be frozen up and suspended. But though that was avoided, the fuel famine has been a cause of great loss to other interests, as the iron furnaces in South St. Louis. Of seven blast furnaces there, only one has been steadily in blast, and one other was started up again, after a fortnight's idleness, on the last Friday of the year. The iron business of South St. Louis, formerly known as Carondelet, is worthy of attention, both for its present strength and future promise. Until within a few years it was doubtful whether this city would be a suitable point for the erection of blast furnaces, for it has neither iron nor coal mines in its immediate neighborhood. But a furnace was built—the Pioneer—and failed. It was started again under new management and succeeded. That was about three years ago, and within that time six large furnaces of the best construction, and producing 35 to 45 tons a day each, have been built. In addition to this, a large rail mill, several zinc furnaces and other industries have made the transport of ore and fuel to this point very large, and insured its permanence. But there is another fact which gives this point peculiar suitableness for the erection of iron works. The Iron Mountain, and Missouri Pacific railroads reach the Mississippi here, and the ore they bring must be transhipped. The Big Muddy mines, the only ones west of Indiana which have so far yielded a metallurgical fuel, are about 80 miles down the river, and send their coal here to meet railroad transportation. St. Louis, then, is at the junction of the two streams of ore and fuel, and with complete railroad and river communication already established or in progress, it has all the requirements for successful business.

Four companies have furnaces at South St. Louis. In going down the river the first one seen is the Pioneer furnace, which, though small, and known hereabouts as a "rattle trap," is still working, and with great financial success. Last year it made more than 6,000 tons of iron.

Next are the two furnaces of the Missouri Furnace Company, 56×14 feet. One is open and the other close-topped. The ore is a mixture of Iron Mountain and hematite, and averages about 66 per cent. The fuel is a mixture of Big Muddy coal, raw, and Connellsville coke. The make is about 225 tons a week to each furnace. These furnaces, and indeed all in South St. Louis, are admirably situated in regard to transportation. On one side is the Mississippi, with its complete connection with all the river system of the interior; on the other are the Missouri Pacific and the Iron Mountain roads, which place the furnaces in connection with the great ore regions of central and southern Missouri. When the bridge is completed it will be difficult to find a position more favorable for business. The defect in the iron business in this whole region is its dependence on Maryland for coke, but that is a defect which will certainly be remedied.

Looking at the certainty of an immense production and consumption of iron in this valley, with its attendant concentration of population, we may confidently predict that means will be found for making a serviceable coke from Western coals. It would be a great thing if we had an ideal fuel here, but not having that, we are pretty certain to find a way of using what we have. Several experimental coking-works have been built. So far, their product is too light and friable for large furnaces, but the work is going on. Several new establishments are projected, and the next year will be a busy one to those who are versed in washing and coking coal.

Immediately south of the Missouri Company are the two furnaces of the South St. Louis Company, 65 × 14 feet. South of them is an open space, where the foundations of a new furnace, to be 80 × 20 feet, are laid. This is an enterprise of the Messrs. GARRISON, and they propose to have a furnace in every respect complete. Their increase of furnace height must be considered a wise step. Experience shows that high furnaces are best for using the raw coal, and the management of the Missouri Company in obtaining so good a yield from their lower furnaces must be considered very creditable to them. All the furnaces in this neighborhood run upon No. 1 foundry, and produce a very high grade of it. The make of several of the companies is entirely absorbed by the Bessemer Works in Chicago, Cleveland, etc., and it is the fond hope of St. Louisians that this same unoccupied space, part of which the GARRISONS are taking up, will see the erection of large steel works, a business which certainly would be a great advantage to all other branches of the iron industry here.

Last in the line comes the Vulcan Works, the largest of the series. Two furnaces, 65 × 14 feet, have been in operation for two years, and the shell of a new one, 75 × 16 feet, is up. The product has been about 500 tons a week. Connected with the works is a large rail mill, with a capacity of more than 100 tons a day. It produced last year about 22,000 tons of rails and was idle a long time on account of the hot weather. This has the honor of being the first rail mill built west of the Mississippi, and it is certainly a most important affair for St. Louis. Most of these furnaces have been idle since December 20th. The South St. Louis were able to keep one in blast, and the Missouri Company blew in one, for a few days, on the last Friday of the year. The trouble with all has been the lack of coal, on account of the river closing so rapidly. The make of these establishments for the last two years is given as follows:

	1872.	1871.
Vulcan Iron Works	22,000	11,000
Missouri Furnace Company	22,000	11,000
South St. Louis	14,750	10,300
Carondelet Iron Works (estimated)	6,400	5,870
Total	65,150	38,170
Increase in 1872	26,980	

C.

MINING SUMMARY.

Utah.

THE GERMANIA SEPARATION AND REFINING WORKS.

From the Salt Lake City *Herald* of Jan. 1:

These works, in the influence which they are certain to have upon the production of argentiferous lead bullion, and in the creation of concomitant industries resulting from the separation and refining of the bullion product of the great basin, in this valley, are entitled to rank as the most important of the enterprises yet undertaken in the Territory with a view of encouraging the development of the mines. The works are located on the line of the U. S. R. R., about ten miles south from this city; and although only commenced in July last, were sufficiently completed to commence and finish lead refining at the rate of forty tons per day some two weeks ago, and within another week will be ready to commence the final process of desilverization, or the separation of the silver from the skimmed slag alloys of zinc, copper, lead, iron and other base minerals.

The process of separating and refining, or, rather, the mechanical use of the process for the latter alone is patented, is the invention of M. Flach, improved by M. Sieger, the latter gentleman having received patents for the principal of his improvements. The chemical agent in effecting the separation of the gold, silver and copper from the lead, is zinc, which has a greater affinity for gold and copper than for silver, and a greater affinity for the latter metal than for lead. This quality of zinc led to the adoption of the plan of charging the tanks of boiling crude metal three times, the amount of each charge being graduated according to the percentage of pure metal to be taken up, by this means effecting a near approximation to a separation of the gold and copper from the silver, at the first operation.

To give a connected idea of the different stages of the process, we will begin with the large iron vats at the south end of the building. These vats are five in number, and two of them, those in which the crude bullion is first melted, have a capacity of twenty-four tons each. They are set in a massive structure of brick, raised so as to economize labor in handling the metal, and are heated by flues from furnaces underneath. After the metal is sufficiently molten, the first charge of zinc is added, and well stirred for half an hour, and then the mass is allowed to rest for three hours, during which time the alloy of gold, copper, and a small percentage of silver comes to the surface, when it is skimmed off and transferred to one of the smaller vats, immediately adjoining. A second similar operation, but with a larger charge of zinc, takes from the lead all of the silver it contains, except a mere trace. The third seems to be intended principally to prove the thoroughness of the two first operations. At the conclusion of these processes the lead has attained a high degree of purity, but is subjected to another and final refining. From the bottom of each vat an iron pipe leads to a reverberatory furnace, and through this the lead runs into the bath of the furnace, where it is subjected to a bright red heat for two and a half hours, by which time all of its base constituents are eliminated by oxydation, or having formed a fused scum on the surface of the pure metal, are skimmed off. From the surface bath, a pipe leads to a large vat in front, where the lead is moulded into bars. This is said to be the purest lead known to commerce, only carrying two pennyweights of silver to the ton, and being absolutely free from base alloys.

There are two calcining furnaces, to purify the slag and dro·s that results from the various primary operations, and extract from them whatever fraction of the precious metals they may contain. Near these furnaces is a large and well arranged cupelling furnace; and at the extreme north end of the building is an "inclined" blast furnace intended for the desilverization of the alloy taken from the vats in the first operation. The charge for this furnace is in the proportion of 400 lbs. of the alloy to 150 lbs. of Wyoming iron ore, requiring thirty-six pounds of Pennsylvania coke. In this operation, for the present, Mr. Sieger informs us, that the zinc will be lost by volatilization, but he intends to construct near the top and in the rear of the furnace, two condensing chambers, by which he will be able to save seventy per cent. of the zinc held in the alloy. He also announces his intention, to prepare to collect the copper contained in the crude bullion, into matt; and to save in marketable condition all metals that will pay the cost of separate extraction.

The building is large, and arranged with especial reference to avoid the necessity of up-handling material and supplies, and a side track from the U. S. road lands everything exactly where wanted. The engine is of forty-five, and the boiler of fifty-five, horse power capacity; there are all necessary store and out-houses, reservoirs, water tanks, &c. One feature, especially worthy of commendation, is a tall stack, some fifty yards from the building, and connected with all of the furnaces by underground flues, which in addition to increasing the draught, carries off the poisonous fumes so deleterious to the health of the workmen in smelting establishments.

From Messrs. Sieger & Billing we gather the following data relative to matters connected with the works. The zinc used is of two qualities, known as commercial or refined, and crude or dross zinc, costing respectively, delivered at the works, nine, and five and a half cents per pound; the Wyoming iron ore used for slagging, carries from sixty-two to sixty-five per cent. of iron, and from fifteen to twenty per cent. of silicate; the alloy skimmed from the vats carries about twenty-five per cent. each of silver and zinc; the coke used comes from Pittsburg, Pa., and costs delivered $29 per ton, and the establishment will not require more than ten car loads per annum; the capacity of the smelting furnaces admits of the separation of 12,000 pounds of alloy per diem; and the entire consumption of coal (Vandyke) is less than ten tons in twenty-four hours.

American Institute of Mining Engineers.

OFFICIAL BULLETIN.

Announcements to Members and Associates.

I. The next meeting of the Institute will be held Tuesday, February 18, 1873, in Boston, Mass. Prof. T. STERRY HUNT, and Prof. W. H. PETTEE are the local Committee of Arrangements.

II. All members and Associates who pay their dues ($10,) for each current year, strictly in advance, will have sent to their address, regularly and weekly, the ENGINEERING AND MINING JOURNAL, which is the organ of the Institute, and will contain the proceedings and transactions, and all important papers read before the Institute and all notices of meetings. Back numbers cannot, as a general rule, be sent.

Those members and associates who have not paid their dues for the current year, are requested to do so at once. Money may be sent in postal orders, checks or bank bills, to the Secretary, THOMAS M. DROWN, 1123 Girard street, Philadelphia, Pa.

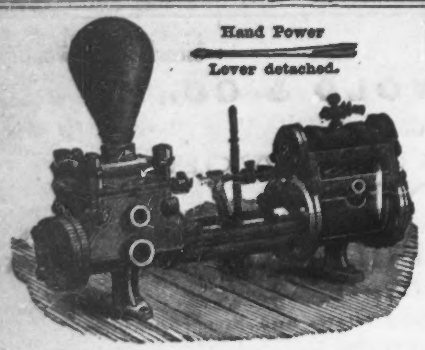
III. It is expected that the more important paper, read before the Institute, and the debates thereon, will be published in annual or occasional volumes to which those Members and Associates will be entitled who have paid their dues.

IV. All authors of papers are requested to notify the Secretary in advance of the meetings, giving the subject and length of their papers. Attention is also called, in this connection, to Rules 12 and 13.

V. The ninth rule has been amended, so that there will be hereafter three meetings a year, in February, May and October.

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

MACHINISTS' SUPPLIES.



GEO. F. BLAKE & CO.,
MANUFACTURERS OF BLAKE'S PATENT

STEAM PUMPS.

No. 79 LIBERTY STREET, NEW YORK.

Factory 61 Chardon St., Boston, Mass.

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

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

Send for Illustrated Price Circular. m-26 3m

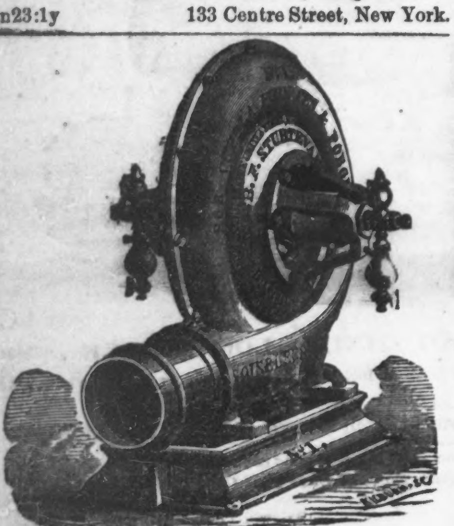
WARING'S

AIR COMPRESSORS,

ENGINES, PUMPS AND BOILERS, DRAWINGS AND SPECIFICATIONS OF MACHINERY.

WARING & PARKE, Engineers.

jan23:1y 133 Centre Street, New York.



B. F. STURTEVANT'S
PATENT IMPROVED

PRESSURE BLOWER,

FOR CUPOLA FURNACES AND FORGES.

Also manufacturer of the Sturtevant Patent Improved Fan Blower and Exhaust Fan. Send for illustrated catalogue.

B. F. STURTEVANT, 72 Sudbury street, Boston, Mass.

n29:1y

KROM'S PATENT DRY ORE

CONCENTRATOR

AND COMPLETE MACHINERY FOR CRUSHING SCREENING AND CONCENTRATING ORES.

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

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

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

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

For information and circulars, apply to

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

MISCELLANEOUS.

The Bessemer Steel Works,
of John A. Griswold & Co.
Troy, N. Y., May 3, 1872.

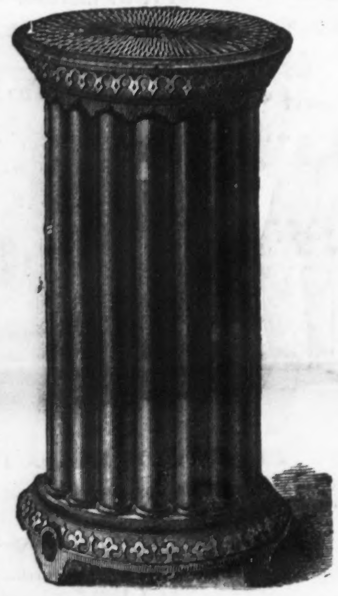
B. F. Sturtevant, Boston, Mass.,

Dear Sir, We have changed your No. 8 for your No. 9. Pressure Blower. The time in melting is about the same with either Blower. We are melting 225,000 lbs. (112½ tons,) Pig Iron daily, (20 hours running time.) It works well.

BARNEY MEE, Supt.

ENGINES, IRON WORK, ETC.

NASON'S VERTICAL TUBE RADIATORS



IN VARIOUS SIZES AND PATTERNS.

JOSEPH NASON & CO., 61 BEEKMAN ST., corner of Gold street.—WROUGHT and CAST-IRON PIPES; all kinds of STEAM and GAS FITTINGS; Apparatus for WARMING and VENTILATING BUILDINGS.

JOSEPH NASON. HENRY R. WORTHINGTON.

nov29-1y

Something New!

ZELL'S

Illustrated Monthly Magazine,

CONDUCTED BY L. DECOLANGE, LL.D.,
Editor of ZELL'S Encyclopedia, &c., &c.

The first number of this new and beautifnl serial will be issued in September, 1872. It will be especially the magazine for the cultured home, always up to the practical as well as the scientific spirit of the times.

It will be largely devoted to information concerning foreign and home countries, especially with those places remote from the general rush of travel. This information will be profusely illustrated by fine engravings from original sketches. The recent discoveries in science, relating to explorations and journeyings of travellers, inventions of pains-taking laborers in the field of the practical arts, the discoveries of celebrated chemists, physicians, botanists and mineralogists will be noted as they occur.

An original illnstrated article on Naples will be published, besides other original tales, sketches of life and character, poetry and various literary papers from the pens of writers of the first talent.

The editorial staff will be under the direction of L. DE COLANGE, LL. D., so well and favorably known as the editor of "ZELL'S ENCYCLOPEDIA."

The pnblisher will spare no pains or expense to make this magazine well worthy the reading public, and has placed the subscription price so low as to be within the reach of all.

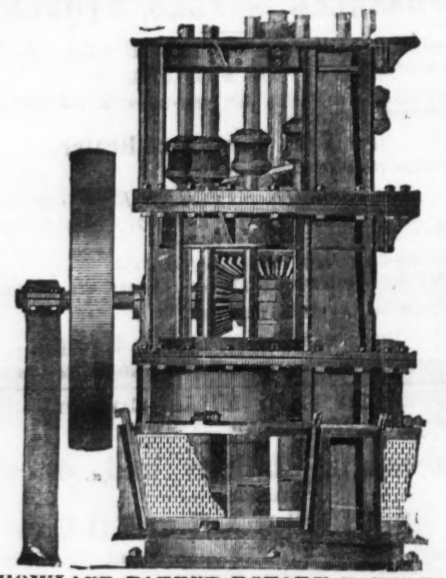
Subscription price, $2 00 per annum.

Single numbers 20 cents.

A specimen copy will be sent to any part of the United States on receipt of 10 cents in postage stamps.

T. ELLWOOD ZELL, Proprietor,
17 and 19 South Sixth street, Philadelphia,
sept3:3m 5 Beekman street, NewYork

MINING MACHINERY, ETC.



HOWLAND PATENT ROTARY BATTERY;

of 12 stamps. It requires no frame to put it up. The best Battery ever used for amalgamating gold, or crushing silver ores, dry or wet. Can be put up on a mine in running order for one-half the price of the straight battery, and in three days after its arrival at the mine. 12-stamp battery, 20,000 pounds, with frame complete; 6-stamp battery, 7,000 pounds. Every mill run at shop before shipping.

CALIFORNIA STAMP MILLS,

All the various styles of Pans, Amalgamators, Rock Breakers, Separators, Settlers, Concentrators, Dry or Wet, for working Gold, Silver or Copper Ores, the same as built in California and at lower prices. SHOES AND DIES made of the best white iron. Send sizes and we will make patterns and forward Shoes and Dies at low prices. Engines, Boilers and fixtures, and other Machinery made to order.

☞ Send for a Circular.

Address MOREY & SPERRY,
Jan 6:6m 95 Liberty Street New-York.

COOPER'S GLUE AND REFINED GELATINE

COOPER HEWITT, & CO.,

NO. 17 BURLING SLIP, NEW YORK.

Bar Iron, Braziers' Rods, Wire Rods, Rivet and Machinery Iron, Iron and Steel Wire of all Kinds, Copperas. &c., &c.

RAILROAD IRON, COOPER WROUGHT IRON BEAMS AND GIRDERS,

Martin Cast-Steel, Gun-Barrel and Component Iron,

PUDDLED AND REFINED CHARCOAL BLOOMS,

Ringwood Anthracite and Charcoal Pig Iron.

Works at Trenton and Ringwood, N. J.

May 17:1y

DENISON'S COOLING AND LUBRICATING Compound will immediately cool a hot journal when in motion. Send for a Circular.

POSTS & KALKMAN, Manufacturers,
Sept. 17:6m 111 Liberty Street, New York.

Advertisements.

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

TO INVESTORS.

To those who wish to REINVEST JANUARY COUPONS OR DIVIDENDS, and those who wish to INCREASE THEIR INCOME from means already invested in other less profitable securities, we recommend the Seven-Thirty Gold Bonds of the Northern Pacific Railroad Company as well secured and unusually productive.

The bonds are always convertible at Ten per cent. premium (1.10) into the Company's Lands at Market Prices. The rate of interest (seven and three-tenths per cent. gold) is equal now to about 8¼ currency—yielding an income more than one-third greater than U. S. 5-20s. Gold Checks for the semi-annual interest on the Registered Bonds are mailed to the Post-Office address of the owner. All marketable stocks and bonds are received in exchange for Northern Pacifics ON MOST FAVORABLE TERMS.

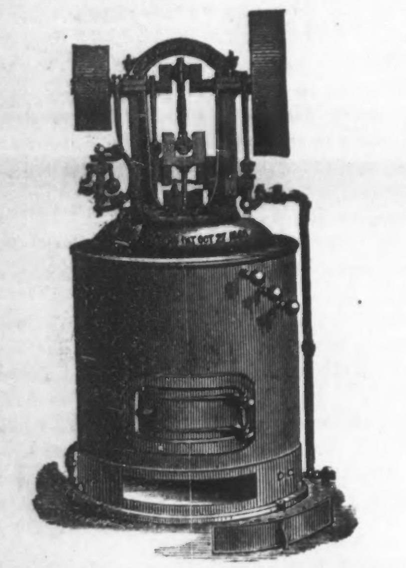
JAY COOKE & CO.,

NEW YORK, PHILADELPHIA, AND WASHINGTON,

Financial Agents Northern Pacific R. R. Co.

Jan. 7:tf

BAXTER ENGINE



ENGINE READY FOR USE.

THE BAXTER STEAM ENGINE is manufactured by Colt's Patent Fire Arms Manufacturing Company of Hartford, Ct., whose reputation for exact mechanism is well known, and who fully guarantee their work.

Every Boiler is tested under inspection of the Hartford Steam Boiler Insurance Company, and by them guaranteed and insured.

We therefore feel justified in claiming that, in points of mechanical construction, safety, and durability, the

BAXTER ENGINE

has no equal; while in simplicity of construction, economy space and fuel, it stands without a rival.

Over three hundred engines are now in use, and giving entire satisfaction.

Sizes—2, 3, 5, 8, and 10-horse power.

THE MOST ECONOMICAL ENGINE IN THE WORLD.

Call and see them or send for Circular and Price List to

WILLIAM D. RUSSELL,

Office of The Baxter Steam Engine Co.,

an16:1y 18 Park Place, New York.

B. B. FRENCH, C. E.,

BRIDGES,

IN IRON, WOOD, OR STONE.

DRAWINGS, ESTIMATES, &c.

155 Broadway, New York.

Dec. 31-3m

BACON'S

HOISTING ENGINES.

FOR MINES, BLAST FURNACES, PILE DRIVING, CONTRACTORS' USE, &C.
Adapted to Every Possible Duty.

COMPACT, STRONG, SIMPLE AND DURABLE.

Manufactured by

THE SPEEDWELL IRON WORKS,

OFFICE AND WAREROOM..................36 CORTLAND STREET, N. Y.
WORKS..................MORRISTOWN, N. J. jan9-tf

OTIS' SAFETY HOISTING MACHINERY,

Special adaptation for MINES and FURNACES.

Just Out—combining RAPIDITY of MOVEMENT, EASE of CONTROL and PERFECT SAFETY with GREATEST DURABILITY.

WORN PARTS CAN BE REPLACED IN A FEW MINUTES.

OTIS BROTHERS & CO.,....PATENTEES AND SOLE MANUFACTURERS.
OFFICE 348 BROADWAY, NEW YORK.......FACTORY AT YONKERS.

May 21:1 yr

COAL YARD, QUARRY, AND CONTRACTORS' APPARATUS.

Andrews's Patents, Noiseless, Friction-Grooved, Portable and Warehouse Hoisters.

FRICTION OR GEARED MINING AND QUARRY HOISTERS.

For Hoisting and Conveying Material to any Distance by Wire Cables.

Smoke-burning Safety Boilers. Oscillating Engines, Double and Single, ½ to 100 horse-power. Centrifugal Pumps, 100 to 100,000 gallons per minute. Best Pumps in the world; pass mud, sand, gravel, coal, grain, etc., without injury. All light, simple, durable and economical.

Send for circulars.

WILLIAM D. ANDREWS & BRO.,

oct-15-1y 414 WATER STREET, NEW YORK.

BURLEIGH

ROCK DRILLS

AND

AIR COMPRESSORS.

The Burleigh Rock Drills, which have stood the test of five years constant use at the Hoosac Tunnel, and which are now in use in nearly every State in the Union, as well as in Europe and South America, are unequalled in efficiency and economy by any other Drilling Machine. They are of various sizes, and equally well adapted to Tunnelling, Shafting, Open Cut or Quarrying, and will drill six to ten inches per minute in granite. They are driven by steam above ground, or compressed air when under ground. The Burleigh Air Compressor is the best engine yet devised for furnishing the "air motor" for the many purposes to which it is now being applied.

Send for illustrated pamphlet to

BURLEIGH ROCK DRILL CO.,

FITCHBURG, MASS.

Aug. 3:6m

LAFLIN & RAND,

POWDER CO., 21 Park Row, opposite Astor House, New York,

invite attention to their facilities for delivering

BLASTING POWDER,

SAFETY FUSE,

ELECTRICAL BLASTING

APPARATUS, &c.,

wherever required, from having nine manufactories in different States, beside agencies and magazines at all distributing points. nov. 1:1y

"ENGINEERING."

"The leading Engineering Journal of the world," indispensable to every Civil, Mining, or Mechanical Engineer, can now be obtained post-paid at $9 30 currency, by remitting Post Office order to NEW YORK OFFICE "ENGINEERING," 52 Broadway.

Patterson Brothers,

No. 27 Park Row, New York City

(P. O. BOX 3341,)

Commission Hardware Merchants

IMPORTERS AND RETAILERS OF

HARDWARE AND CUTLERY,

Offer at manufacturers' prices, wholesale and retail, a very complete assortment of

WATERBURY AND ANSONIA

BRASS.

Low, Ordinary and Spring Wire, No. 00 to 34 Sheet, No. 0 to 40, in width from ¼ inch to 24 inches, Sheet Copper, Sheet Iron, Hoop Iron; German Silver Wire, and Sheet German Silver; Tubing, Copper Wire, Silvered Wire, Iron Wire of all kinds; Steel Wire, Brass, Copper and German Silver Rod.

THE

American Trade Journal.

Particularly devoted to the general trade interests of the country, has an established commercial circulation exceeding

40,000 COPIES,

extending throughout the United States, and to Great Britain, Brazil, Mexico, Central America, Buenos Ayres, Chili, Australia and Japan.

It has been the agent for the successful introduction to notice and sale of American productions in the countries named; and, by a steadily increasing circulation in that direction, has proven the most valuable medium for our trade interests abroad as well as at home.

Published Weekly and Monthly under the auspices of the BOARD OF TRADE.

F. H. ROLLINS, 8 Church street, New York.

Oct.1.1.year

WOOD ENGRAVING

EXECUTED AT THE OFFICE OF

The Engineering and Mining Journal.

27 PARK PLACE, NEW YORK CITY.