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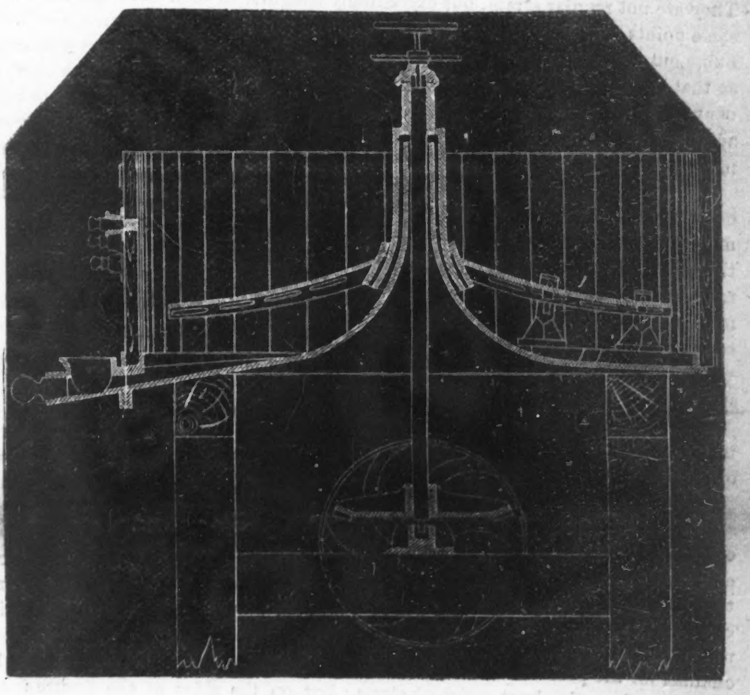
The Settler.

The work of the settler, in the system of amalgamation, is to separate the minute particles of mercury and amalgam from the pulp through which they are distributed. It resembles a pan in some respects, being made up of a circular box in which revolves a central axis carrying arms, and to these arms are fixed shoes. These iron shoes, however, do not come in contact with the bottom of the settler, as no grinding action is desired. They are faced with wooden rubbers which keep the heavier parts of the pulp thoroughly stirred up, while the revolving arms perform a similar service for the lighter portions floating above. The pulp is thinned by a stream of water during the operation for which reason the settler has a larger capacity than the pan. It is formed of a conoidal iron casting, in the hollow axis of which works the upright to which the revolving arms are fastened. The sides of the settler are of wood, but sometimes sheet-iron is used instead. Holes stopped by plugs are pierced in the side at different levels through which the thinned pulp can be gradually drawn off. On one side is bolted an iron quicksilver bowl, communicating with a radial gutter cast in the iron bottom. The rotary part of the apparatus consists of the central shaft before mentioned which carries on its lower end a bevelled cog wheel, and at its upper end an arrangement for adjusting the height of the wood rubbers so as to lower them as they gradually wear away. This arrangement, which is a duplicate of the devices for a similar purpose in the pans heretofore illustrated by us, consists in a deep collar embracing the vertical part of the conoidal iron bottom of the settler, and hung upon the shaft by a screw furnished with a hand wheel. The revolving arms are carried out from this collar. All these details are plainly shown in the accompanying cut, which shows the machine as made at the Union Iron Works, San Francisco.



THE SETTLER.

Observations on the Mines and Ores of Little Cottonwood Canyon, Utah.

BY HENRY ENGELMANN, E. M.*, SALT LAKE CITY.

The lead ores of Little Cottonwood mining district, which come out of the limestone formations, have almost all a very curious characteristic feature in common, however they may differ in appearance, richness, chemical composition and fusibility, viz. : they have in their composition a large proportion of exceedingly fine siliceous sand or silt, intimately mixed with the ore-matter. In some mines this feature is obvious ; in others it would not be suspected from the appearance of the ore, but may be discovered by a careful washing process, whereby the coloring slimes on the one hand, and the heavier and coarser particles on the other, are removed. In solid pieces of ore it often requires the application of acids to prove the presence of this sand. Freest from it is the galena which lies within the main body of oxidized ores, and is evidently a secondary product, formed from the oxidized ores by the reducing agency of organic matter contained in the rocks, and which has, in turn, again undergone oxidation in many instances. In the Emma ores this sand is quite prominent. Prof. SILLIMAN stated at a former meeting of this association that a cargo sample of that ore contained over 40 per cent. of silica diffused in the mass in the form of an impalpable powder, "and he was led to believe, because a piece of the wallrock was nearly free from silica, that the silica was an original and integral factor of the ore mass." However, closer investigation proves that the silex is an original factor of the enclosing rocks, and not strictly an impalpable powder, but a more or less fine sand, which can be separated in a great measure from the impalpable slimes by washing. In other ores this sand is far more subordinate, but a glance at the waste-dumps will satisfy any critical observer that such material plays a very important part in most mines of the district, even where it is less prominent in the selected ores.

The leading geological features of the district are the following : The lowest rock exposed is a white granite rock, with dark-colored mica, which forms for a distance of several miles the high walls of the lower part of the cañon of Little Cottonwood creek, west of the mining region, and comes again to the surface on the other side of the mining town of Alta, projecting into the mining field on its east side. It is also largely exposed on some of the neighboring branches of Big Cottonwood Creek. This granite is overlaid consecutively by a considerable thickness of quartzites, enclosing slates ; then by a first limestone belt, by a second series of quartzites, and finally by the second limestones. These strata do not, however, rest conformably upon the granitic rock. At some points in the vicinity the limestone may be seen to abut against the granite. All the stratified rocks are more or less metamorphosed. The quartzite shows most evidently by its structure that it is an altered sandstone. The limestone has at some points become coarsely crystalline, at others the silica which it contains has entered into new chemical combinations, forming asbestus and other crystalline silicates which are disseminated abundantly through the rock. These strata are of paleozoic age, probably of the carboniferous period, but possibly older. No fossils have ever been discovered in this cañon by which their age might be determined.

I have also observed several dykes of greenstone traversing the strata, similar to the greenstones so largely developed in Bingham cañon, and, some miles distant, traces of more recent eruptive action may be distinguished. As might be expected under such circumstances, contortions and dislocations of the strata are not wanting. Some can be plainly seen, others, undoubtedly existing, are hidden from view. Thus, near the lower end of the Alta flat, on the north side of the cañon, the lower quartzite and the lower limestone may be seen on opposite sides of a fissure, both dipping in the same direction. The valley itself, near Alta, appears to be the result of a dislocation. The trend of the strata on both sides is almost at right angles. Another fault, trending north and south, appears to pass to the east of the Wellington mine, and its influence appears to extend across the cañon, where the trend of the strata changes considerably towards the east end of the Emma hill. [The towering mountains are throughout this region designated as hills when individual eminences are referred to.] What relation these dislocations of the strata may hold to the ore deposits, remains as yet entirely a matter of speculation. The workings in none of the mines have gone deep enough to ascertain their influence. They may date from different periods of upheaval, and may have existed, partly at least, before the period of mineral infiltration. Some of the minor fissures have been the occasion of the formation of fissure veins, and even the location of the deposits, which run parallel to the stratification of the rocks, may have been in part influenced by fissures opened in the stratification in consequence of such

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* A paper read before the American Institute of Mining Engineers, at Boston, February 20, 1873.

upheavals, which afforded ready access to the percolating mineral-bearing waters.

At present, the principal mines are in the second limestone, but ores have been discovered in all the different formations. Thus, the granite southeast of Alta is, on the sides of a narrow fissure, impregnated with galena, blende, pyrites, etc. Along the junction of the granite and limestone, east of Alta, but especially on the adjoining uppermost branches of Big Cottonwood Creek, traces of copper ores have been discovered over a considerable area. Near the greenstone dykes, ores have been observed in the adjoining rocks. Veins cutting the quartzites appear to be often filled with a mixture of iron pyrites and arsenical pyrites carrying silver, and at other points with galena and antimony glance and the products of their oxidation. But few of these prospects have been followed up to any considerable extent. The limestones are the principal ore-bearing rocks. While the Emma belt is in the second, the mines of the Lexington hill are in the first limestone.

The ore deposits in these limestones are of various kinds. Most prominent we find "leads" conforming more or less to the country rock in trend and dip. They are not regular strata, but exceedingly irregular in their development. At some points they maintain a moderate width for some distance, then again they bulge out to immense deposits, and at intervals they contract to almost nothing, so that their continuation even appears doubtful. They enclose masses of the country rock as "horses," and spurs branch off from them and penetrate the adjoining strata. In some places they are rich in lead and silver, in others much poorer, or even traceable only as a discoloration of the rock. Such is the great ore-belt including the Emma, Vallejo, Flagstaff, Reed and Benson, and other mines. They are exactly such as would be formed most naturally by mineral waters percolating the strata, which dissolved the earthy carbonates of the rocks, and deposited mineral carbonates and sulphates in their place by the most simple chemical action, eroding wide openings and depositing large masses of ore where the rock was most easily dissolved, and confining themselves to narrow channels where the rock offered more resistance, forming no continuous stratum of ores, but a series of connected deposits, pockets and spurs.

Next we find fissure-veins, which cut across the stratification of the sedimentary rocks. We have seen that numerous faults and fissures traverse the rocks of the district. Where mineral-bearing waters have found access to these fissures, fissure-veins have been formed; but these fissure-veins differ from the ideal structure which we are accustomed to attribute to this kind of veins. I can best explain their appearance if I say that they present very much the same features as the above-described strata-leads, with the only difference that they intersect the strata instead of following them. Their aqueous origin, by the direct interchange of the mineral in the water with the lime and magnesia of the rock, is unmistakable. The pre-existing fissure, cutting the strata, offered the readiest channel for the percolating waters, which therefore followed it, instead of eroding a way along the least resisting strata; but on the sides of the fissure they attacked the strata more or less according to the resistance the latter offered, and we find, therefore, these fissure-veins filled with ore and the insoluble residue from the strata, and decidedly "pockety." Several such veins may be observed on the south side of the cañon, on Peruvian hill. Nothing is more natural than that the mineral waters passing through such a fissure-vein, on coming to a stratum which offered them special facilities for attack, should have followed that stratum and formed a spur to the vein analogous in its structure to the first described strata-leads; and such combinations we may observe in reality. A very interesting example of this combination of fissure-vein and strata-lead can be seen *exposed in the face of the mountain* near Ophir, in East Cañon.

Possibly some veins of the district may be true fissure-veins part of the way, and farther on the fissure may be barren, and the principal body of ore may continue in such a spur as a strata-lead. Still others may be what is often called gash-veins, not long and deep fissures cutting the different rock formations, the result of dislocations of the strata, but fissures confined to a limited thickness of strata, more the result of shrinkage or some similar agency. Such gash-veins, in combination with strata-deposits, are apt to form a net-work of ore deposits.

Finally, we may find ore deposits of a limited extent apparently disconnected with any others, the result of local slides which severed them from the mother lode. Several such have been exposed, exciting on the part of the discoverers great hopes, followed speedily by disappointment.

The first as well as the second limestone, which carry the principal ore deposits of the district, present a very peculiar character. Large bodies of these rocks have the appearance of a saccharoidal sandstone, and closely resemble white lump sugar, with a finely granular structure. They are so soft that they crumble under the least pressure, and are often mistaken for sandstone. The application of acids proves that they consist of a mixture of the carbonate of lime (and perhaps magnesia) with fine siliceous sand. Within a distance of a few feet these strata often change their appearance, lose their saccharoidal structure, and assume the appearance of common sub-crystalline siliceous limestones, or the silex separates and unites to honey-combed concretions and masses, or, predominating, forms a quartzite, while other adjoining strata contain little silex. (Some so-called ledges of milling ore, in an adjoining district in the same formation, consist of such barren concretions of silica in this saccharoidal limestone). Such rock is largely developed on Davenport hill, Emma hill, Peruvian hill, &c., and it would seem as if it had been especially favorable to the deposition of the ores; nor does this appear strange. This rock is, in consequence of its structure, far more readily permeable to water than the limestones of denser texture, and would offer to mineral waters a hundredfold more points of attack than an ordinary limestone or dolomite. It is natural, then, that in the zone of these saccharoidal rocks the ore deposits are numerous; that in them principally the exchange took place between the lead, iron, silica, and other metallic salts held in solution by the waters and the earthy carbonates. The latter were all dissolved, the mineral carbonates and sulphates took their place, the silex contained in the rock in the form of fine sand remained behind and was enveloped by the metallic salts, exactly as it had before been by the lime, while the denser portions of the strata, and the less siliceous portions which are also denser, resisted the action of the waters. This is the obvious cause of the siliceous character of the ores throughout the district in the strata-leads and fissure veins. Where the sand predominated too much over the lime and magnesia in the rock, few metallic minerals were deposited in proportion, and the ores at such points are prevailingly siliceous and comparatively poor in metals, even to such a degree as to become unproductive. From such points is derived the large amount of arenaceous matter on the waste dumps of the mines. The ore is contained in the veins principally in the form of earthy carbonates, and sometimes in sulphates. Distinct crystallization is rare. It is apparently mostly in the form in which it was originally precipitated by the rapid action of the lime upon the mineral waters. If it had undergone reduction and reoxidation, the silica would have become more separated from the metallic parts of the ore. By the action of organic matter in the rock some sulphates have been reduced, and especially galena has thus been formed, which is mostly crystalline, and rather free from sand. In some instances it has been reoxidized. As regards greater depths, this reducing action will probably be found stronger, and consequently more sulphides will be met with, such as galena, pyrites, blende, etc.

I have remarked that the silica is in the form of a more or less fine sand, sometimes almost impalpable. Where it has predominated we find pieces of sandstone in the ore; and frequently it has undergone a metamorphosis and been concentrated to larger grains of amorphous silica, but never, so far as I have seen, to crystalline quartz, except in the thinnest coatings of small cavities in the ore. A very curious case of this transformation of the silica is found in one of the fissure veins of the district, which, at the point at which it has been opened, is nearly filled with a siliceous earthy matter containing little lead and iron, and some silver, and numerous white fragments of finely-grained silica. Close by, the whole vein, more than ten feet wide, is composed of a semi-vitreous, brittle mass of silex, which is rent with innumerable cracks and partings—a kind of opal.

Mines of the described character, wherever they occur, are remarkable, when "in *bonanza,*" for the immense output of ore which they are capable of affording, for the small expense of extraction, and consequently for the large returns which they yield. In these respects they closely resemble contact-veins, among which we may count many of the richest mines. On the other hand, it is exceedingly difficult to form a correct estimate in regard to continuation and extent of the rich ore-bodies beyond the limits of actual exploration. The real value of such a mine depends upon the ore in sight. The prudent investor of capital has to disregard the evergreen hope of the prospector; and a judicious management will place great stress upon pushing the works of exploration, by tracing the limits of the known bonanzas and developing new ores in the course of the lead. The idea of isolated deposits is incompatible with the manner in which the ore has evidently been formed. A rich zone is apt to continue rich, with incidental interruptions, until the surrounding country rock changes in a manner indicating that it has been less favorable to the precipitation of the ore; while, on the other hand, a lean streak may at any point, on reaching a more favorable rock, develop a larger wealth of ore.

The prospects in regard to continuation in depth depend much upon the nature and situation of the leads. With many of the mines the prospects appear to be very fair; yet there are indications that, at a certain depth, far less desirable ores may make their appearance, such as pyrites and zinc blende, poor in silver. Further developments will be watched with interest. Fissure veins are, of course, apt to undergo great modifications on entering a different formation—on passing from the limestone to the quartzite, for example, in which the veins appear to carry more arsenic and antimony, and to be developed in a somewhat different manner.

The bulk of the ores which are mined at present consists of lead carbonate and some sulphate mixed with more or less silica, as described above, in an earthy or loosely agglomerated condition, interspersed often with more or less galena, and mixed with varying quantities of oxide of iron, some containing so little of it that their color is gray, and others being dark brown. At some points the brown iron ore forms solid pieces, which are often siliceous. Some ores contain, besides antimonial oxide or antimoniate of lead, a little molybdate of lead, carbonate of copper, linarite, manganese, etc. At other points we observe a yellow basic hydrous sulphate of iron, mixed with clay; at still other, pyrites and blendes, arsenical pyrites and antimony glance. Many of the ores contain too much sulphur to be profitably smelted in the shaft furnace, where they cause too great a loss of silver dispersed in particles of matte in the slag (although the smelters generally will not acknowledge this source of loss), and too little sulphur to be profitably roasted. It is high time that a better separation and classification of the ores took place at the mines. The present system, or rather practice, belongs to a period which ought to have gone by in the central districts of Utah.

The assay value of the ores is quite variable. The gross average of those which are sold for smelting may be said to vary between $40 and $120 in silver per ton, and between 20 and 60 per cent. of lead. The Emma ores sold in 1872 averaged nearly $90 in silver and 45 per cent. in lead. The value of specimens varies between very wide limits. I will merely mention a few instances: Zinc blende without an appreciable quantity of silver; yellow iron sulphate with $13 per ton; siliceous brown iron ore with $30 per ton; arsenical pyrites with $50 per ton; siliceous lead carbonate with 50 per cent. of lead and $52 silver per ton; galena with $156 silver per ton; galena with $450 silver per ton; carbonate and sulphate of lead with $1,200 silver per ton; carbonate of lead with $2,000 silver per ton. The antimoniates are often, but by no means always, richer in silver than the average of other ores.

The value of the ores to the smelter, other things being equal, varies with the relative percentage of silex and iron which they contain. Some are self-fluxing, or contain even a larger proportion of oxide of iron than is required for forming a good slag, while others are quite refractory, and require a large addition of fluxes, whereby the production of the furnace is reduced, and the quantity to be smelted and the cost of smelting are materially increased. A mixture of ores from different mines is generally most profitable to the smelter.

As the silica is usually present in excess in the Little Cottonwood ores, and renders their treatment more expensive, the separation of part at least of that silica, in other words, concentration or dressing of the ores, would be highly desirable; but this is by no means as easy a matter as might be inferred from some of my remarks in the beginning of this article. The silica is in the form of sand or grains; but it is so intimately mixed and agglomerated with the oxidized ores that it is in most cases impossible to separate them satisfactorily. The idea that fine stamping of the ores would facilitate this separation is not correct. It is easy to separate the heaviest grades of solid ore and the pure grades of sand; but in the majority of cases separation cannot be carried far enough, and there are many pieces of ore in which the combination of ore with silica appear to be chemical, which pieces form solid shells and concretional bodies in the ore-mass. There are, however, ores which can be dressed in such a manner that a considerable proportion of silica can be removed therefrom and superior smelting ores separated, while another portion, viz., the slimes, containing most of the iron of the ores, may either serve as an argentiferous flux, or be beneficiated by amalgamation. Having paid considerable attention to this point, and made numerous tests with the most widely different ores of the district, I propose to enter upon its discussion more fully at some future time.

The American Institute of Mining Engineers.

BOSTON MEETING.

Session of Tuesday Evening, February 20.

(Continued from page 132.)

At the close of the President's address a number of gentlemen, recommended by the Council, were elected as members or associates of the Institute (this list was given in our last number), and various announcements as to the programme of the meeting were made on behalf of the Council and the Local Committee.

On motion of Prof. Pettee, the following resolution was unanimously adopted:

Resolved, That the members ot the Boston Society of Natural History, and those gentlemen connected with the Massachusetts Institute of Technology, or otherwise interested in mining and metallurgy, be invited to take part in the discussions which follow the readings of the papers at all the sessions of this meeting.

The President: I wish to say, before the reading of the first paper, that Dr. Hunt's address has brought up a number of important subjects, too important, as he remarked in reading it, to be fairly overhauled in a single evening. It is always at a disadvantage that we listen to a paper for the first time, without the leisure to examine carefully its statements of detail from which its conclusions are drawn. Some of Dr. Hunt's suggestions (if I may use a milder term than conclusions) are extremely interesting. Some of them are novel; some of them I cannot accept. I refer particularly, under the last head, to the suggested denial of the influence of igneous rocks on the formation of mineral deposits. But I do not mean to discuss these points to-night. It is, as I understand, with the desire that observers who have had their experiences in different fields from those described in that paper, should throw what light upon the subject they can, that these views were brought forward. I trust that many members, both those who are present and those who are absent to-night, will be led by Dr. Hunt's address to collect evidence bearing upon this point; that they will keep the subject in mind until the next meeting, and make it the text of fresh conclusions drawn from other data. We have never had more profitable contributions in this Institute than those which sprung up, some of them at the earliest meeting, and have been passed back and forward, like shuttlecocks, from one to another, so that what was brought up at one meeting has been criticized and discussed at future meetings with wider information. I could give several illustrations which have led, not by the original paper or debate, but by the study and investigation of the members "between times," so to speak, and the discussions at succeeding meetings, to valuable results. I hope, therefore, that the very important and profound questions raised in this address will be carefully examined and illustrated by as much of our individual experience as can be brought to bear upon it. I want to ask Dr. Hunt, in regard to another statement in his paper, whether I understood him to say, that in his experience phosphates, and particularly apatite, were wanting in the Norian rocks in New York, and in the deposits attached to these rocks?

Prof. Hunt: That is certainly what I said. So far as my observations go, I have never found in these granular ores, of the titaniferous class, any phosphate of lime. I have made several analyses of these titaniferous ores and have found them to contain a very small proportion of phophorus. But I merely state the facts so far as I observed them, in order to awaken inquiry and get further contributions to our knowledge of this matter. Apatite certainly occurs with the iron ores of the older Laurentian gneiss, intermixed with the ore in considerably large quantities, and freely disseminated through some of the limestone and pyroxenic rocks which are the immediate accompaniments of the ores, as it were, and it is commonly found in those rocks, and not, so far as my observation and experience goes, in those of the Norian series.

The President: At our Troy meeting we took an excursion to Mount Moriah, in Essex County, unfortunately without the company of Dr. Hunt. We all knew he had examined that ore quite carefully, and some member of the Institute, as I understood at the time, spoke of the rocks around Mount Moriah enclosing the great beds that are being worked there, near Port Henry, as the Norian rocks of Hunt. That is probably a mistake, which my question was intended to bring out.

Dr. Hunt: In a report which I made two years ago, which was never published, and which I went over with Prof. Silliman this morning, I made it a point that the rocks around Port Henry are in the old Laurentian rocks; but when you get further to the northeast you come to the Norian region, and get an entirely different character of rock. I could not mention any more remarkable instance of the union of phosphates with the ore than what is presented in the Port Henry ore bed where the phosphates predominate; but in Elizabethtown and Westport, the Kingdom ore-bed and some others, you lose the phosphates. I don't mean to generalize too much, because there are large beds of iron ore in the older Laurentian rocks in which there are phosphates. There are small amounts of phosphates in the titaniferous rocks. A small amount of titanium is found in the case of some iron ores of the Laurentian masses. There are, perhaps, no sharp lines to be drawn; but the distinction in regard to the distribution of these different classes of ores is one which probably has a money value in regard to working them.

The President: I would like to ask Dr. Hunt, whether he thinks this difference, as to the presence or absence of apatite, has any bearing upon the question of the organic or other origin of the deposits; whether the phosphorus in the apatite is referred by him to organic sources, co-existent with the original deposition of the beds?

Dr. Hunt: I could scarcely confirm anything of that kind; for I do not see any necessary connection between the presence of phosphates and organic matter. To a certain extent there is a connection between the accumulation of phosphates and organic matters, as we see in our beds of guano; but that these deposits may have been first disseminated in the rocks and existed there before animal or vegetable life, is evident. Sir Roderick Murchison reasons as if he supposed the presence of phosphates was connected with animal life; but neither animals nor vegetables ever had power to create phosphates; they only assimilate and bring together the mineral elements in the soil. Hence I don't consider that there is any necessary connection between the presence of phosphates and organic life, I would recall the fact that in Maine, alongside with ores of tin, we find large crystals of phosphates. That goes back to the whole question of the distribution of this element, and the nature of the processes by which different mineral species are gathered together.

Prof. Silliman: I don't propose to prolong this discussion; but I desire to say that I will take occasion to-morrow to make a communication in regard to the occurrence of magnetites in Northern New York, as bearing particularly upon this question of the presence and absence of phosphates and titanic acid. I have had some opportunity during the last season to study the region near the St. Lawrence River. I desire to second the President's remarks, which, I have no doubt, meet the full concurrence of all gentlemen present, concerning the delight with which we have listened to the address of Dr. Hunt. The general scope of his remarks as regards the distribution of metals by evolution, and the precipitation of those metals in sedimentary rocks, by processes which are analogous to those which are taking place to-day, is one so particularly suggestive, and so rich in practical value, that it is sure not to slumber for want of observation. You, sir, and other gentlemen here, who have witnessed the singular deposition or mode of occurrence of the argentiferous and other ores in the limestone of the regions in the center of the continent, will bear testimony to the complete revolution which we are compelled to make in our early ideas on this very important subject, and the acceptance of results which are as yet but imperfectly understood. You will bear in mind, probably, the extraordinary method of occurrence of the silver ores of the Oquirrh range on the west bank of the Jordan river, opposite the Wahsatch, in Utah, which present the most wonderful, singular, and beautiful appearance. You have everywhere, distributed through the cracks of the limestone (which may be likened to the cracks in the varnish of an old picture), ferruginous ores of silver, lead, and antimony. There is evidence, constantly, in the abundance of aqueous action, of the erosion of large cavities in the interior of the limestone. There are these deposits of epigene minerals, having no manner of connection with the rocks in which they occur; for limestones are destitute of lead, antimony, and silver; and the question occurs, what has been the source of the solutions which have found there their precipitation? I mention it only as serving to lend force to the remarks of Dr. Hunt upon the very important subject which forms the theme of his address.

THE MINES OF COTTONWOOD CAÑON.

The President: The first paper to be read this evening treats of a part of the Utah mining field, and I will say, for the information of those who have not been in Utah, and hence are unacquainted with the geography of its interior, which this paper somewhat presumes them to know, that the Little Cottonwood Cañon is a dozen miles south of Salt Lake City, in the Wahsatch Mountains, on the east side of the Jordan valley, opposite the Oquirrh range. In this little cañon are situated some of the mines which have made Utah silver-mining so famous during the last two years, and particularly the Emma, which sold for a very large sum in England, as you will recollect.

A paper on the Mines of the Cottonwood Cañon, by H. Engelmann, of Salt Lake City, was then read by the Secretary, in the absence of the author. This paper is given in another column.

Professor Silliman. I was not informed, until Dr. Engelmann's publication last summer, in the Engineering and Mining Journal, that there existed large masses—many hundreds of tons, as he said—of nearly pure siliceous sand upon the dumps of the Emma. I requested a gentleman at the mine to send me a sample of these, and whether what he selected was or was not a sample, I am unable to say; but what I received was not siliceous material, but soluble dolomite. But I thought, on the whole, it was not worth while to discuss a question of that kind upon any evidence but one's own experience in the collection of samples. I don't think that time really alters the position which I took in regard to the distribution of silica in the Emma ore, as to whether it was or was not an integral portion of the metalliferous mass. I think that question is still an open one, if we consider that these ores are epigene ores, as they unquestionably are. The question immediately suggests itself, whether they have been deposited as carbonates or sulphates; or whether they have been deposited as sulphides, and by the process of oxidation converted into carbonates and sulphates of the various metals present. I was inclined to the latter opinion, more especially that in that portion of the great *bonanza* of the Emma where the atmosphere particularly could have no access, the mass was substantially galena, and the transformation was yet going on, under the influence, as I supposed, of the same cause as in other portions effecting its complete oxidation and change into carbonates, &c. I was disposed to look upon all the epigene minerals of the Emma deposit as having been the result of oxidation subsequent to production of sulphides. In allusion to a point, which is incidentally mentioned by Dr. Engelmann in his paper of the occurrence of a small portion of molybdates, I ventured to suggest a year ago in a short paper, that throughout the Wahsatch as far as observation had gone, we find a very remarkable substitution of molybdic acid for phosphoric acid; that in place of pyromorphite, etc., so often found in company with lead ore, we find a complete absence of it. Although the molybdates are rare, they were never absent entirely; and careful observation would always detect them. I found them in numerous other points, and more recently there have been found in Utah (at the Tecoma mine) the most magnificent crystals of molybdates of lead (wulfenite) that I ever saw.

It is comparatively rare that another mineral acid has taken the place of phosphoric acid. On the other side of the Jordan river you do find the phosphate of lead, but there you are in a different geological age. I can scarcely agree with Dr. Engelmann that the Little Cottonwood contains no fossils. I would refer to a paper by Professor Tenney in a late number of the *American Journal*, in which he describes species of Devonian fossils from there; and Mr. King in his remarks upon the Wahsatch also recognises the existence of carboniferous or Devonian fossils.

Prof. W. P. Blake: When I first climbed up that dump of the Emma, I thought it was formed of white sand. I took some down to the Assay office, dried it carefully, and found it would all dissolve. It was supposed by everybody to be sand, and, in order to make sure, I subjected it to the test; then I gave it up, and supposed there was no sand there, but Prof. Silliman found silica in the ore. As I understand Dr. Engelmann's paper, that is derived from the surrounding rocks. Mr. Silliman mentioned the fact.

Prof. Silliman: There was 40 per cent. of silica in some of the first-class ores, as shown by an average sample from 80 or 100 tons—a cargo sample, subjected to ultimate analysis with carbonate of soda. Of course, there could be no doubt as to the presence of silica. I beg leave to make this cautionary remark. I don't wish by any means to be understood as saying that Dr. Engelmann may not be entirely right in the fact of observing silica as sand. It would be absurd in me to challenge his capacity to detect the presence of silica. Of course, he must know how to distinguish these very familiar things; but I can only say, in the particular sample which reached me as quartzite sand there was no silica, after treating with hydrochloric acid and evaporating to dryness.

The President: It may be possible that Dr. Engelmann may have overstated the extent to which silica occurs in that form. At the same time I am inclined to think he has taken precautions such as would render him safe in his opinion.

Prof. Blake: In regard to the occurrence of fossils, I think no mention was made of the fact that specimens of fossils have been taken from the underground chambers of the Emma. I have no doubt that the rocks of the Emma deposits are carboniferous. On the same zone, between the Emma and the Flagstaff, you can get abundance of corals and other fossils, but they are very obscure.

Prof. Silliman: I think that is an open question. I collected a large number of these specimens and brought them home, and subjected them to Mr. Dawson and Prof. Tenney, in the belief that they were organic remains; but they concluded that the forms were illusionary. They could not recognise the forms, and if they could not, it would have been presumption in me.

Prof. Blake: I have found distinct fossils there. I collected some large bones, but gave up bringing them in, because the paleontologists said it was useless to try to do anything with them. There is something further in regard to the origin of that ore. It is a fact which has interested me in the formation of the mines of the Tiger and others in the Oquirrh range. There is an immense bed of iron pyrites, sprinkled with galena, and all carrying silver; and this bed is very regularly formed, and is the most distinct case of the kind that I saw in Utah. The decomposition of such a mass, of such great extent, would give a mineral solution which, percolating downwards into limestone, might give us the class of deposits which we find there, and the deposits which follow the lines of the greatest solubility, or, perhaps, following down the fissures, and in that way giving rise to these very irregular and extraordinary bodies. We find these in some places very narrow and contracted, and then expanding out into large chambers.

The President: Some years ago, while traveling in the West, I made the acquaintance of a gentleman—a man who, though cut off from all intercourse with scientific men, developed to a remarkable extent a knowledge of geology, and also a practical knowledge of the geology of his State exceeding that of any other man. He showed me a large and interesting collection of minerals; and he betrayed in conversation such a perfect knowledge of many problems in geology that I was much surprised when he said to me, "There is one thing in geology I wish you would explain. I never saw any allusion to it in books, and I have studied it in a hundred or two hundred instances without being able to find any explanation." He picked up one of these amethyst geodes, which he had cut in two, and, showing me the concentric circle, said to me: "How does that get there? I have cut in two more than a hundred, and I have observed this concentric structure, without the slightest chance for it to get in, and it is to me the most mysterious thing in geology." I said: "You must cut some more in two. If you had sawed it through in the right place, you would have found out where the fluid got in." It is often asked, How did the silver ore, in its original solution, get into the place in which we find it, which seems to be entirely isolated from every other, and which apparently "peters out" at the bottom, so there is no connection there? I have no doubt we might often find the connection if we could make sections of the deposit in all directions, or if we should happen to make a section in the particular direction which was followed by the infiltrating water. When we reflect how incomplete are the sections of a bed of ore, and how incomplete is the exposure of its superficial limits which we obtain in mining, we shall be satisfied that many a channel may exist, unsuspected, which would have sufficed to bring in the infiltrated mass. Perhaps even more important than this is the influence of surface erosion in carrying away the traces of the sources of supply. As Dr. Engelmann says, it is not an uncommon thing for the infiltration to follow fissures in the rock for a certain distance, find its way off between the rocks into intercalated and parallel layers, and back again into the fissures. On such irregular deposits of ore the effect of surface erosion may be to cut off the connections between different parts and to leave them as apparently distinct and independent bodies, to puzzle the observer. If you go into any limestone cavern, and follow its winding passages and irregular architecture, you will easily conceive that the cutting away of the larger part would leave chambers, concerning which no man could say how they came there, and what relation they bore to each other. In like manner we may find several ore deposits where originally there may have been only one deposit.

Now, that enormous erosion has taken place is undoubtedly true. Prof. Robert Schlagintweit, with whom I had the pleasure of traveling, some years ago, in our western country—a man who has observed the action of erosion in almost all the lands of the earth, and is particularly acquainted with the surfaces of mountain ranges, remarked to me with much astonishment upon the precipitous nature of the cañons of the Sierra, and the comparatively small amount of debris which they contain. The traveler in the Inland Basin will notice the same phenomenon, and will easily conclude, from the outlines of the mountains and valleys, that the latter are filled up; that the debris is in the valleys, and not in the side cañons, but that there has been a levelling process going on, the extent of which might be roughly calculated from the relations of the upheaved strata and the contour of the surface. At least, I think it may be possible to estimate the amount of material taken from these mountains and deposited in these valleys during the period when the latter have not been the course of mighty rivers, but the beds of lakes, distributing the material within defined areas.

This fact of great erosion is plain enough. It has degraded the mountain ranges by hundreds and thousands of feet; it is not to be wondered at that we cannot find, in our explorations of comparatively petty depth, the place where the mineral came in. This argument I brought forward in my second Report

CONTINUED ON PAGE 152.

☞ THE COAL TRADE.

NEW YORK, March 6, 1873.

Business does not show any exceptional features, but is just about what this season usually brings. We have before spoken of the small apparent effect of the hard winter upon the trade. It is certain that stocks must be closely drawn upon this year, and, according to most calculations, there ought by this time to be some call for coal. Perhaps the increase of price, which has been the result of official action, has been sufficient to moderate the demand. If so, the advance cannot be looked upon as unnatural or forced, but would have come, either in whole or in part, from the natural effects of rapid consumption and delayed opening of navigation. When the canals will be open cannot yet be even guessed, for the winter is still too threatening to make any day that can be fixed upon, uncertain, unless it is put uncomfortably far in the future. The production so far this year does not show any noticeable alteration from last year, and when the spring trade opens it is likely to be brisk at stiff prices.

The Clearfield County strike has ended, and after three months' struggle the miners resume work at the old rates. Another warning is, therefore, added to the long and unheeded list of experiences which should be sufficient to make the miner know when he is as well off as he can be. A time may come when the weight of past suffering will be enough to restrain present dissatisfaction, but we fear that it will be delayed many years. The resumption of work in Clearfield is having the happiest result upon the soft coal trade generally. The Pennsylvania railroad has ceased to play the part of a coal ogre, and no longer sweeps within its maw all that comes near it. Supplies are increasing in New York, and, though prices are still high, there is a slight improvement on last week, and a very great one in the rates of a month ago. It is a delicate matter to make quotations in an uncertain market, and we cannot name closer figures than $8 to $9.

Anthracite Coal Trade for 1872 and 1873.

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

COMPANIES.	1872.		1873.	
	WEEK.	TOTAL.	WEEK.	TOTAL.
*Phila & Reading R.R†	73,600	675,245	64,176	735,022
*Schuylkill Canal	..	13,356	...	6,594
*Lehigh Valley R.R.	57,708	671,830	53,966	628,983
Lehigh & Sus. R. R.	29,500	206,110	16,793	291,953
Lehigh Canal	....	....	....	....
Scranton North	16,013	113,417	13,134	108,465
" South	37,380	332,210	42 070	305,455
Penn. Coal Co., rail	19,984	153,254	14,473	119,937
" " " canal	....	...	....	....
Del. & Hnd. Canal Co	....	....	....	....
" " East	12,634	93,068	5,274	49,727
" " West	8,803	67,690	8,659	71,495
" " South	2,847	58,559	7,417	54,173
Shamokin	....	48,534	....	69,027
Trevorton	....	....	....	....
Lykens Valley Coal Co	....	....	....	....
Wyoming North	....	....	....	....
Wyoming South	....	....	....	....
P. N. Y. C. & R. R. Co.	5,043	57,442	10,479	133,532
Williamstown Col'y	....	......	....	....
Big Lick Col	....	......	....	....
Total	262,512	2,490,715	236,441	2,572,364
1870	236,441			2,490,715
Increase				81,649
Decrease	26,071			

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, 1872 and 1873.

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

COMPANIES.	1872.		1873	
	Week.	Year.	Week.	Year.
C. & O. Canal	..	....	....	....
B. & O. R. R.	18,588	161,067	26,704	179,228
Penn. S. Line	....	......	2,653	15,370
H. & B. T. R. R.	5,040	41,624	8,319	15,168
*Harrisburg & D.	5,865	100,097	4,827	64,479
*L. V. R. R.	....	....	194	5,765
P. & N.Y.C. & R. Co.	5,781	70,033	4,517	50,588
Cumberl'd Branch Canal	....	....	....	....
" Railroad	291	291	3,021	18,314
Total	35,560	373,112	50,235	398,877
			35,560	373,112
Decrease				
Increase			14,675	25,765

Northern Central Railway, Shamokin Division.

Below is the return of Coal sent over the Shamokin Division of the N. C. R. W., for the 7 days ending February 21, 1873.

		Tons. Cwt.
East	321 18	
West	9,718 16	
		10,040 14
Same time last year		8,976 18
Increase		1,063 18
Decrease		......
Total amount shipped to date		69,026 11
Same time last year		48,533 16
Increase		20,492 15
Decrease		

Philadelphia & Reading Railroad and Branches.

COAL TONNAGE

For the Week ending Saturday, March 1, 1872.

BY RAILROAD.—ANTHRACITE.

PASSING OVER MAIN LINE AND LEB. VAL. BRANCH.

	Tons. Cwt.
From St. Clair.	31,606 12
" Port Carbon.	2,945 16
" Pottsville.	1,931 19
" Schuylkill Haven.	6,587 19
" Pine Grove.	774 01
" Tamaqua.	5,457 05
" Harrisburg.	860 06
" Dauphin.	
Total	50,163 18

FOR SHIPMENT BY CANAL.

Passing Frackville Scales	
" Mill Creek "	
" Schuylkill Valley Scales	
" Mt. Carbon "	
" Cressona "	
" Pine Grove "	
" Tamaqua "	
Total	

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

Via Catawissa & Williamsport Br.	254 09
" N. C. R. R. passing Locust Gap.	849 00
" " " Shamokin.	4,897 01
" " " Herndon.	....
Total	6,000 10

SHIPPED WEST OR SOUTH FROM PINE GROVE.

Via Schuylkill & Susquehanna R. R.	662 09
" Lebanon & Pine Grove Branch	587 08
Total	1,249 17

CONSUMED ON LATERALS.

From Frackville Scales.	846 19
" Mill Creek "	758 07
" Schuylkill Valley Scales.	974 11
" Mt. Carbon "	1,312 11
" Cressona "	314 16
" Pine Grove "	88 02
" Tamaqua "	325 14
Total	4,621 00

LEHIGH AND WYOMING COAL.

Received via Silverbrook Junction, Sent East	......
Cat. & Wpt. Br. Sent West	....
" " Rupert, Cat. & Wpt. Br.	10 12
" " Allentown, E. Penn'a Br.	66 00
" " Alburtis, " "	......
" " Oreland, G. & N. Br.	1,451 16
" " Connecting R. R.	....
" " Willow Street R. R.	612 09
Total	2,140 17

BITUMINOUS.

From Harrisburg.	4,817 10
" Connecting R. R., G. & N. Br.	
" Junction R. R.	10 00
Total	4,827 10

COAL FOR COMPANY'S USE.

Anthracite	6,701 16
Bituminous	150 04
Total.	6,852 00

RECAPITULATION.

	Total for Week.	Corres-p'g week last year.	Increase and Decrease.
Passing over Main Line and Leh. Val. Branch	50,163 18	60,840 15	d 10,676 17
For Shipment by Canal			
Shipped Westward via Northern Central R. R.	6,000 10	4,347 19	I 1,652 11
Shipped West or South from Pine Grove	1,249 17	2,001 05	d 751 08
Consumed on Laterals	4,621 00	5,154 15	d 533 15
Lehigh and Wyoming Coal	2,140 17	1,255 02	i 885 15
Total Anthracite paying freig't	64,176 02	73,599 19	d 9,423 14
Bituminous	4,827 10	5,865 08	d 1,037 18
Total of all kinds paying freig't	69,003 12	79,465 04	d 10,461 12
Coal for Company's use	6,852 00	3,484 07	I 3,367 13
Total Tonnage for Week	75,855 12	82,949 11	d 7,093 19
Previously this year	828,937 01	818,975 13	i 9,961 08
Total to date	904,792 13	901,925 04	I 2,866 09

SHIPPED BY CANAL.

From Schuylkill Haven			
" Port Clinton			
Total Tonnage per Week			
Previously this year			
Total to date	6,594 00	13,355 16	d 6,761 16

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

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

WHERE SHIPPED FROM	WEEK 1873., tons ct.	WEEK 1872. tons ct.	YEAR 1873 tons cwt.	YEAR 1872. tons.cwt.
Wyoming Region	16010 00	20650 11	241407 04	170214 16
Upper Lehigh Region	4036 13	4004 18	33253 19	30188 07
Beaver Meadow Region			27816 04	5309 03
Hazleton Region	91 12	434 18	2527 18	2[illegible]97 03
Mauch Chunk Region	4154 06	9511 05	58284 16	45240 13
Tresckow Region				
Mahanoy Region				
Totals	24322 11	34601 12	363290 01	253660 02
Increase			109639 19	
Decrease	10279 01			
DISTRIBUTION.				
Forwarded East of Mch Chunk by Rail	16792 13	29499 14	291953 01	206110 07
Forwarded East of Mch Chunk by Canal				
Delivered at and above Mauch Chunk	783 07	1526 05	14550 15	10391 18
L. V. R. R at Packer'n	564 05	391 12	7805 06	2686 11
Delivered to L. & B. R.	343 19		[illegible]3238 09	
R. at Plymouth Bridge	58[illegible]8 07	3184 01	35742 [illegible]0	34551 06
Totals				
Of the above there was transported on acc'nt of L. C. & N. Co.	5184 17	9511 05	102026 06	59569 07
W.-B. C. & I. Co.	6581 03	15972 07	127336 17	121049 11
Totals	11766 00	25[illegible]83 12	229363 03	170608 18
Increase			58754 05	
Decrease	13717 12		[illegible]	[illegible]

Report of Coal Transported over Lehigh Valley Railroad

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

WHERE SHIPPED FROM.	WEEK. Tons. Cwt.	TOTAL Tons. Cwt.
Total Wyoming	9,107 09	154,230 15
" Hazleton	36,600 16	378,216 18
" Upper Lehigh	111 16	1,032 17
" Beaver Meadow	12,534 10	143,740 15
" Mahanoy	4,740 00	73,130 04
" Mauch Chunk	88 19	875 17
Total	63,183 10	751,227 06
Same time last year	67,614 14	771,398 12
Increase		
Decrease	4,461 04	20,171 06
Forwarded East from Mauch Chunk by rail	53,965 19	628,982 19
Same time last year	57,708 10	6671,829 18
Increase		
Decrease	3,742 11	42,846 19

DISTRIBUTED AS FOLLOWS.

Forwarded East from Mauch Chunk by rail	53,096 02	615,539 05
do East for use L. V. R. R	869 17	13,443 14
Delivered at and above Mauch Chunk for use of L. V. R.R.	1,135 04	16,780 04
To P. & N. Y. R. R.	6,469 15	82,688 13
To N. C. R. R., at Mount Carmel		1,788 19
To D. H. & W. R. R.	1,264 01	10,264 03
To L. & S. R. R. at Packerton for rail	95 08	3,456 13
Delivered at M'h Chunk	95 10	1,154 06
Delivered on line of road above Mauch Chunk	157 15	4,534 19
To L.S.&R.R., at Penn Hav., for railroad		1,541 10
Do. for canal		
To Lehigh Canal Mauch Chunk		
To Catawissa Railroad		35 00
Total	63,183 10	751,227 06

Statement of Coal Transported over Cumberland and Pennsylvania Railroad

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

WEEK.

	C. & O. C'l. Tons. Cwt	B.&O.R R. Tons. Cwt.	Pa. S. Line Tons. Cwt.	Total. Tons. Cwt.
1873	—	26,703 12	2,653,02	29,356 14
1872	—	18,582 12	....	18,582 12
Increase	.....	8,121 00	2,653,05	10,774 02
Decrease	—	......	....	

YEAR.

1874	—	179,223 00	15,370 09	194,593 09
1872	—	161,066 11	....	161,066 11
Increase	....	18,156 09	15,370 09	33,526 18
Decrease	—	....	....	....

Cumberland Branch R. R.

WEEK.

	To C. & O. Canal. Tons. Cwt.	To B.&O.R.R. Co. Tons. Cwt.	Total. Tons. Cwt.
1873	—	3,021 08	3,021 08
1872	—	290 10	290 10
Increase	—	2,730 18	2,730 18
Decrease	......	......	......

YEAR.

1873		18,314 09	18,314 0
1872		290 10	290 1
Increase		18,023 09	18,023 09
Decrease			

Delaware and Hudson Canal Company.

Coal mined and forwarded by the Delaware and Hudson Canal Company for the week ending Saturday, March 1, 1878.

	WEEK.	SEASON.
By Delaware and Hudson Canal	....	....
By Railroad, East	5,274	49,727
" West	8,659	71,495
" South	7,417	54,173
Total 1872	21,450	175,395
Corresponding time in 1871 :		
By Delaware and Hudson Canal	....	....
By Railroad, East	12,684	,068
" West	8,808	[illegible]
" South	2,847	53,[illegible]
Total	24,284	219,317
Decrease	43,922	

Pennsylvania Coal Company.

Shipments of Pittston Coal for the week ending March 1, 1872

	1873.		1872.	
	WEEK.	YEAR.	WEEK.	YEAR.
By Railway	14,473 10	119,936 13	19,[illegible]	[illegible]3,254 01
" Canal	....		......	
Total				
Decrease 1873	33,317 08			

Delaware and Hudson Canal Company.

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

	WEEK.	SEASON.
North	48,748 10	381,767 [illegible]
South	7,417 04	54,1[illegible]2 11
Total 1873	56,165 14	435,939 12
Corresponding time in 1872 :		
North	[illegible]5,691 05	412,345 08
South	6,679 10	58,559 02
Total	52,361 15	470,904 10
Increase North		
Decrease North		
Increase South		
Decrease South		
Increase	3,8[illegible]	
Decrease		34,964 18

Delaware Lackawanna & Western Rail Road Company.

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

	WEEK. Tons. Cw	YEAR. Tons. Cwt.
Shipped North	13,133 12	106,465 06
Shipped South	42,069 15	305,455 02
Total	55,208 07	411,920 08
For the Corresponding time last Year :		
Shipped North	15,013 01	113,417 00
Shipped South	37,379 16	33,210 00
Total	52,392 17	445,627 00
Increase	2,810 10	
Decrease	......	33,766 12

Penn. and N. Y. R. R.—Coxton. Pa.

Coal tonnage for week ending March 1, 1872.

	Week. Tons. Cwt.	Total. Tons. Cwt.
Anthracite received :		
From Lehigh Valley R. R.	6,469 15	82,688 13
" Lack. & B. R. R.	507 03	6,451 04
" Pleasant Valley R. R.	2,865 07	35,345 04
" Sul. & Erie R. R.	636 08	9,047 04
Total	10,478 18	133,582 05
Same time last year	11,521 01	121,330 00
Increase	1,042 08	12,202 05
Decrease		
Distributed :		
To Lehigh Valley R. R.	189 18	9,469 11
To Lack. & B. R. R.	....	286 09
To S. Central R. R.	2,299 06	28,915 07
To Ithaca & A. R. R.	3,445 12	19,771 07
To Erie R. W. Pockets for shipm't.	1,766 09	38,225 06
To individuals on line of road	1,115 15	12,701 08
To points at & above Coxton for use of Co	666 18	6,659 09
To points between Waverley and Elmira	994 15	17,558 08
Total	10,478 13	133,532 05
Bituminous received from BARCLAY R. R.		
Shipped north from Towanda	4,506 07	50,304 09
Shipped south from Towanda	11 00	
Northern Central R. R.	....	278 03
Total	4,517 07	50,582 12
Same time last year	5,780 19	70,032 13
Increase		
Decrease	1,263 12	19,459 01
Distributed :		
To Erie Railway	4,265 19	41,875 13
To So. Central R. R.	228 08	8,222 11
To Ithaca Valley R. R.	....	71 08
Lehigh Valley, R. R.	....	168 06
To individuals on line of Railroad.	23 00	103 02
To points on line of road for use of Company		41 12
Total	4,517 07	50,582 12
Grand totals transported		
Anthracite	10,478 18	133,582 05
Bituminous	4,517 07	50,582 12
Total	14,996 00	184,114 17
Same time last year	17,302 00	191,362 13
Increase	2,306 06	7,247 16
Decrease		

Prices of Coal by the Cargo.

[CORRECTED WEEKLY.]

	AT NEW YORK. March 7. R. A.	W. A.	AT PHILADELPHIA. March 7. R. A.	W. A.
SCHUYLKILL.				
Lump	$- —	$- —	- —	
Steamer	- —	- —	- —	- —
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.

March, 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 40	4 40	4 40	4 40	4 80	4 40
*Lackawana at Weehawken	4 20	4 30	4 40	4 65	5 10	4 30
Wilk'b're at Hoboken	4 25	4 35	4 45	4 70	5 15	4 35
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—March, 1873.

Wholesale Prices to Trade.

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

BITUMINOUS COALS.

Kittaning Coal Co.'s Phœnix Vein, f. o. b. at Phila	$
Lemon " " "	
Cumberland Vein Coal	....
Consolidation Coal Co.'s on board at Baltimore	....
Maryland Coal Co "	....

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

March, 1873.

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

No coal before spring.

Prices at Havre de Grace, Md.

March, 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 "	
New York "	

Prices of Foreign Coals.

March, 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.

March, 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.*
Pictou...nett	$2 25	1 25
Sydney	2 25	- 80
Lingan	1 75	- 80
Caledonia	1 75	- 80

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

AMERICAN.	Nominal quo. Currency.
Westmoreland	$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 @- —
Redhank Cannel, Penn	- — @- —
AT PHILADELPHIA.	
Westmoreland	7 00 @- —

Freights.—March, 1873.

	Cumberland.		Anthracite.			
TO EASTERN PORTS.	*From Georgetown.*	*From Baltimore*	*From Philadel'a.*	*From Eliz. Port, Port Johnson, and Hoboken.*	*From Newburgh.*	*From Rondout...*
Amesbury						
Bangor						
Bath		4 50				
Boston	3 10	4 00		3 00		
Bridgeport	2 75	3 50		1 00		
Bristol				2 00		
Cohasset Nar'ows	2 25					
Derby						
Dighton	2 85					
East Cambridge.				3 00		
Fall River	2 75	3 50		2 00		
Hackensack						
Hartford						
Hoboken	2 10			50		
Jersey City	2 10			50		
Lynn						
Middletown						
Mystic						
New Bedford	3 00	3 75		2 00		
Newburyport	3 10	4 12		3 20		
New Haven	2 75	3 50		1 00		
New London	2 75	3 50		1 40		
Newport	2 30			2 00		
New York	2 25	3 00		50		
Norwalk	2 50	3 60		1 00		
Norwich		3 75		1 60		
Pawtucket				ice		
Portland	3 25	4 00		2 00		
Portsmouth, N.H		4 12		3 10		
Providence	2 75	3 50		2 00		
Rockport						
Saco						
Sag Harbor				1 40		
Salem	2 70	4 12		3 00		
Stamford				1 00		
Stonington				1 40		
Taunton				ice		
Warren				2 00		
TO RIVER PORTS						
Albany						
Catskill						
Cocksackie						
Coeyman's						
Cold Spring	2 30					
Fishkill						
Haverstraw						
Hudson	3 25					
New York						
Nyack	2 25					
Poughkeepsie	2 80					
Rhinebeck						
Rondout						
Saugerties						
Sing Sing						
Stuyvesant						
Tarrytown						
Troy	3 00					
West Point						
Yonkers						

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

Foreign and Provincial Freight

March, 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 Mauch 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 23
TO HOBOKEN	
L. V. R. R., Mauch 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, March, 6. 1873.

IRON—Scotch Pig is without change. Cablegrams report a further advance in prices, Coltness and Gartsherrie being now quoted 170s., and Glengarnock 160s. The almost entire absence of demand for consumption from various causes, such as the high cost here, the difficulty in moving goods, and general tightness of the money market, these all tend to restrict purchases beyond present needs. Most of the sales noted below were made on speculation. We quote Eglinton $55, Glengarnock $56a $57, Gartsherrie $59a $60, and Coltness nominally 61a 62. The sales are 775 tons Glengarnock, part at $55 currency, part 30 days; 60 do., and small lots Gartsherrie, $60; and 280 tons Monckland, at Philadelphia, on terms not made public. American Pig is without much change; several rolling mills, we understand, are running on short time for want of orders; No. 1 Pig may be quoted firm at $50, and No. 2 $46a $49; Gray Forge is in less demand than Nos. 1 and 2, and may be quoted quiet at $40a $44; 100 tons Nos. 1 and 2 sold at about our quotations. New English Rails are entirely nominal, and the few sales made are at less than cost of importation; the stock is said to be about 25,000 tons, 10a 15,000 tons of which is available or mercantile purposes, but generally held above our quotations, it costing about $78 gold to lay them down here. American are looking upward, though no sales have been made above $80 currency; most holders are now asking $82a $83. In old English Rails there is nothing doing—they may be quoted nominally $57a 60 for D. H., and $56a $59 for T. Scrap is inactive, but holders are demanding $57a $60 for No. 1 Wrought from yard; there is nothing offering from dock. Manufactured Iron, from store, continues very firm, and prices abroad are advancing. The following telegram was received yesterday by cable:

LONDON, March 4.—The Iron workers of Methyr-Tydvil have signified their willingness to resume work at the old rate of wages until the end of the present month, if an advance of five per cent. is guaranteed from April 1.

Import of Iron into New York, from Jan. 1 to Feb. 28, 1873.

	BAR.	PIG.	SHEET, &c.
From Foreign Ports	tons. 1,501	tons. 9,711	bdls. 31,830
Coastwise	1	....	479
Total	tons 1,502	tons 9,711	bdls. 32,309
Same time, 1872	3,897	12,591	53,332

COPPER.—New Sheathing is steady at 43 cents, and Bolts and Braziers', 45c, Bronze and Yellow Metal Sheathing, 27c, and Y. M. Bolts, 32c, net cash. Ingot is still neglected, the Foreign accounts are favorable, but meet with no response here; the stock, however, is very moderate and well concentrated, and prices are nominally sustained 34¾a35 cents is asked for Lake, but when lots are forced on the present unwilling market, these figures cannot be obtained; we have only to notice sales of 50,000lb. Lake, for April delivery, at 35 cents; and small parcels English, 30, 30 days.

LEAD.—Foreign is inactive but stocks are not urged and prices are sustained; 50 tons Spanish sold at 68 cents, gold. Bar, 9¼ cents; Pipe and Sheet, 10½, and Tin-lined Pipe, 16½, usual discount to the Trade.

Import of Lead into New York. from Jan. 1 to Feb. 28, 1873.

From Foreign Ports	pigs. 7,163½
Coastwise Ports	11,040
Total	pigs. 82,678
Same time 1872	91,649

SPELTER.—The demand is very moderate, but prices remain firm and still rather favor sellers: 25 tons Silesian sold at 7½ cents, gold.

Import of Spelter in New York, Jan. 1 to Feb. 28.
1873. ……… plates. 52,549 | 1872 ……… plates. 51,993

TIN.—Pig remains dull and irregular, and sales can only be effected at prices below the general asking rates; we have but to notice the sale of 350 slabs Straits at 31 cents, and 5 tons English at a private price. Banca is held at 37¼ cents, Straits 31¼a32, and English 31¾a32, all gold. Cables from England advise a further advance of 1s. in Plates, now 42s. for ordinary Charcoal Tin, and prices are very firm, and again a little higher here, with considerable business. The transactions embrace 2,000 bxs. Charcoal Tin at $11 87½a12 for I. C.; 1,000 do., for forward delivery, $11 87½; 300 do. extra at the rate of $11 87½ for I. C., 10 by 14; 1,000 do. I. C. Coke, $10 50; and 500 do., $10 37½, all gold. Coke Tin are now quoted $10 50a10 75, and Charcoal Terne, $10 50a$11 gold.

Import of Tin into New York, from Jan. 1 to Feb. 28.

	1873	1872
Pigs	11,230	12,099
Plates	bxs. 154,482	110,779

Our latest Liverpool circulars quote Plates as follows:

	1731	1872
I. C. Charcoal, ordinary brands	39s.a41s.	34s. a35s.
I. C. Charcoal, best brands	42s.a44s.	35s.6d.a36s.
I. C. Coke, ordinary brands	35s.a36s.	30s.6d.a32s.
I. C. Coke, best brands	37s.a38s.	32s.6d.a34s.

ZINC.—Sheet, 11c.; Manganese, black oxide, 4c.; gray, 6c.

LONDON, February 15th, 1873.

The Iron Trade throughout the whole of the producing districts is, at the present time, surrounded with difficulties. In the face of a good demand for all descriptions of finished iron, prices are rising, but production is more limited than ever. Many of the principal works are losing time, through short supplies of coal; and as for the price of coal it is increasing every day, so much so that but few of the ironmasters are able to quote, being in such great doubt as to the margin left for profit. It will be noticed that our lists of prices of the principal Staffordshire makers are printed without figures, with the exception of the Earl of Dudley's, Messrs. BARROWS and Sons' and Messrs. MILLINGTON': all the rest are only quoting for specifications. The celebrated Yorkshire makers, such as the Bowling Iron Company, the Monkbridge, the Lowmoor, the Farnly Iron Company, and Messrs. Cooper and Company, are all asking 40s. a ton more for their various productions. The prices of manufactured iron in the Cleveland district are firmer, and the works fully occupied. As for pig iron, the make in every district is bespoke for some time to come, and it is very difficult to give reliable quotations. The coal question is the most prominent of the hour, and it will be seen, from the parliamentary proceedings, that attention has been called to the dearness and scarcity of coal by Mr. MUNDELLA; and Mr. W. H. SMITH extracted from Mr. GLADSTONE, on Friday night, his objections to interfere with the export duties. In addition to the difficulty, the disastrous Welsh strike seems to be further than ever from coming to a settlement. The smaller firms and the various public companies, it would seem, are in favor of any scheme which would enable them to resume operations; but both Mr. FOTHERGILL and Mr. CRAWSHAY insist upon unconditional surrender at the 10 per cent. reduction. It may be all very well for such wealthy men to hold out; they are in a position to do so, but such firms as the Ebbw Vale, the Blaenavon, and the Nantyglo and Blaina, as well as the smaller masters, are in a different position. In the meantime, distress is rampart all through the principality, and scores of local tradesmen are involved. Whenever the good offices of the peacemaker will be invited to harmonize the angry feelings of both parties we cannot say, but it is to be hoped that not many days will elapse before some attempt will be made, by men of sufficient authority to command the respect of both sides, to effect a settlement.

In estimating the principal features of the Board of Trade returns it is essential to contrast the figures showing the increase or decrease in the total value of our exportations. This information, to such extent as the official figures admit, will be found below; of course it is confined to the interests which most concern us, but it will enable our friends to form a judgment as to how far any changes exhibited are due on the one hand to the natural progress of business, or on the other to the general rise in prices. Coal is the most striking article, an increase of more than 77 per cent. in the value of our shipments having been co-incident with a falling off of more than 5 per cent. in their quality.

Principal Articles.	Quantities. Month of January. 1872.	Quantities. Month of January. 1873.
Coals and patent fuel……tons.	842,328	790,227
Metals—Copper unwrought and wrought……cwts.	57,039	61,478
Iron, unwrought and wrought……tons.	200,095	222,331
Lead……tons.	3,895	5,924
Tin, unwrought……cwts.	8,315	5,924

	Value. Month of January.		Increase or decrease per cent. in Jan., 1873, as compared with Jan, 1872.	
	1872.	1873.	Quantities.	Value.
Coals and patent fuel…	£469,628	£834,598	‡5·1	*77·7
Hardware and cutlery..	380,114	522,253	..	*8·
Machinery and millwork	552,282	711,692	..	*28·9
Metals—Copper, unwrought and wrought……	239,659	280,600	*7·8	*17·1
Iron, unwrought and wrought..	1,903,317	2,661,339	*11·1	*39·8
Lead……	74,862	44,473	‡49·2	‡40·8
Tin, unwrought……	60,155	42,877	‡28·8	‡28·8

* Increase. ‡ Decrease.

Von Dadelszen and North's Weekly Metal Report.

4 and 5, East India Avenue, Leadenhall Street,
LONDON, E. C., Feb. 14th, 1873.

A moderate amount of business has been reported in our Metal Market during the past week at steady prices.

IRON.—Remains in the same position, but there are slight signs of some arrangement being made in Wales. In Staffordshire they are asking higher prices. Scotch Pig-Iron has advanced to 138s. 6d. for m/n. The shipments last week were 10,537 tons, against 13,200 last year.

COPPER.—Early in the week was strong and in demand, £88 being paid cash for Chili, but there has been a reaction, and we close very flat with sellers at £88 cash, for good ordinary Brands: and Lota at £85 5s. Wallaroo after selling freely at £94 cash, closes at £92 10s. The telegram from Chili gives charters for first 14 days January, as 1,800 tons—1,000 tons in Bars, remainder in Ore and Regulus. English rather firmer. There is still an inquiry for America.

TIN.—Steady but quiet, business doing on the spot at £144. Little inclination shown to operate for forward delivery. Banca nominal, £147 to £148. Billiton, to arrive from Holland, £142., ex. ship. In Holland, prices rather easier. Banca, 86f. Billiton, 83f. Distant sailing, 82f. English steady. £146 for Ingots. £147 for Bars.

TIN-PLATES.—Steady.

LEAD.—Firm. £22 5s. to £22 10s.

SPELTER.—Scarce, nominal. £25 to £25. 10s. according to Brands.

QUICKSILVER.—Dearer. £13.

ANTIMONY.—£60 to £62.

Iron Trade Circular "Rylands."

MONTHLY MARKET REVIEW.

PHILADELPHIA, March 1, 1873.

AMERICAN PIG IRON—Has been without material fluctuations in price the entire month; and sales have been confined pretty much to New York and Eastern buyers—the local buyers being well supplied for current, and, in many cases, future wants. Holders, both first and second hands, are firm in their views, and no concessions are made. Good Lehigh brands can be purchased to-day for furnace delivery at $47a$48 for No. 1 Foundry, $44a$45 for No. 2, and $39a$40 for No. 3 Forge. Schuylkill and Susquehanna irons are offered at $1.50a$2 per ton below Lehigh makes. In Pittsburgh good neutral anthracite makes are selling at $40, 4 mos. flat, or fully $5 per ton less than prices here.

SCOTCH PIG—Has been and is in small supply here and in New York, and is confined there pretty much to two holders. The high prices have prevented any but very small transactions. On the other side prices continue to advance under the augmenting troubles of disturbed labor and dear coal. Messrs. Sanders Bros. Circular, under date of February 12th, Liverpool, reports quotations at that date f. o. b., in the Clyde as follows: Gartsherrie 157s. 6d., Coltness 159s., Sumerlee 159s., Langloan 159s., Calder 157s. 6d., Carnbroe 147s. 9d., Glengarnock 147s. 6d., Dalmellington 138s., Eglinton 138s. Exports for January to United States 9,031 tons. Exports for January to other countries 86,688 tons. Stocks of Pig Iron, Glasgow, February 7th, 92,456 tons, a decrease of 14,463 tons since December 25, 1872.

RAILS—Have been in fair inquiry during the month, but at figures showing no margin of profit for makers. One sale of 5,000 tons was reported early in the month at about $76.50 mill; another of 2,000 tons was effected later at $81.50. The price is dependent very much upon the deliveries required and the terms of payment. Many makers are holding at $83 for present and $85 for spring and summer delivery, with anticipations of filling up at those prices when spring opens. Abroad rails are held at £11 10s. to £12 for heavy sections, compared with £9 10s. at same date as last year. All the large iron works in the South Wales district are standing idle in consequence of the dispute between masters and men. There is, however, early probability of a resumption.

MERCHANT BAR.—Although most every one anticipated a brisk demand and consequent advance in price for bars during the month it has not come. The city stores here are selling at 4.3 cents per lb. base, and the mills are generally willing to book orders at 4a4 1-10 cents for quick delivery lots. There seems to be but little doubt that on the breaking up of winter a strong demand will set in and prices probably enhance.

OLD RAILS—Have been in full supply, with prices far too high abroad to enable transactions with this country. Sales were reported as effected in New York of some 300 tons about the middle of the month at $53 gold, but at present writing $52 gold here would be considered a good sale. The price abroad under the latest advices is £8 15s. to £9 for D. H's c. f. & i. to Philadelphia.

WROUGHT SCRAP IRON—Has been in better request during the entire month; stocks both in port and afloat are unprecedently light, and held in a few strong hands. Ship lots were sold here at $50a$51, and no higher sales than $52 have been reported for miscellaneous lots. It is extremely difficult, however, to give a fair idea of the market value of Scrap, as so much depends upon its shape, quality and assortment.

EDWARD SAMUEL.

San Francisco Stock Market

BY TELEGRAPH.

NEW YORK, March 6th, 1873.

Our report from the San Francisco Stock Board is dated March 5th; without exception the list has declined; the report is as follows:

		March 5.	
Savage	—	68	—
Crown Point	—	97	—
Yellow Jacket	—	72	—
Kentuck, "New Issue"	—	9⅛	—
Choliar Potosi	—	45	—
Gould & Curry "New Issue"	—	13⅛	—
Belcher "New Issue"	—	84	—
Imperial	—	7¼	—
Raymond & Ely	—	81¾	—
Meadow Valley	—	14⅛	—

The American Institute of Mining Engineers.

CONTINUED FROM PAGE 148.

to the Government, on Mines and Mining, with respect to the question whether fissure veins grow wider or richer in depth. As matter of fact, they do not, and as matter of fact, they do. There is a conclusive reason for concluding that there cannot be any general rule. I mean this consideration of the erosion. How can we have the face to discuss the question whether the vein will or will not grow wider "in depth," when the question, as we are discussing it, refers to 100 or 200 feet, and we are already 5,000 feet down on that vein when we begin at what we call the top. These changes in veins are alternate rather than progressive in either direction with increasing depth. Of course changes are likely to occur in them, as has been mentioned with regard to the Little Cottonwood mines, when they passed from one kind of country rock into another. Mr. Engelmann refers here to the solubility of the rocks. In other cases, the specific capacity of the rocks for heat, and their conducting capacity, are concerned. I may say, in regard to the deposits in the Little Cottonwood cañon, that it has always seemed to me they present the vein phenomena in every respect but one. It is as though of the three stages of vein-formation which we recognize, the formation of the fissures, the filling of the fissures, and the physical and chemical changes subsequent to the filling of the fissure, the first and second had been combined, there being, in many instances, really no fissure at the commencement, but the water having made its own place and deposited its own precipitate, forcing its way in by chemical solution, rather than by finding a ready-made path through the strata ; and, therefore, we may look to find such vein-phenomena as depend upon infiltration and chemical deposits of metals. Those phenomena connected with a regular continuation in depth of fissures under uniform conditions, I think we have not had reason to expect, in such cases.

Prof. Silliman—I will make a single statement confirmatory of the remarks of the President, as to the difficulty of fixing a point where a given chamber or cavity should come to the surface, or where the filling came in. In the upper range in Little Cottonwood, at a point below the summit, there has been, during the last few months, an exploration, begun at my suggestion, and which has developed a large chamber not before known, and of very considerable extent, filled with ores. At a point 200 feet in from the mouth, and after driving through solid rock, and with apparently no connection with the atmosphere anywhere, were found the bones of some small animals which were sent to me, and were identified as being the bones of an animal like the skunk. These bones were in the midst of the ores. Unquestionably that cavern, which now contains this ore, had been a place of resort for those animals ; or, on the other hand, the waters had access to that space, and the animals were washed in. Certainly, the animal was of an extant species, and did not indicate anything as regards the age of the formations in which the deposits occurred, but only the fact that it was a cavern inhabited by animals. I wrote out to see if they could not find larger animals, but I think no other has been discovered.

The President—I was informed, a year or two ago, by Mr. Reitheimer, in charge of the Hell Gate excavations, that some shells were found in a seam of the gneiss, underlying the channel. They were sent to a leading paleontologist, and were identified as shells of the present time. There was no escape from the conclusion that they had been washed in through a fissure in the rock, the clay-filling of which had subsequently become indurated. In blasting and throwing the rock out, the connection had probably not been noticed between the cavity and the surface. At any rate, the fossils were rejected as spurious ; and we were saved a great geological sensation.

The meeting was then adjourned to the next morning.

On Heterogenesis.

By O. Loew.

Some time ago a work on spontaneous generation, by Dr. Bastian, made its appearance, and gave rise to much comment and criticism in scientific journals, as well as in the newspaper press. Recently, Mr. T. Borden Sanderson published in *Nature* an account of his experiments made with the view to contradict Bastian's statements ; but he had to acknowledge that, under the circumstances described by the latter, living Bacterias were obtained. He boiled infusions of turnips with some cheese in a retort *for ten minutes*, and sealed the retort immediately. After a few days the contents of the retort were examined under the microscope, and living Bacterias were recognized. To every reasoning mind it will be evident that those observations, called by Dr. Bastian, "*De novo* production of living things," do not prove anything at all with regard to "heterogenesis."

Pouchet, Mallet, Wyman, and other exact observers had, *long before Bastian*, published the same facts ; but Pasteur, the great French savant, had demonstrated that living germs were always the cause of life in boiled solutions. I myself, six years ago, made many experiments in regard to this question. I heated infusions of hay, diluted solutions of glue, milk, etc., in sealed glass tubes, *up to 150° C. for one hour*, and exposed some of those tubes to the action of the sunlight ; others, provided for the purpose with platinum wire, to the action of an electric current ; others, again, I kept in the dark. After three months I opened those tubes in the laboratory of the celebrated physiologist, Professor Ludwig, in Leipzig, with great expectations. Nothing living was found, to my great disappointment. All these tubes, however, after being opened, soon developed Bacterias.

After looking over all the facts found by Dr. Bastian, we must confess ourselves unable to form an idea of what "*Bastianism*" means, which word is made use of in *Nature*. We are now just as much in the dark about the question of the original formation of organisms as ever, for there existed certainly neither turnips nor cheese at the end of the Azoic period, or during the formation of the Potsdam sandstone.

To any one who wants to gain information about all that has been done, and the experiments in regard *to* "heterogenesis," I recommend to study the very able article of Dr. H. Huppert in "Schmidt's Jahrbücher für die gesammte Medicin," 1866. Bastian's work is simply the English translation of it.

Geography and the Vienna Exhibition.

Those who intend going to Vienna will do well to brush up their geography, for the arrangement of the building is strictly based upon the succession of the nations in making the circuit of the earth. We learn from *Engineering* that the nave or great axis of the building is made to run as nearly as possible east and west. The transepts, consequently, point north and south. The countries are then arranged according to their geographical position on the surface of the earth. North and South America occupy the extreme western end of the building ; England and the countries of Western Europe come next, and so on till we get to the far eastern transepts, which are appropriated to China and Japan. In the case of two countries being the same distance east or west of a given meridian, the one which lies most to the north on the face of the globe occupies the transept and part of the nave on the northern side of the axis, and *vice versa ;* this latter rule has, however, been sometimes disregarded, as it does not in the least injure the working of the system.

By means of this arrangement, any one possessing the most elementary notions of geography can find his way about with perfect ease. To give an example : if a visitor finds himself in one of the transepts belonging to France, and should he want to go to the Chinese portion of the building—knowing, as he does, that China lies to the east of France on the surface of the globe, he has only to go into the nave, turn towards the eastern end of the long axis, and walk till he sees the name China hung up from the roof in large letters. If, on the other hand, he had wanted to visit the American department, he would have had to perform precisely the same operations—turning, however, to the west instead of the east. It is equally easy for visitors who are in the park to find their way from the outside to any particular part of the Industrial Palace ; for each transept is furnished with a portal at its end, over which is marked the name of the country occupying it.

The St. Gothard Tunnel.

The machine-piercing of this tunnel is reported to have commenced last month. The cost of M. Favre, the contractor's, preliminary arrangements and operations, plant, &c., are estimated at £80,000. The compression of the air for the rock-boring machines, and the machine work of the *ateliers*, will be effected by hydraulic motors, of a combined power of 500 horses. At the northern extremity of the tunnel there is an available fall of water of about 95 feet, close to the entrance, which will be utilised for turbines. This stream is the Reuss, an effluent of the St. Gothard. At the southern end the waters of the Tremola, with an available fall of 984 feet, will be turned to account by turbines, or by a hydraulic machine with vertical column of water. It is expected that upwards of 100 yards at each end of the tunnel will be driven each month, or considerably over a mile by the end of the year. Last year 396 feet were cut, chiefly on the southern side.

Flat Ropes in the Mines.

At the Brückenberg coal mine, Zwickau, Saxony, two flat steel-wire ropes, made by Felton & Guillaume of Cologne, are used in a shaft said to be 800 metres, or 2,600 feet deep. They are nearly 5 inches wide, 1 inch thick, and 492 fathoms in length, weighing about 23 lbs. per fathom (5¾ kilo. per lineal metre). They are formed from 7 round wire ropes placed side by side, united by a wire of three strands, each of 4 No. 14 wires. Each of the 7 round wire ropes is formed of 4 round strands, each composed of 7 wires surrounding a hempen core. The breaking strain of the cable is 105 tons. After 426 days' use, the wear was limited to the wire uniting the 7 ropes, which requires renewing, and the total cost per ton raised does not exceed one penny. These results indicate considerable economy from the employment of flat ropes in deep shafts.

Determination of Iron in Blast-Furnace Slag.

The following process is recommended as avoiding some of the inconveniences presented by other methods.

The slag is finely powdered and placed in a platinum crucible with three or four parts, by weight, of ammonium fluoride, and heated in a water bath, adding gradually sulphuric acid. When effervescence ceases the crucible is heated in a sand-bath until the acid commences to pass off. While cooling, water is added, and when cold, the insoluble residue is collected on a filter and washed until the filtrate no longer contains iron. The filtrate is then reduced to $Fe O$ by zinc, and the iron is determined, as usual, by titration.

THE ENGINEERING
AND
MINING JOURNAL.

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

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CONTENTS FOR THIS WEEK.

MESSRS. FAIRBANKS & Co., the well-known scale manufacturers, are making for the New York School of Mines a machine for testing the strength of materials, which is one of the most complete and efficient testing machines which have come under our observation. The specifications called for an apparatus which combined in one construction the means of applying tension, crushing and transverse strains. These requirements have been attained. An ordinary Fairbanks railway scale is the basis of the machine, and from this rise two long and strong screws, carrying at the top a massive block which is moved up and down by the rotation of the screws. The latter pass through the platform and form the axes of two wheels with cogs which play in an endless screw. The latter carries on the end outside of the framework a large wheel which is geared to a small one, and this small wheel is the one turned by the operator. By this arrangement the power applied at the small wheel is enormously multiplied at the screws. On the platform stand two bearings about seven feet apart. When a rail or bar is laid on these bearings the rotation of the screws in one direction brings down the block upon the piece to be tested, and with a pressure increasing by very small increments up to the breaking point. Crushing strains are produced in a similar way, but, of course, with the use of only one point of support, and tension is brought about by hanging the bar from the screw block, fastening it to the platform and reversing the screws. Thus one piece of mechanism serves to produce all three strains without alteration of its parts. The platform is an integral part of a scales, the pressure exerted is weighed directly upon the beam, and the last few pounds can be applied from the beam instead of from the wheel. We have described this machine from the drawings. It is not yet constructed, but we understand will be immediately begun. With this in its possession, the School will be able to make valuable contributions to our knowledge of the strength of materials as well as afford to constructors and manufacturers in New York City much needed facilities for answering the questions which so constantly come up in their trades, respecting the quality of the materials they make or use.

Wet Treatment of Copper in Tennessee.

The Union Consolidated Copper Company of East Tennessee have for some time been experimenting with the MONNIER process for the wet extraction of copper. After an examination of the results of treatment in the works of Messrs. WATSON & CLARK, of Philadelphia, they erected such works as were necessary for a trial, and made a practical test of their own ores by this method. Their conclusion was, that ore averaging 5 per cent. can, at the current rate of wages and fuel in Tennessee, be reduced for about 6¼ cents per pound of copper. Allowing for all contingencies, the maximum cost will not exceed 7½ cents a pound. This includes the cost of treating the ores under 6 per cent., a very important point at the Tennessee mines. The possibility of treating this ore will permit the extraction of large amounts previously left standing in the mines. The treatment of rich and poor ores together will, of course, reduce the proportionate cost per pound of metal, which, we are informed, is not expected to rise above 5 cents.

These mines possess an almost unlimited amount of these low grade ores, and if by this process the cost of mining and smelting can be reduced to 12½ cents a pound, the extraction of copper will be very much increased. That sum which is understood to be the cost of a pound of copper at the Calumet & Hecla mine, Lake Superior, will enable the company to meet any commercial rivalry.

With its immense supply of ore the Union Company expects to very greatly increase its yearly production of copper. At the margin which wet extraction leaves, there will be a large sum obtained from ores that are now looked upon in most American mining districts as nearly worthless. This company, since the rehabilitation of its mines in 1865, has produced from its selected ores 8,000,000 pounds of copper, but its operations are necessarily limited by the necessity of selecting and dressing its material. With the introduction of a wet method, which is in itself exceedingly ingenious and simple, and is also directly in the path of metallurgical improvement, there is every reason to expect still greater results from the famous and interesting mines of Ducktown.

Steel Works in Rhode Island.

AMONG the most interesting of the new enterprises in the iron business of this country, both from a general and a local point of view, is the establishment of a new steel works at East Providence on the WILSON-BESSEMER system, the general features of which we describe in another column. The introduction of the Swedish method of making Bessemer steel would in any case attract attention, and the establishment of large works in Rhode Island, with the intention of utilizing the exceedingly dense anthracite coal of that State, is a matter of no small local importance. As will be seen from the description, the process is not the pure Swedish, but a modification intended to add to the simple apparatus of that method the ease of control which the English plant affords. That there is strong faith in the results, the investment of the large sum of money necessary for such works is sufficient proof. Building is now going energetically on.

Another enterprise connected with these works is worthy of mention. A SIEMENS-MARTIN plant is also under construction and partly finished. The gas generators are already up, and the masons are at work upon the regenerators and furnaces, so that it is hoped steel will be turned out by June. The establishment enjoys the services of Mr. JONES, formerly connected with the works of Mr. SIEMENS, the patentee of the furnace, in Swansea. This gentleman has long been employed in the manufacture of SIEMENS-MARTIN steel, having made some of the first steel of this sort ever produced. He has since had experience in the same work both on the Continent and in this country. We believe it is the intention to introduce the production of steel direct from the ore by the process of which Mr. SIEMENS is the inventor, and which has long been, and which is now successfully carried out on a large scale in his Swansea works. The Providence works, therefore, bid fair to be the first in this part of the world to found a practical and successful method of direct production of steel from the ore, a desideratum which has ardently been sought by so many inventors. These few notes show that the works in Rhode Island are in the hands of intelligent and energetic men, and sufficiently bear out the assertion with which we began them—that the new establishment deserves attention, as we hope it will win success.

Plumbago in Canada.

TIN and plumbago are magic names in miners' ears. No mining district in the West pretends to respectability until the finding of one or the other, or both of these minerals is reported. Probably it is the fact that they are about the last things the miner can hope to light upon, that makes the search for them so interesting. Especially does the United States appear to have been left in the cold in allotting the distribution of these minerals. Tin does not exist even in Missouri, and though we have plumbago, our small show is crushed way out of sight by the ponderous exhibit of other countries. This is peculiarly aggravating, for we have in Mexico one of the greatest deposits of tin in the world, and now our Northern neighbor, the Dominion, comes forward with claims of immense deposits of both tinstone and plumbago, the former north of Lake Superior and the latter in the township of Buckingham, about eighteen miles to the north of Ottawa, the capital of the Dominion of Canada. The mines, which have been opened (a rather enthusiastic account of which we find in

Engineering), are situated on the river De Liviére, a tributary of the Ottawa, and are favorably placed both as regards the working of the ore and its transport. A recent examination of these mines, made by Mr. George Henwood, is said to have disclosed the fact that there are fourteen well-defined lodes, in which plumbago of unusual purity occurs in large quantities. Several of the lodes intersect each other, and the mineral in some of them varies in thickness from six to ten feet. Besides this, there is a quarry of disseminated ore, over a quarter of a mile in length, and seventy feet in height, producing a very good percentage of plumbago. Some fine specimens of the mineral taken from the lodes by Mr. Henwood were lately to be seen at the School of Mines, but are now at the offices of Mr. Harvey. They are exceedingly rich in appearance, and are remarkable for their crystalline formation and purity. They display all the varieties of ore, some being columnar and reticulated, and others laminated. One specimen measures two feet in length, sixteen inches in depth, and about five inches in thickness. Assays of this ore, made by Messrs. Johnson & Sons, show it to contain 97 per cent. of plumbago, the minimum annual yield of which the lodes are capable, being estimated by Mr. Henwood at 5,000 tons, whilst twice that quantity, it is stated, can be obtained annually from the workings in the quarry.

The Wilson-Bessemer Process.

It is well known that the Bessemer process as carried out in England is, in many details, exceedingly expensive. The plant, too, requires a large outlay, and American practice has still further increased the cost by resorting to the most solid construction, and making the establishment as far as possible automatic in its working. Compared with the Swedish method it has defects, too, though these are over-balanced for work on the large scale by the greater quantities that can be treated, and the greater handiness of the apparatus.

Mr. Geo. F. Wilson has patented some improvements, which are designed to secure the easy handling of the English method, with the cheapness and directness of the Swedish. His system includes a gas melting furnace, the waste gas of which heats the converter preparatory to the blow, and a fixed converter, the construction of which permits rapid repairs. Iron may be run direct from the blast furnace to the converter, or, if mixing is required, first to the gas furnace, where other irons can be added. Mr. Archibald MacMartin E. M. has published a description of this system, from which we take the following :

"This improvement, though securing simplicity of structure and consequent relative inexpensiveness of plant, nevertheless leaves scope for the adoption of all, even the most complicated, phases of the other types of the Bessemer.

The simplicity of structure is secured by the adoption of stationary converting-furnaces and the use of a rectangular casting pit supplied with a railroad, on which cars containing the ingot moulds, can be drawn under and past the spout of the casting ladle, which is *stationary*—being attached to the spout of the converting-furnace. This secures the total avoidance of hydraulic apparatus. The bottom of the pit is on a level with the outside ground and connects with it, by rail, through a doorway on one side of the building ; while a platform, extending the whole width of the building, is built up in front of the pit to a convenient height for the workmen, standing on its edge, to close the moulds as they are filled with steel. Between the back of the platform and the wall of the building at that end, there is left space enough for a double track railroad to be laid—also on the ground level and connecting with an outside railroad. On the platform and opposite the tap hole of the converting furnace, is planted a crane, which has a full sweep in all directions, reaches across both pits and is used in loading the cars, moving the ingot moulds, &c., and replacing the casting ladle. The space between the spout of the converting furnace and that end of the pit not connecting with the outer air, is such, that a train of cars, containing ingot moulds enough for the largest charges, can stand in it without hindering the work around the casting ladle ; and the moulds will come successively under the mouth of the ladle, as the train is gradually pulled forward by means of a chain connection.

The converting furnace being stationary, it is desirable to avoid the great defect of the Swedish method already mentioned, by an improved mode of applying the blast.

To this end Mr. Wilson has invented a stationary converting furnace in which the blast enters on two opposite sides and by such an arrangement, that it is as finely divided as in the English converter ; while two streams of jets, meeting each other in the center of the furnace, interpenetrate and drive each other upwards with maximum mechanical agitation. To equalize the effect of this approach of the streams of blast from two opposite entire sides of the furnace, it has been deemed expedient to increase the diameter of the furnace between those sides ; thus making the cross-section oblong. The most convenient form of cross-section for the accomplishment of this end, (admissible also, because, the furnace being stationary, straight horizontal lines are allowable), seems to be a combination of two equal semi-circles, separated by a rectangle whose two larger and opposite sides are equal to and coincide with the respective diameters of the semi-circles. The exit of the flame is then above, at the back of the furnace. This arrangement, it will be seen, avoids the great Swedish defect, as well as does the English converter, and at much less expense ; because, while a fine division of the blast and a consequent maximum exposure of metallic surfaces to its influence, is secured, there is no employment of expensive hydraulic apparatus, and the converting furnace, being stationary, can have maximum simplicity of structure ; while the wear and tear upon the tuyere bricks, which are above, or on each side, instead of under the metal bath, is very much lessened.

The two converting furnaces in a single plant, are, with their attached chimneys, placed back to back, but with two gas furnaces (also back to back) standing sideways between them and also connecting with the same chimneys at both sides. In the back of each converting furnace is a square opening (a little below the level of the gas furnace tap hole), through which the waste flame of the gas furnaces can be made to pass into the converting furnace ; while connection with the chimney can be made by means of a temporary canal, built of tiles, between the mouth of the converting furnace and the entrance to the chimney. Thus the converting furnace is heated (wholly, or in part), while the waste heat of the gas furnaces is utilized. During a blow a door closes the opening in the back of the converting furnace, while the waste heat of the gas furnaces ascends to the chimney, directly through a connecting flue, at other times closed.

The gas furnaces are used for the preparation of the charge of iron for the converting furnace, which receives it through the opening in its back, as it comes through a trough from the tap hole of the gas furnace ; after which the opening is closed, previous to beginning a blow. In order that the waste flame from the gas furnaces may penetrate as far down into the converting furnace as possible, the hole in the back of the converting furnace is built as low down as possible, consistent with a due regard to the upper level of the converting furnace charge at its highest ; below which the bottom of the opening must not come ; though the door closing it is made strong enough to resist all shocks from fitful masses of metal, which may be propelled against it, at times, from the interior.

The gas furnaces are not "regenerating gas furnaces ;" inasmuch as the waste heat which in them is required for the "regenerators," is here used to heat the converting furnaces. But the gas and air, before entering the furnaces, are heated below, each in a separate, continuous channel, composed of fire-clay retorts suitably connected together in a furnace (or rather oven), in which the heat is applied in a manner analogous to that employed in the "Belgian furnace" for smelting zinc ores. Each oven is, in a very simple manner, so arranged as to allow the currents of air and gas to be reversed. to correspond to a similar reversibility in the working of the gas furnaces, which can (either, or both of them) be connected with either of the converting furnaces. This is a great advantage over the "regenerating gas furnaces," the direction of whose working must be reversed every half hour.

The employment of two gas furnaces instead of one, for the preparation of charges for one converting furnace, will almost double the number of blows possible in it, during twenty-four hours, and will very much lessen the necessity for heating the interior of the converting furnace previous to each blow. Only one of the converting furnaces in a single plant is to be used at a time—one being worked, while the other is in repair.

The preparation of the charges for the blows—which it is the office of the gas furnaces to secure—is one of the essentials of G. F. Wilson's improvement upon the Bessemer process in general. It is proposed to use the cast-iron, taken as directly as possible—consistent with regularity in the process—from the blast furnace to the converting furnace. Therefore, as in the Swedish arrangement, the steel-plant should be constructed in connection with one or more blast furnaces ; but, if the iron, *unmixed with other brands*, should be taken immediately from the blast furnace to the converting furnace, the defects of the Swedish process would ensue. Therefore, it is tapped, in any desired quantity, into a weighed ladle whence it is poured into one of the gas furnaces, where the heat and time required to melt the same quantity of pig iron are entirely dispensed with, and as much iron of various brands and kinds (or any other beneficial substances), can be added, as may be necessary to bring the charge to the desired standard of preparation for the converting furnace.

Mr. Wilson describes the construction of his improved stationary converter as follows :

"The bottoms in my furnaces, where the wear and tear is naturally greatest, are of most simple construction. Their foundation is of fire-brick and the upper part is formed of the most suitable mixture of fire-clay and quartz, more or less rammed down into a solid mass and dried in the preliminary heating of the furnace. This mixture is suitable, because conducive to the formation of a good slag. It is made solid enough to resist the *mechanical* action of the superincumbent metal during the blow ; still it must yield to the chemical, dissolving power of oxides in the charge. At the end of each blow, therefore, the bottom is expected to be shallower than before, and will occasionally need repairs, to make up this deficiency. These repairs can be made between two successive blows—with little loss of time and without cooling down the furnace—in a manner analogous to that in which the hearths of reheating-furnaces for iron are repaired.

Next to the bottoms, the tuyere-brick arrangement, in my furnace, will have the most wear and tear. But this combination is *bodily movable*, and as easy of full replacement, when necessary, as are single tuyere-bricks in the English converter ;—while its component parts fit together and into the furnace, without any extra ramming. The remainder of the lining of my converting furnace is solid fire-brick structure and, because stationary, most simple in form. Thus also repairs in it will be most simple, as in ordinary cupola-furnace. In my gas furnaces, the repairs will be much less than in the Siemens-Martin steel process, because the temperature I employ will not need to be so high, or so continuous, as in the other case. The repairs here may be put at about the same figure as for ordinary reverberatory furnaces, when used for melting pig-iron in Bessemer works."

The Monnier Process for the Wet Extraction of Copper.

In the issue of this journal for August 20, 1872, Mr. Alex. Trippel gave a description of the chemical changes which take place in the Monnier process for the extraction of copper. We continue the description of that process with an account of the separate operations and a detailed statement of the cost of treatment.

The Monnier metallurgical process consists : First; In a calcination of the metallic sulphurets with a certain proportion of sulphate of soda, sulphate of iron, or other similar salt, in a muffle furnace. Second ; In lixiviation of calcined ore. Third; Evaporation and Crystallization of the sulphates. Fourth; Reduction of the sulphate of copper. Fifth; Smelting copper into ingot. Sixth; Amalgamation of gold in the residue.

For the purpose of explanation, we suppose the ore to be treated to contain only copper, iron, and gold. The treatment for silver, cobalt, and nickel being more complex, the necessary space for detailed description of it cannot be given at present.

The ore is mixed with sulphate of soda and crushed by means of any approved machinery, but as dry crushing is desirable, a rock-breaker and Cornish rollers are believed to be the best. It must be fine enough to pass a sieve of twenty-four holes to the linear inch. It is next roasted in a muffle furnace having a hearth, or sole, sixty-eight feet long by fourteen feet wide. The hearth, or sole, is constructed of tiles two and one-half to three inches thick, laid flat side by side, and resting upon division walls, laid parallel with the sides of the furnace. The heated gases from the fire at the end of the furnace pass beneath this sole, and have no communication with the muffle in which the ore is manipulated through side doors arranged for that purpose. Through these doors the ore is turned over each hour, and is always turned towards the fire or front of the muffle. It is thus moved over the sole of the muffle from the rear end, where it is discharged, completely roasted.

A new charge is introduced every hour, and a like quantity discharged at the door provided for its exit, where there is also admitted a regulated quantity of air. One hour after the introduction of the ore at the rear of the muffle, the sulphur begins to burn. Sulphuric acid is formed by the oxidation of part of the sulphur, while a larger proportion escapes as sulphurous acid. The iron and copper are converted by the sulphuric acid into sulphates, and the sulphate of soda into a bi-sulphate.

When the mixture has reached a point within twenty feet of the discharging door, the sulphur is completely oxidized, and all not combined with the metallic oxides or the soda, has been expelled from the muffle. A low red heat is now reached, and the sulphate of iron and the bi-sulphate of soda begin at this temperature to suffer decomposition. The sulphuric acid at first combined in this form has been stored up merely, and now is evolved by the greater heat ; being nascent, its combining power is of intense activity and force, and it attacks any metallic oxides, or trace of sulphuret remaining uncombined, converting them into sulphates with great rapidity.

This evolution of nascent sulphuric acid continues until immediately over the fire-box, when all the copper is completely converted into soluble sulphate ; only stony, or earthy matter, iron oxide and gold, remain insoluble in water. In this latter stage of the roasting, the value of the admixture of sulphate of soda, etc., becomes very apparent. It holds fast to the excess of sulphuric acid formed during the early stages, and carries it on to this critical point. While by other methods only a portion of the metals are retained as sulphates, and the remainder are reduced to an insoluble form, by this method the acid is retained until required by the copper, when it is given up just in the nick of time and the copper is recovered in a soluble condition with great ease. Though care is required at the last portion of the calcination, no more skill is necessary than an ordinary laborer, with a few days instruction, will acquire to enable him to manage the furnace in a satisfactory manner.

Should the manufacture of sulphuric acid be an object, an exit pipe is inserted into the back end of the muffle, leading to the leaden acid chamber. The air admitted to the muffle, through the register in front, must be sufficient to furnish the requisite quantity of oxygen to the sulphur throughout the entire length. The furnace is worked quite in the same manner, and no other disposition is required for the manfacture of sulphuric acid from the resulting sulphurous gases. These are converted from a waste into a product of value, with the further advantage of a less consumption of nitrates oxidizing the sulphurous acid, owing to the advanced oxidation in the muffle, and to the volatilization of anhydrous or monohydrated sulphuric acid.

LIXIVIATION.

To extract the sulphate of copper formed by the calcination, and also the sulphate of soda for repeated use, the ore is now lixiviated. This operation is conducted on the principle of *displacement*, in a series of three round tanks with double or battened staves (known as the Monnier tank). To avoid delays a fourth tank is furnished, to alternate in the series in charging and discharging. The tanks are provided with perforated false bottoms, covered with gunny cloth, or straw and gravel when these are not obtainable. Roasted ore is placed in them to the depth of three feet, the tank already containing about four feet of water. As the water slowly percolates through the mass, it dissolves the soluble salts. Passing through the false bottom and its covering, it is filtered, and then rises through pipes of india rubber, communicating with the next tank in the series, about thirty-eight inches above the false bottom, or two inches above the charge of ore. The india rubber pipe projects in the tank about eight feet, and the end is fixed to a wooden float, so that the liquor from one tank is introduced on the top of the liquor on the next tank. Communication between each of the succeeding tanks of the series is established in a similar manner. For the purpose of removing exhausted ore, and of renewing the charge, any tank is for the time excluded from the series, by carrying the pipe around it.

Each tank, therefore, receives in turn the water, which becomes more nearly saturated with the soluble salts, as it flows through each successive charge. From the third and last tank of the series, the liquor flows by a spigot into a reservoir for subsequent treatment. When tank No. 1 is quite exhausted of soluble matter (to be ascertained by testing a little of the outflowing liquor, intercepted at the spigot), the water supplying this tank is caused to flow in like manner into No. 2. This tank thus becomes the first in the series, which is completed by establishing communication between Nos. 3 and 4, making No. 4 the last in the new series. The residual powder is removed by a jet of water, through a circular opening of about nine inches diameter in the bottom of the tank.

When the liquor flowing from the last of the series of lixiviators, No. 4, is not of sufficient density (20° to 25° of Beaume) it is carried by the india rubber pipe into the empty lixiviator No. 1, filling it to a depth of about 3½ feet, after which a new charge of the hot roasted ore is introduced and levelled down. This tank is then ready, (tank No. 2 being completely lixiviated,) to take its place in a new series by making communication with No. 4, the series now being Nos. 3, 4, and 1. So, by alternately charging and discharging these tanks, the lixiviation is made continuous. In this mode of lixiviation, the liquor moves downward, owing to the constant withdrawal of that which is more nearly saturated, and thus gives place to the less saturated portions. An important advantage consists in the small amount of pumping required. It is for this reason that the space above the point at which the water is admitted into each tank is so great, (about two feet.)

(TO BE CONTINUED.)

Why Smiths Wet their Coal.

To the Editor—Sir : Some weeks since the *Scientific American* had an abstract from some scientific paper, and quoted M. Seidler as saying : *The reason the smiths sprinkle the coal dust near the blast-pipe is to keep the top layer in shape.* This is not the fact in the case. The generally-received opinion is, that wetting the coal is foolish and useless, or worse than useless, as the water has to be dried out at a cost before the coal will burn. But this, like many thousand practical chemical operations that are in daily use, is but little understood either by the smith himself, or by the scientific student that thinks his science is all wisdom. What is done daily, and has been done for years, is not to be looked upon as only a whim or notion ; and no such foolishness need be attributed to all the smiths of the land, as wetting the top layer merely to keep it in shape. By using the coal wet and packing it down with the shovel, it cokes on the inside, and in coking throws the gases into the fire or chamber in the inside of the fire. There these gases meet the oxygen of the blast, and form a chemical union ; and in so doing produce a heat the most intense known in practical arts. Without wetting the coal, the smith will have a "gassy" fire, with a large bluish flame, disagreeable to his face and hands, consuming three times the amount of coal, and not performing one-half the work in the same time. Scientifically, he produces chemical effects that are valuable to him in heating his work in less time, and in practice saves a large amount of coal by using it wet and keeping the top of his fire wet and well packed down.

W. A. Sweet.

Syracuse, March 4, 1873.

[Our correspondent will probably agree with us if we put the matter in much less "scientific" shape. By wetting and packing the top of his coal, the smith forms a crust which confines the heat to a much smaller space, and so, though he loses *heat* he gains *temperature*, because he gets his combustion exactly where he wants it. The wet coal is not the best fuel ; but it is a good covering for the fuel.]

Permanent Effect of a Shock.

We have all read in our histories how one of the Bramah presses burst when raising the middle span of the Britannia Bridge, and how triumphantly the enormous span bore the shock of falling several inches. Recent investigations into the magnetic condition of the Britannia and Conway bridges show that although the strength of the structure was apparently unaffected by the accident, there are still indelible marks of the occurrence remaining after a quarter of a century. The magnetic condition of the span in question is different from that of the others. The shock produced molecular mobility for a moment, and permanent magnetization was the result. Similar results can be produced in a small way with a hammer and a bar of iron ; but the striking fact disclosed by the examination of the Britannia Bridge is the permanence of the impression made by the one accident in the bridge's history, a permanence that may fairly give rise to the suspicion that whatever could produce such a fixed change in the structure of the iron may one day prove to have been a greater injury than was supposed.

MINING SUMMARY.

Idaho.

The Owyhee *Avalanche* of Jan. 10 has the following local Mining Summary:

Ida Ellmore.—The 9th level drifts, both north and south, are being pushed ahead rapidly, and are beyond doubt opening up a big mine. At every point where the vein has been cut, it shows a solid ledge from 4 to 5 feet in width and carrying first-class ore. Already some of the ore is being raised and sent to the mill from this level, which will add largely to the bullion product of our camp. The Company's mill is running steadily on Chariot and Ellmore ore.

Golden Chariot.—They are taking out from 8 to 10 tons of ore per day from the 5th level stopes of this mine. A winze has been started south of the shaft and will be sunk from the 6th to the 7th level; it is now down ten feet, showing a ledge from 2 to 2½ feet wide of fair milling ore. The 7th level drift is being run to connect with the winze. The 5th level drift has also just been started south. They have resumed sinking the shaft for the 10th level. Superintendent Linkton seems well pleased with present prospects of his mine.

South Chariot.—This Company have started up their mill on ore from their mine, and we learn from superintendent Miller, that, thus far, the indications are, that it will pay well. Considerable ore from the South Chariot and Red Jacket mines is now being hauled to the mill, which has ten stamps and is one of the best in camp.

Red Jacket.—This mine never looked better than it does at present, and as soon as the ore that is now out, and being taken out, shall have been milled, we are confident that it will prove itself to be a handsomely paying mine.

Mahogany.—This mine is looking splendidly throughout. The 6th level drift south is in 225 feet showing fair looking ore in the face of it. The winze is down 104 feet, and carries pay ore all the way from the 6th to the 7th level. Drifts have been started to run both north and south of the winze. Stoping has been commenced in the 6th level south; north the stopes continue looking well. The shaft will be down for the 7th level and timbered by the 1st of February. The Cosmos mill is kept steadily running on Mahogany ore.

Minnesota.—This mine continues to look favorable. The shaft is down 350 feet, which takes it to the bottom of the 5th level. Good ore has been taken out between the 3rd and 4th levels, both north and south of the shaft. Two winzes have been commenced, one of which is 68 feet south of the shaft and the other 83 feet north. Both of them are now down 20 feet, and it will take about two months to complete them. These winzes are going down from the 4th to the 5th level. Superintendent Coffin says that he does not expect to find much pay ore till the 5th level drift south taps the winze, where very rich ore was found in the bottom of the 4th level. The 3d level drift south is in 113 feet. They are now taking out from 5 to 6 tons of ore per day, which will be increased to double that amount by the middle of next month. They will commence milling the ore in about two weeks.

Empire.—This mine is looking better than it has for some time past. The ore that is now being milled pays 33 per cent. better than former crushings. The mine is now yielding about thirty-five tons of ore per day. Fine quality of ore has been struck in the 2d level north. The shaft has been just completed for the 4th level, and a cross-cut has been started to cut the vein, with about 12 feet to run. A winze has also been commenced south of the shaft to connect with the 4th level. The Empire is just now properly opened and will yield a large amount of ore. They have supplies enough on hand to last till June, and it ought to be a dividend paying mine, as the expenses are so much reduced.

War Eagle.—We understand that arrangements have been made to settle the financial embarassments of this mine, and that they will immediately commence taking out ore.

Illinios Central.—Continues to yield very rich ore and is, without doubt, one of the best little mines on War Eagle mountain.

Bullion Shipment.—Wells Fargo & Co. shipped from here during the week ending yesterday, 4 bars of bullion valued at $8,863 57.

Nevada.

BELMONT DISTRICT.

From the Reese River *Reveille*:

On Wednesday, Feb. 12th at 3 o'clock P. M., the fine 20-stamp mill of the El Dorado Consolidated Company made its formal start. We took occasion to be present, and were well pleased with what we saw. All the machinery of the mill moved off in good style. A few tons of low grade ore was run through to fill up the joints and to see that all was in working order. On Monday next the mill starts up in full blast on first-class ore, and will continue without cessation as long as there is a pound of ore in the District; but from the present encouraging appearance of this company's mines there is ore enough to wear out several mills.

The El Dorado mine is turning out more ore at the present time than ever before. The big strike in the south incline continues even better than at first expected. Three hammers are sending up over ten tons of fine ore every day; running only one shift. The breast of ore holds its uniform thickness of 12 to 15 feet; the stopes in the 240-foot level in the main incline look first-rate, from which a great quantity of chloride and black metal ore is being hoisted. The lower stope in the Arizona mine looks splendid, and the ore being taken out needs very little assorting. Some 200 tons of this ore lies on dump at the Company's new mill; it is estimated to be worth at least $250 per ton. Working about seventy men.

MONITOR COMPANY

are stoping fine ore above upper tunnel level. Notwithstanding the hundreds of tons of fine ore that has been taken from this upper work, the breast still holds its own and seems inexhaustible; also stoping out splendid ore from the stopes on the second level, which is midway between the two levels. The lower tunnel level is now in over 300 feet northerly, running in good ore, also taking out very rich ore from stopes 240 feet north of tunnel in the lower level.

The Monitor mill is running steadily, made its monthly clean-up on the 1st instant of over $80,000. This mill has been doing splendid work, averaging over 20 tons of ore daily and working it up to a very high percentage. A large amount of ore lies on the dumps ready for the mill, Working in all about seventy men.

BELMONT COMPANY

are working on a fine large body of high grade ore in the Canfield mine, which was discovered midway between the 74-foot and 290-foot levels and about 350 feet north of the main incline; also stoping out good ore on 290-foot level north. Still pushing this level northerly, its length is already 730 feet from the main incline. It shows fair milling ore nearly its entire length, but the last twenty feet is through the richest body of ore ever found in the mine. Still running 350-foot level northerly; good ore in the drift 310 feet from the main incline. Some $60,000 worth of ore lies on the dump assorted and ready for the mill. Working about thirty men.

EL DORADO NORTH COMPANY.

Vertical shaft down 120 feet; still sinking as fast as double shifts can put it down. Work done by contract.

American Institute of Mining Engineers.

OFFICIAL BULLETIN.

Announcements to Members and Associates.

I. 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.

II. It is expected that the more important papers, 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.

III. 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.

IV. 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.

METALS.

New York, March 6, 1873.

IRON.—Duty: Bars, 1 to 1½ cents ⅌ ℔; Railroad, 70 cents ⅌ 100 ℔s.; Boiler and Plate, 1½ cents ⅌ ℔; Sheet, Band, Hoop, and Scroll, 1½ to 1⅞ cents ⅌ ℔; Pig, $7 ⅌ ton; Polished Sheet, 3 cts. ⅌ ℔; Galvanized 2½; Scrap Cast, $6; Scrap Wrought, $8 per ton. All less 10 per cent. No Bar Iron to pay a less duty than 35 per cent. ad val.

	Store Prices.
Pig, Scotch—Coltness ⅌ ton	61 00@62 00
Gartsherrie	59 00@60 00
Glengarnock	56 00@57 —
Eglinton	— —@55 00
Pig, American, No. 1	— —@50 00
Pig, American, No. 2	46 —@48 00
Pig, American, Forge	40 00@44 00
Bar Refined, English and American	— —@110 00
Bar Swedes, assorted sizes (gold	120 00@130 00

	Store Prices, Cash.
Bar, Swedes, 1½ to 5 x ⅜ & ⅞ 2 sq. & 6 to 12 x ⅜ & ½	145 00@155 00
Bar, Refined, ⅜ to 2 in. rd. & sq. 1 to 6 in. x ⅜ to 1 in.	105 00@ — —
Bar, Refined, 1½ to 6 by ¼	— —@110 00
Bar, Refined, 2½ to 2⅞ round 1 & 1⅛ by ¼ & 5:16	112 50@ — —
Large Rounds	112 50@125 00
Scroll	120 00@150 00
Ovals and half-round	130 00@150 00
Band	— —@122 50
Horse Shoe	117 50@127 50
Rods, ⅝ to 3-16 inch	110 00@152 50
Hoop	130 00@172 50
Nailrod	@ 9
Sheet, Russia, as to assortment (gold)	16 @ 17
Sheet, Singles, D. and T. Common	—6½@— 7½
Sheet, D. and T. Charcoal	—7¼@— 8½
Sheet, Galv'd, list 5 per cent. disconnt	—@ — —
Rails, English (gold), ⅌ ton	70 00@ 71 00
Rails, American, at Works in Pennsylvania, currency	80 00@ 82 00

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

	All Cash.
Copper, New Sheathing, ⅌ ℔	— @— 43
Copper Bolts	— @— 45
Copper Braziers, 16oz. and over	— @— 45
Copper Nails	— @— 45
Copper, Old Sheathing, &c. mixed lots	28 @— 30
Copper, Old, for chemical purposes, 14@16 oz.	— @— —
Copper, American Ingot	34½ @— 34⅝
Copper English Pig	30 @—
Yellow Metal, New Sheathing & Bronze	27 @— 00
Yellow Metal Bolts	— @— 32
Yellow Metal Nails	27 @— 30

LEAD.—Duty: Pig, $2 ⅌ 100 ℔s.; old Lead, 1½ cents ⅌ ℔. Pipe and Sheet, 2½ cents ⅌ ℔.

Galena, ⅌ 100 ℔s	$- — @- —
Spanish (gold)	6 45 @6 50
German, do.	6 45 @6 50
English do.	6 50 @7 00
Bar (net)	9 25 @ —
Pipe (net)	- — @10 50
Sheet	- — @10 50

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

English Cast (2d and 1st quality) ⅌ ℔	— 18 @— 22
English Spring (2d and 1st quality)	— 9½@— 10½
English Blister (2d and 1st quality)	— 11½@— 16
English Machinery	— 11½@— 14
English German (2d and 1st quality)	— 11¼@— 12
American Blister "Black Diamond"	— — @— 11½
American, Cast, Tool do.	— — @— 17
American, Spring, do.	— — @— 11
American Machinery do.	— — @— 11½
American German, do	9 @— —

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

	Gold ⅌ ℔.
Banca	37½@—
Straits	31 @32
English	31½@32

PLATES.

Fair to Good Brands.	Gold.	Currency
I. C. Charcoal, ⅌ box	$11 87½@12 00	$14 00 @14 25
I. C. Coke	10 50 @10 75	12 50 @12 75
Coke Terne	8 75 @ 9 75	10 50 @11 50
Charcoal Terne	10 50 @11 00	12 50 @13 00

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

Plates, Foreign (gold) p. 100 ℔.	7 87½@ 750
Plates, Domestic p. lb.	8¾@— 10½

ZINC—Duty: Pig or Block, $1.50 per 100 lb.; Sheet 2¼c. per

Sheet per lb.	—10½@11 ℔

Advertisements.

MISCELLANEOUS.

Wm. A. Sweet, Pres't. Geo. W. Harwood, Treas. Fred. B. Chapman, Sec'y.

SWEET'S MANUFACTURING CO.,

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MANIPULATORS OF

Bessemer Steel,
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Blister Steel.

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Sweet's Cast Steel Crow Bars,
Sweet's Cast Steel R. R. Bars,
Sweet's Oil-tempered Seat Springs,
Sweet's Excelsior Steel Tire,
Swede's Spring Steel,
Cast Spring Steel,
English Spring Steel,
Sleigh Shoe Steel,
Cutter Shoe Steel,
Frog Point Steel.

Nov. 19:1y

SUPERIOR RAIL MILL.—Capacity: 1,000 Tons Per Week.

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RAILROAD IRON,

Office, corner Fifth Avenue and Smithfield Street, Pittsburgh.

Our central location enables us to draw from both sides of the Allegheny Mountains Metals and Ores best adapted for making a No. 1 Rail, and together with our Improved Machinery, are a sufficient guarantee of our ability to produce Rails of a quality unsurpassed for durability and strength, by any foreign or domestic manufacture.

New Patterns, of any desirable weight, made to order on Short Notice.

We respectfully solicit orders for New Rails, or Re-rolling. June 26.1y

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Full particulars given on application. Oct. 8-tf

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IN IRON, WOOD, OR STONE.

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Dec. 31-3m

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May 17:1y

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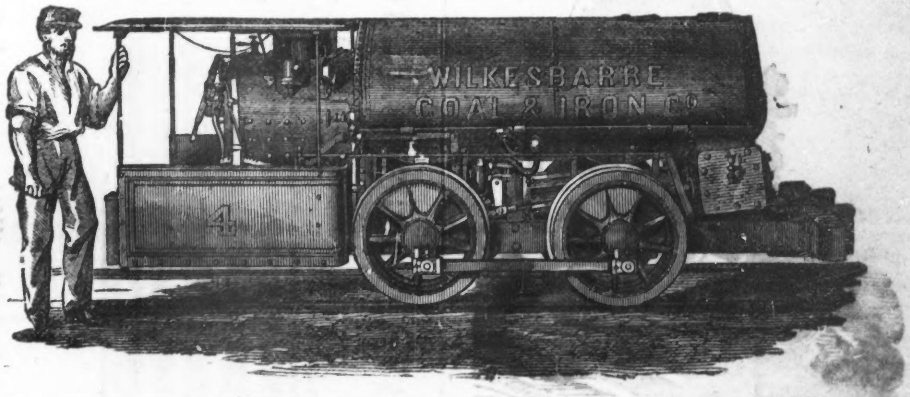
OXIDE OF ZINC, SPELTER, SHEET ZINC.

Jun28:1y SPIEGELEISEN CINDER FOR BLAST FURNACES.



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Gauge, two feet six inches or upwards; Hight above rail, five feet four inches; Width over all, five feet one inch. Adapted to burn Anthracite or Bituminous coal or coke.

Materials and Workmanship Equal to those in Full Gauge Railroad Locomotives,

Guaranteed to pass curves of twenty-five feet radius and haul on a level track in good condition.

Three Hundred and Forty Gross Tons of Cars and Lead

For Photograph and full particulars, address

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Feb:7-1y:eow

BLAKE'S STONE AND ORE BREAKER.

The office of this Machine is to break Ores and Minerals of every kind into small fragments, preparatory to their further comminntion by other machinery. Also to break stone for McAdam roads, and Ballasting Railroads.

This machine has now been in use, enduring the severest tests, for the last ten years, during which time it has been introduced into almost every country on the globe, and is everywhere received with great and increasing favor as a labor-saving machine of the first order.

Illustrated circulars, fully describing the machine, with ample testimonials to its efficiency and utility, will be furnished on application, by letter to the undersigned.

☞ The Patents obtained for this machine in the United States and in England having been fully sustained by the courts, after well contested suits in both countries, all persons are hereby cautioned not to violate them; and they are informed that every machine now in use or offered for sale, not made by us, in which the ores are crushed between upright convergent faces or jaws actuated by a revolving shaft and fly-wheel, are made and used in violation of our patent.

☞ Those who visit New York City can be shown this machine in operation by inquiring of B. R. Western, 37 Park Row, who will give information, prices, &c., and receive orders.

Mch. 14-1y. **Address** **BLAKE CRUSHER COMPANY, New Haven, Conn.**

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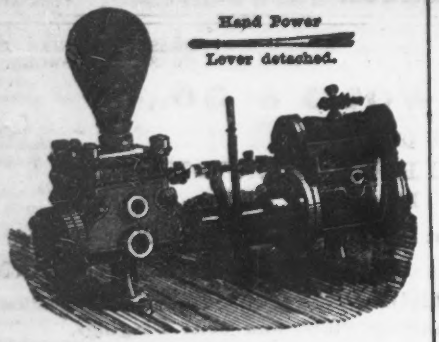

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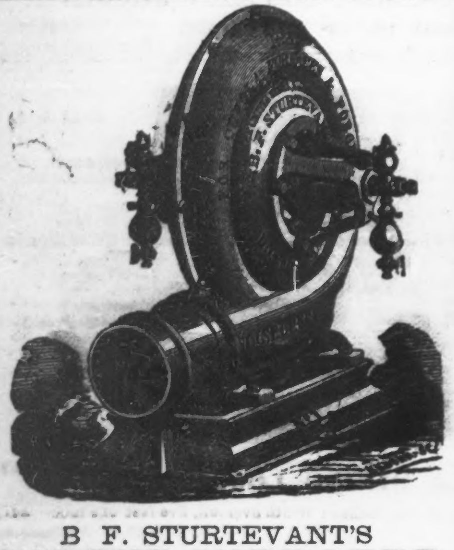
A specialty made of the manufacture of Double-Acting Plunger Pumps for mining purposes—combining economy of space, capacity, and great durability. All wearing parts made of composition metal.

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

Send for Illustrated Price Circular. m-26 3m



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KROM'S PATENT DRY ORE CONCENTRATOR

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

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

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

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

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Troy, N. Y., May 3, 1872.

B. F. Sturtevant, Boston, Mass.,

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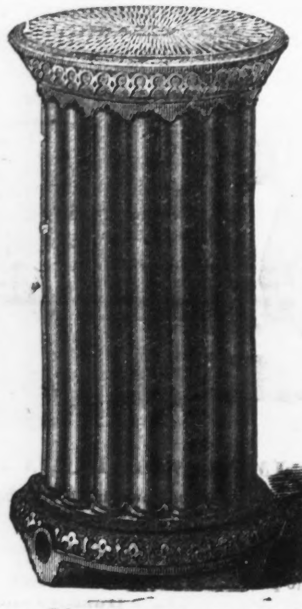

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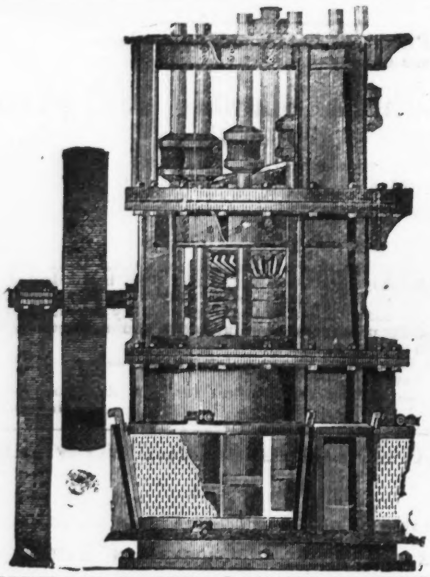

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of 12 stamps. It requires no frame to put it up. The best Battery ever used for amalgamating gold, or crushing silver ores, dry or wet. Can be put up on a mine in running order for one-half the price of the straight battery, and in three days after 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.

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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.

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Jan 6:6m

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

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May 17:1y

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POSTS & KALKMAN, Manufacturers,
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Sept. 17:6m

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Stock Constantly on Hand
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Chairs, Spikes and Fish
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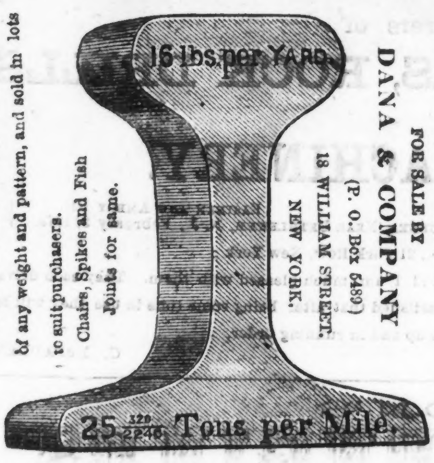

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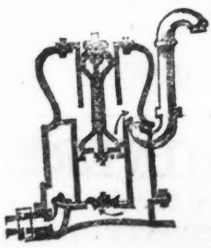

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Simple, cheap, and effective.

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CLAY CARBONATE COPPER ORE,

(SUITABLE FOR WET PROCESS.)

1000 Tons 5 per Cent Yield.

FOR SALE AT VERY LOW FIGURES.

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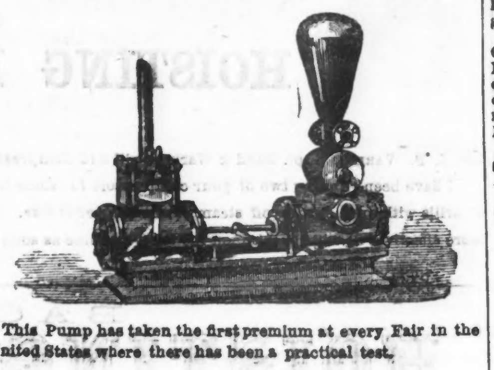

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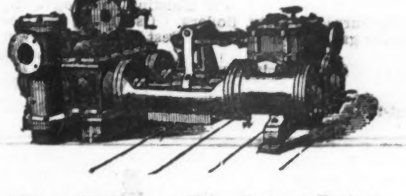

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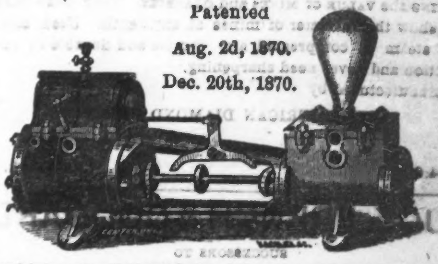

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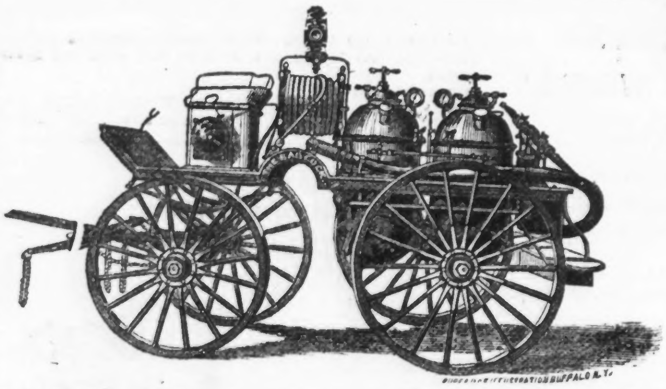

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