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The Mortar of the Great Pyramid.

AT the last meeting of the Chemical Section of the Philosophical Society of Glasgow, the President, Dr. WALLACE, F.R.S.E., read a paper in which he gave a number of interesting details regarding the mortar employed in building the Great Pyramid, and incidentally referred to the composition of some mortars that he analysed a few years ago, including two from the interior and exterior of the Great Pyramid, two specimens of very ancient Phœnician mortar from the Island of Cyprus, two from ruins at Athens, and from Rome and other places in Italy. It was most interesting to observe the remarkable differences between the mortars of the various ancient peoples. By going to Baalbec and other ruined cities of Turkey in Asia, buildings might be found constructed of immense blocks of stone jointed with such excessive nicety that even the blade of a penknife could not be pushed between them, but without a vestige of mortar. In the structures of the ancient Egyptians, on the other hand, taking the Great Pyramid as an example, mortar was freely employed, but consisting almost entirely of gypsum or sulphate of lime. A specimen was examined from an ancient Phœnician temple, the highest stone of which was, a few years ago, five feet below the level of the ground, at the time the specimen was taken. It was something like that found in some of the baronial castles in this country, and was like a piece of solid rock. The gentleman who brought it home supposed it to be the very oldest mortar in existence. If it were so, Dr. WALLACE said that it was most remarkable, inasmuch as it was as perfect in condition as it could possibly be, having been made, evidently, of burnt lime, fine sand, coarse sand, and gravel. It might be called concrete, rather than mortar. At any rate, one thing was certain—namely, that the lime in it had become completely carbonated; and another specimen of the same age exhibited the same phenomenon, thus satisfactorily settling a point which was long in dispute. The ancient Greek mortars from ruins in the vicinity of Athens were also very perfect, but contained more lime than that from Cyprus, and no gravel. The mortars from various ruined buildings in Herculaneum, Rome, and its neighborhood, appeared to have been made from burnt lime and puzzuolana, or what is called by geologists volcanic ash. Dr. WALLACE stated that he had had some correspondence with Professor PIAZZI SMYTH regarding the mortar of the Great Pyramid, some portion of which he read, and he gave the following analysis of a specimen which he had recently examined :—

Hydrated sulphate of lime	92·83
Carbonate of lime	4·63
Carbonate of magnesia	1·66
Alumina and traces of oxide of iron	·24
Silicon	·88
Water (hygroscopic)	·07
	100·31

The following are analyses of two specimens examined a few years ago :—

Hydrated sulphate of lime	81·50	82·89
Carbonate of lime	9·47	9·80
Carbonate of magnesia	·59	·79
Oxide of iron	·25	·21
Alumina	2·41	3·00
Silica	5·30	4·30
Water (hygroscopic)	—	—
	99·52	100 99

In reply to a question, Dr. WALLACE stated that he believed the sulphate of lime, which is abundant near the Pyramids, had been partly calcined to drive off the water of hydration in the mineral before being used in making the mortar. There was very little cohesiveness in the samples exhibited.

Brittle Variety of Silver from Bolivia.

BY FREDERICK FIELD, F.R.S.

A specimen of silver, weighing about half a pound, has been recently sent from Bolivia. It has a brownish color, resembling very much the minerals Domeykite or Algodonite (Cu_6As and $Cu_{12}As$), for which it was at first mistaken. Like those interesting compounds, it afforded a brilliant white metallic streak with the knife, and was capable of being reduced to powder to a great extent by the pestle. Analysis proved, however, that it contained neither copper nor arsenic, but consisted essentially of silver, with percentages of chlorine, ferric oxide, carbonate of lime, and a small amount of cobalt. After digestion for some days with dilute acetic acid, the carbonate of lime was entirely dissolved, and the brittle residue pulverised and quantitatively examined. It yielded—

Silver	78·12
Chloride of Silver	12·01
Ferric oxide	9·34
Cobalt	0·40
	99·87

The analysis presented no peculiar difficulties, and, as it is known to chemists that a mixture of silver and its chloride is very brittle, this little note would scarcely be worthy of record were it not for the fact that the silver in the mineral, after precipitation in the state of chloride from its solution in nitric acid, remained perfectly white after being exposed to sunlight for many days, while the metallic chloride, existing *as such* in the mineral, blackened immediately on exposure to light. Thus, when the powdered ore is treated with nitric acid, and the solution precipitated by hydrochloric acid, the resulting compound after thorough washing is not affected by the sun; whereas the residue, after digestion with weak solution of ammonia, filtration, and precipitation by an acid, yields a chloride of silver which is at once discolored. This peculiar property of chloride of silver has been previously noticed. In a paper by the writer, in the *Quarterly Journal of the Chemical Society*, vol. x., p. 242, the following observation may be found :—"Lœwig has shown that chloride of silver is soluble to a considerable extent in nitrate of mercury, and crystallises, as the solution cools, in octahedra. When solutions of nitrate of silver and corrosive sublimate are mixed together, a precipitate of chloride of silver is formed, which, on boiling with the nitrate of mercury produced by the double decomposition, is partially dissolved, and the solution, after filtration, deposits chloride of silver in small crystalline grains. These crystals, after washing with water until no trace of mercury passes, and exposed to the sun's rays, do not blacken like the ordinary chloride. A considerable quantity was prepared and exposed moist to the direct rays of the sun for a month, and remained unaltered in appearance.

Three Weeks Shut up in a Coal Mine.

The *North British Mail* gives the following account of the finding of two miners, who were shut up in No. 2 Kenmore pit, at Carmyle-on-the-Clyde, by an accident which flooded the mine, February 6: "Their names were Macbeth and Moodie. The bodies were recovered eight weeks after the water broke in and they were the only men in the pit at the time. The theory of practical miners as to what followed the rush of water into the pit is without doubt correct. The two men would at once make to the highest part of the workings, to which, in point of fact, the water never reached, gradually coming down as the water receded before them, in hopes of being able to reach the bottom of the shaft. This was proved by the fact that in one or two places were found indications of where the poor men had made beds for themselves at a higher level than that where they were found in their last sleep. It is something horrible to contemplate, but the result of calculation of the time it would take the water to subside from the highest point it reached to the spot where the bodies were found argues that the poor men must have survived in the darksomeness of their living tomb for about the space of three weeks. The poor fellows, therefore, did not perish by drowning. Their more cruel fate was to linger on, with feelings gradually deepening in despair, until expiring of inanition. In the pocket of MACBETH's jacket were found a portion of cotton wick, used by miners for their lamps, and a portion of the *Weekly Mail* of January 4, an examination of both of which showed clearly that they had not been subjected to the influence of water. Close by the bodies were found the two tin flasks, in which the poor men, as is the miners' custom, carried their tea. These are deeply interesting relics of the event, seeing that on both are attempts at writing, with a common pin or other pricking instrument, a last message to the dear ones behind. Obviously both were written in the deep darkness of the mine, long after the writer's portion of oil (no doubt husbanded to the last drop) had been spent; and this, together with the lengthened exposure to damp, &c., has made them only partially decipherable. On MACBETH's flask, however, where the writing is the more legible of the two, can be distinctly made out the following :—"My dear wife, long after you and all other people thought we were dead, I had great hopes of seeing you. I bid you farewell, hoping God will comfort and take care of you and them" (pre-

sumably the children). On the other flask only a few straggling words have been made out after considerable difficulty. These, however, by miners are deemed to be rather pregnant ones, and we give them as they occur: "MOODIE . . . and . . . me . . . had . . cage . the . been risen . . by them would . . saved . . s . . ." We may leave those who can "read between the lines" to put their own interpretation upon this. We have only to add that the two poor fellows who, under such sorrowful circumstances, died together, were not divided in their burial. They were interred in one grave in Tolcross Churchyard on the 5th curt., between 400 and 500 of their fellow-miners attending the funeral."

On the Occlusion of Gases in Pig Iron, Steel, and Wrought Iron.

THIS subject is receiving a good deal of attention in Europe as well as in this country, and though the results so far obtained are inconclusive, the investigations show that this is a most promising field for future metallurgy. One of the experimenters is MR. JOHN PARRY, well known as a prominent investigator of the phenomena connected with the treatment of iron and its products. MR. PARRY, in a paper which is not yet finished, says:

In the *Chemical Journal*, vol. v., 1867, Professor GRAHAM first published his remarkable experiments showing that many of the metals were capable of taking up several times their own volume of gas, and evolving the same on heating *in vacuo*, using that invaluable instrument designed by Dr. HERMANN SPRENGEL, now known as the Sprengel Mercurial Air Pump. This instrument afforded a ready means of first creating a vacuum and afterwards collecting the gases evolved on heating the metal contained in a close tube; it was also shown that many of the metals contained what may be termed natural gas, *i. e.*, gas occluded in the metal during its manufacture, and ever afterwards retained under ordinary conditions. The Author was much struck with these experiments, notably those on the gases evolved from wrought iron. It was shown by GRAHAM that on heating carefully-cleaned wrought iron wire *in vacuo* 46 grms. of spec. grav. 7·800 gave, in two hours, 46·85 c.c. gas measured at 15° C., or that one volume of iron had discharged 7·49 vol. gas, of which about two-thirds was carbonic oxide. Another sample gave 7·27 vol. gas, which contained about 15 per cent. carbonic acid; the remainder was principally carbonic oxide, with hydrogen and a trace of hydrocarbon. A sample of exhausted iron wire was exposed at a red heat to the action of carbonic oxide, and was found to have taken up 4·15 times its own vol. of carbonic oxide. Professor GRAHAM remarks:—The relation of the metal iron to carbonic oxide appears to be altogether peculiar. The intervention of carbonic oxide in the process of cementation with charcoal has long been recognized. The decomposing action of carbonic oxide has been supposed to be exercised only at the external surface of the metal. The experiments appear to show that the process is not confined to the surface of the iron bar, but may occur throughout the substance of the metal, in consequence of the prior penetration of the metal by carbonic oxide, and it would appear that the diffused action of carbonic oxide is the proper means of distributing the carbon throughout the mass of the iron. It is also suggested that cementation may be promoted by alternately heating and cooling the bar iron. Also, the lowest red heat appears to be most favorable for the absorption of carbonic oxide by iron. Some time ago the author made some experiments in this direction, by forcing carbonic oxide into an air-tight vessel containing a bar of red-hot iron. It was not proved that the bar had absorbed carbonic oxide, but in all cases the pressure of the gas, shown by a gauge, first rapidly, then slowly, diminished, until after many hours only atmospheric pressure was shown. It was conceived that a more extensive series of experiments in this direction in the various kinds of pig iron, steel, and wrought iron, manufactured at the works, might lead to useful results; at any rate, as GRAHAM had proved the existence of these gases in iron, it was desirable to determine the amount and kind of gas or gases occluded in pig iron, etc., such information being rendered more valuable from the fact that the history of the manufacture of each sample tested could be readily obtained. It was, however, found that these experiments presented grave difficulties, and much time was lost ere reliable results could be obtained. Up to the present time only a few experiments have been made, at a low temperature, necessitated by the use of glass tubes, the author failing to get any other kind of tube capable of retaining a good vacuum for many hours. These difficulties have, however, been overcome, and it is hoped that soon a complete series of experiments will be ready, giving the absolute amount and kind of gas or gases contained in pig iron and steel of various qualities; also special determinations of the gas contained in overheated steel and wrought iron. These are all qualitative experiments, the absolute amount of gas given off from a given weight of iron has not yet been determined.

Experiment 1.—Fifty grms. spiegeleisen heated *in vacuo* at a low red heat for three hours; collected 12 c.c. gas; barometer, 760 millimetres; temperature, 15 deg. centigrade, containing per cent.:—Carbonic acid, 0·942; carbonic oxide, 17·87; oxygen, none; hydrogen, 81·105.

Experiment 2.—Fifty grms. common white pig-iron, heated as above 6½ hours, collected 13 c.c. gas, containing per cent.;—CO_2, 6·800; CO, 2·32; H, 84·00; N, 6·88.

Experiment 3.—37 grms. good wrought iron, heated two hours gave 9·4 c.c. gas, containing per cent.—CO_2, 9·920; CO, 34.262; H, 54,100; N, 1·718.

Experiment 4.—4·75 grms. grey pig-iron, heated two hours, gave 15·81 c.c. gas, containing per cent.—CO_2, 1·600; CO, 5.200; H, 89·700; N, 3·250.

1	cubic inch	spiegeleisen	discharged	about 2	cubic inches gas.
1	"	white pig-iron	"	2	"
1	"	wrought iron	"	2	"
1	"	grey pig-iron	"	2·1	"
1	"	steel	"	0·13	"

Experiment 5.—10 grms. soft steel, heated two hours, gave 18·44 c.c. gas, containing per cent.—CO_2, 16·550; CO, 24·352; H, 52·610; N, 6·488.

It is noticeable that grey iron contains the largest quantity of hydrogen, this experiment showing that it is gradually eliminated in the process of manufacture from raw pig to wrought iron. The grey iron and steel were exposed to a higher temperature than the other samples, as follows:—A clean porcelain tube containing the metal was enclosed in a tube of infusible glass, closed at the end; a clay tube was moulded around these; the lower part containing the iron was placed in a clay crucible, the latter was then filled with blast furnace slag. The anterior end of the tube was drawn out and connected with the pump in the usual manner, and a good vacuum having been first formed in the cold, the crucible, etc., was strongly heated in a small charcoal furnace, and the molten slag covering and enclosing the whole, it was found that a good heat could be applied without danger from leakage or fusion of the tubes.

The grey pig-iron gave off much more gas than was expected; the experiment, however, was perfect throughout, and every precaution taken, the tubes being clean and perfectly dry. The gas, in this instance, may be occluded in the graphite; to test this the author intends separating the latter according to Snelus's method, and testing the portion containing the excess of graphite *in vacuo*. Clean lumps of grey pig-iron were used for the steel. The sample was drilled in the laboratory, with new drills, never before used, and perfectly free from grease and oil. Not the slightest alteration was noticed in the quality of the wrought iron. It behaved exactly like the companion piece cut off the same rod, worked and bent by the smiths.

Next we have a paper by L. TROOST and P. HAUTEFEUILLE which is as follows:

The present memoir is the record of a research as to the origin and mode of production of the gas contained in pig-iron, steel, and wrought iron. It is generally admitted that wrought iron, steel, and cast iron have the property of dissolving gases at a high temperature, which are again set free as the temperature falls. Does it follow that the disengagement of gases which accompanies castings on a large scale is perfectly accounted for by this property of the metals? We think not, and we can show that these outpourings of gas can be produced under conditions where the variations of temperature are far too small to affect the solubility of the gases. In fact, the bubbles which are set free, and which produce the "blowers" found in the metals after they have cooled, frequently cause, by their disengagement, an appreciable change in the chemical composition of the cast iron, or steel, as the following experiments go to prove. The bubbling of pig-iron or of steel which metallurgists daily notice can be easily studied in the laboratory. It suffices to maintain the material at the fusing point in vessels of refractory earth, the phenomenon then continues, so long as it remains melted, without any sensible variation of the temperature being necessary. This disengagement is not due to any action of the metal upon oxidizing gases in the atmosphere (aqueous vapor, or carbonic acid), for it is equally manifested in their absence. A casting kept in fusion seventy-two hours, in a well-closed apparatus, and under a low pressure, set free gas at the expiration of the third day. This same casting, placed in an atmosphere of carbonic oxide, or of hydrogen, behaved precisely as if in a dry vacuum, and analysis has shown us that the gas which is evolved is carbonic oxide. The continuous evolution of this gas cannot proceed from gas in solution, since the temperature remains stationary; it must therefore result from a reaction of the cast iron upon the porcelain vessel containing it; and that this is the case we have learnt from analysis. We have found that the pig-iron loses carbon, and becomes enriched with silicium. We have been able to follow up this absorption of silicium by the casting to as much as 8 per cent. Beyond this percentage the fusing point of the metal becomes so elevated that we were no longer able to study the phenomenon in porcelain tubes. These first experiments show that at temperatures above its melting point carburetted iron reduces silica. We have, for the present, confined ourselves to determining the amount of absorption of silicium by melted iron under such a pressure of carbonic oxide as should approach that of this gas in smelting furnaces. The vessels which we used were of *gaize*, a very refractory siliceous substance, very poor in alkalies. A grey pig-iron which contained 0·21 per cent. of silicium, and 5 32 of carbon, was heated in a *gaize* crucible of very great thickness, placed in a plumbago crucible surrounded with retort charcoal. Under these conditions, the gaseous atmosphere in contact with the cast-iron, is composed of carbonic oxide and hydrogen, as in the furnaces of ironworks. After four-and-twenty hours of heating, the *gaize* was much eaten away, the pig-iron had absorbed silicium, and in addition an acid silicate of the protoxide of iron was formed.

The same experiment repeated with steel gave analogous results. The pig-iron and steel on subsequent analysis gave the following numerical results:—

	Silicium. Per cent.	Carbon. Per cent.
Pig-iron—Original sample	0·21	5·32
" After 48 hours heating in porcelain	0·87	5·20
" After 24 hours heating in *gaize*	1·07	3·90
" A globule found imbedded in the *gaize*	3 40	--
Steel —Original sample	0·10	1·54
" After 24 hours fusion in an Hessian crucible	0·26	0·74
" After 24 hours fusion in *gaize*	0·80	0·70

The action of the melted iron and steel, upon the silicious matters surrounding

them, proves that, whenever it is desired to avoid the presence of silicium in the metal, it must be melted in vessels of lime or magnesia. The reaction we have pointed out takes place in all the ordinary operations of smelting, and is continued in casting, if the sides of the crucible are very silicious; this should not, however, be taken as the principal cause of the production of silicious castings, inasmuch as the reaction of the carburet of iron upon silica is very slow, and the basic nature of the slags is unfavorable to it. We have, in fact, ascertained, that a silicious pig-iron heated in lime, or in a very basic silicate of lime loses silicium. The veritable cause of the production of silicious pig-iron, even in the presence of carbonic oxide gas, depends mostly upon the action of the alkaline metals (which are always more or less present in the beds of fusion) upon the silicates. The influence of the alkaline metals (whose presence we have always taken pains to avoid in these experiments) is easily put in evidence. If a mixture of carbonate of potassa, charcoal, silica, and iron filings is heated in a blast-furnace, we have then, at a high temperature, iron and silica in company with the vapor of potassium. Under these conditions, we have obtained a cast-iron, containing 5·16 per cent. of silicium, and 2·94 per cent. of carbon. This reaction, which is much more rapid than the preceding ones, better explains the formation of siliceous pig-iron during the rapid descent of the metal through the hottest zone of the blast furnace.

In the course of this research we have been able to study the occlusion of gases in iron and steel under the most varied conditions. The results of these, we propose to make the subject of a future communication.

Method for the Manufacture of Cast Iron, Wrought Iron, and Steel.

BY ALOIS THOMA.

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ROASTING OF IRON ORES WITH GAS.

ALL ores must be roasted before they can be reduced. Roasting can be effected according to either of the two following methods:

1st. In the upper part of the blast furnace; this method is generally termed "working with raw ores."

2d. In specially constructed kilns, which method is employed when it is desired to obtain a product as free as possible from injurious substances, and at the same time to economize fuel during the smelting.

The roasting according to the first method—almost exclusively in use in America—takes place too rapidly to be perfect, requires high furnaces, and powerful engines in order to drive the blast with sufficient pressure through the high column of material, particularly the compact zone in which the roasting takes place.

It is well known that raw ores increase in volume as much as 15 per cent. during roasting. Since now this expansion of the volume of ores cannot take place upwards, the weight of the mass, from the point, where roasting first commences, to the top, being too great to allow it, the difference must be made up by the spaces between the pieces of ore being closed. The mass becomes thus much more compact, not only impeding the passage of the gases, but also preventing the thorough roasting of the larger pieces of ore.

Furthermore, as the escape of the gaseous portions of the ores cools very much that zone of the stack, occupied by the roasting process, there is more of the height required for this purpose, and the reduction which can only begin when the pieces have been roasted at least to a certain depth, commences at a point so far below the tunnel head, that very slow charges become necessary, so that the process may be complete.

If a large production of the furnace is therefore required, the vertical dimensions must be very great, and this necessitates a high pressure of the blast.

The above mentioned difficulties or objections can be mostly removed by a careful roasting of the ores in specially constructed kilns. Upon the perfection of these depends the completeness of the roasting, and from this the quality of the product. For this purpose my furnace or kiln offers advantages which have not been approached by any other apparatus. In it the ores are not only entirely deprived of sulphur, phosphorus, and arsenic, (even when containing as much as 20 per cent. of sulphur, and an excess of phosphorus,) but they are also *thoroughly* and *evenly* roasted, so that the product contains neither pieces which are roasted too little nor such which are burned too much, so that silicates have been formed. The degree of roasting is entirely under control. The consumption of fuel is very small, 120 to 160 lb. of anthracite or 6 to 8 cubic feet of wood beingrequired for 2000 lb. of ore. Blast furnace gases can also be used for the purpose, or the escaping flame from gas fires may be employed. The capacity of the kiln is 25 tons of thoroughly roasted ore per day. I would remark that this kiln is suited to the roasting of all ores, particularly sulphurous ores.

PRODUCTION OF PIG IRON.

The method of making pig iron, at present in use, is the most difficult operation of the iron maker. In general, the process is so little open to inspection, that the progress of the work, and the causes of the oft-recurring disturbances, can only with great difficulty be recognized, and often not at all. As the reduction of the oxides, the carbonizing of the same, and the separation of the metal from the earthy materials, in other words, the smelting of the ores, must all take place in the same apparatus—the Blast furnace—any disturbance in one zone must act disadvantageously upon all others, and hence the great uncertainty, and danger of a total interruption of the work, if the cause of the disturbance cannot be discovered. Another great evil of the blast furnace is the large consumption of charcoal, coke or anthracite, which latter material must be very pure in order to produce a good iron. Finally the construction of blast furnaces for a large production, necessitates a very large outlay of capital, as they require heavy and costly blast engines and motors.

It is well known that very rich ores cannot be used alone in the blast furnace, because their reduction takes place with difficulty and very unevenly, and cannot be controlled. They must be mixed with others, which is often a great mifortune, as the ores required for such mixing are not always to be had in the neighborhood.

All the above difficulties in the production of pig iron are overcome by my method. This result I accomplish by not conducting the whole operation in one apparatus, but by first reducing and carbonizing the ores in one apparatus, and then melting the product in a separate furnace.

THE REDUCTION AND CARBONIZING OF THE ORES.

The facility with which the oxide of iron—in a glowing heat—is reduced by carbonic oxide, carburretted hydrogen and hydrogen gases, and the ease, with which, in the presence of the first named gases, carburets of iron are formed, permits the reduction and carbonization of the oxides of iron in the ores by means of gases *without* the contact with solid carbon, as is the case in the ordinary blast furnace. In the gas furnace this reduction takes place not only in a uniform and complete manner, but also in a very short time. Upon this fact, which is proved by my experience, rests the principle of my reducing furnace.

The practical application of this principle is very simple. The roasted ore, broken to the size of walnuts, is allowed to descend in a shaft, and subjected therein to the gases evolved in adjoining generators. Part of the gases are burned before reaching the ores—generating a heat of from 1500°—1800° and the remaining gas is used for the reduction and carbonizing of the ores. This takes place, as said before, very rapidly, fresh ores being brought into the carbonizing zone as required. The ores are drawn out at the bottom as fast as they are reduced. The furnace is therefore a draw-kiln and can prepare about 12 tons per day, the consumption of fuel being about 2¼ cords of wood or about 4000 lb. of coal; two ordinary laborers being required. In all cases, where quantity of fuel is given, such of ordinary quality is meant.

The process of reduction of the ores in my furnace is the same which takes place in the ordinary blast furnace, with the exception that any kind of fuel can be used with great economy, and, besides, it is in the power of the furnace-man to give it any degree of carbonization he may desire, which cannot be done in the ordinary method. Furthermore, the process can be interrupted and started again at any time without any disadvantage or danger to either furnace or ores.

As the fuel is used in the form of gas, the ores are not damaged by any impurities which it may contain. It follows as a consequence of my method of reduction, that an excellent quality of pig iron must be made even from indifferent ores or those containing sulphur, phosphorus or arsenic, as these great enemies of the iron master are removed in the roasting kiln, as stated above.

The carbonization of the ores takes place at such a low temperature, that the decomposition of silica cannot occur, and therefore an iron very tough and free from silicon, must be obtained. In the following smelting the iron cannot take up silicon, because carbon and silicon complement each other, and as the iron has already taken up its carbon, silicon does not enter into combination. Neither will the manganese—at the low temperature of the reducing furnace—unite with the iron. It remains in combination with the earthy materials of the ores, and afterwards, in the smelting furnace, uniting with any silicon which may have been separated, assists in forming a liquid slag, thereby assisting the production of a pure iron.

Another great advantage is offered by this process. Copper, the greatest enemy in the manufacture of Iron and Steel, *does not enter into combination with carbonized iron.* As the temperature, at which the reduction in my furnace takes place, is so low, that no combination between the iron and copper can take place, so in the smelting of the prepared ores the copper can be drawn off by a peculiar arrangement of the taps, and a pig iron entirely free from it may thus be obtained.

It follows from the foregoing, that with cuprous ores the reduction process must be continued until the iron is carbonized. In this case the smelting furnace can of course be very low and smelting can be conducted very rapidly.

THE SMELTING OF THE REDUCED AND CARBONIZED ORES TO PIG IRON.

For this purpose, the large plant heretofore necessary for a large production, is not required, nor are expensive blast engines or high pressure of the blast necessary, as the lesser height of the stack permits a corresponding diminution in the pressure of blast for circulation through the same.

As a consequence, much less capital is necessary for buildings, less powerful engines for blast and elevator, and less waste of fuel at the tunnel head. That there is a great saving in fuel, is apparent from the fact that a great deal of the work of the blast furnace is done away with by the reduction furnace, and as none of the injurious substances can enter into combination with the iron, a pure and excellent metal must be the result.

The smelting of the previously prepared ore in my reduction furnace, is only a kind of cupola work on a large scale, *as it is only necessary to separate the cast iron from the slag.* The work is, therefore, very simple and not subject to the disturbances of the ordinary blast furnace.

The consumption of charcoal is 40—50 per cent. less than by the ordinary methods, and with coke and anthracite the proportion is the same. *The greatest advantage of my method is the extra quality of the product.*

BAR AND PLATE IRON.

The manufacture of bar and plate iron will lose much of its importance, when

a cheap cast steel comes into general use. The inquiry for bar iron will be much reduced when railroad bar, boiler plate, and articles of machinery and building, which require a great strength, together with a low price, can be replaced by steel.

The production of bar and plate will receive a great impetus in those regions or districts, where they can be made by my method directly from the ores. In general, more attention will be given to the quality of the ores than to that of the fuel, particularly coals, when it is seen that the uniform quality and price of the metal is little disturbed by the quality or quantity of fuel, and that wood or peat can easily be obtained for an extended work.

In the production of bar and plate iron, I use the gas as fuel entirely, having had many opportunities in the works which I have built and managed, to prove its great advantages. Only by the use of it can wood, peat and lignites, be used upon a large scale with the same pecuniary result as with hard coals, obtaining at the same time an excellent product with certainty and also a perfect freedom from smoke.

I use a furnace, the construction of which is determined according to whether I am to make bar or plate, directly from the ores or from pig iron. The manufacture of bar or plate directly from the rich ores, is a matter of the greatest importance in many of the States, as there are many places where such ores can be obtained, but often so distant from coals, that at present they have but little value, viz: many of the leaner and sand ores of Michigan, which can be worked there to great advantage with the wood of the neighborhood. Plate iron made in that region, could soon take the place of the famous Russian sheet iron, as it could be made there at a very reasonable price.

BAR IRON FROM PIG.

The construction of my furnace for puddling and re-heating combined has been so perfected by the experience of years that an improvement upon it seems hardly possible. *It is much simpler in its construction than any others of its kind, cheaper to build, easier to manage, requires less repairs and works with greater certainty and better results, using less fuel than any other.* A boiler is heated by the escaping gases of both the puddling and heating furnace. The tubular boiler is of a peculiar construction, requires but little space, is not likely to explode, and produces steam of high pressure. With but little addition of fuel, one of these boilers has supplied steam under a pressure of 5 atmospheres for an engine of 48 horse power.

The results of working my furnaces have been very favorable. The average loss in 8 furnaces in puddling a gray iron was only 5 5-8 per cent., and in the heating furnaces 15—17 per cent. For the production of one ton of bar iron from pig, 1¼ cords of wood are required, and a corresponding amount of coal or peat.

PRODUCTION OF BAR OR PLATE DIRECTLY FROM THE ORES.

Where rich and not too quartzose ores can be obtained, the manufacture of bar iron directly from them, without first producing pig iron, can be carried on with great pecuniary advantage. As already remarked, such ores occur in the greatest abundance in the United States, and as I can use any quality of fuel, wood, peat and lignites, which may be obtained in the neighborhood, may be used for the working of them. The production of bar iron directly, is done in the following manner. If the ores are massive, that is, not in the shape of sand, they are first roasted in my patented kilns; no other manner of roasting will give equally good results. After this, they are broken to the size of peas, and put into a peculiarly constructed reduction furnace, where they are reduced, but not carbonized.

The sand ores of Michigan do not require the preliminary roasting, but are placed immediately in the reduction furnace.

These reduced ores are balled in a puddling furnace, constructed for this particular purpose, and then put under a hammer or other suitable machinery, and then made into rough bar. The blooms or rough bars, are next reheated in a gas heating furnace and again hammered or rolled.

The iron so obtained has all the good qualities of that produced in the old catalonian forge; it is, moreover, thoroughly uniform, and is therefore of the very best sort. It is particularly suited to the manufacture of plate, which will be as good as the Russian sheet. I know the Russian sheet well, because I have made it in Russia.

In order to show the great advantage of making the iron direct from the ores, I give below the cost, from my own experience, for the manufacturing of bar and plate in Michigan (the proper allowance being made in prices of labor, &c.) from the sand ores, and using wood as fuel:

A.—BAR IRON MANUFACTURING.

Reduction of the Ores.

3000 lb. sand ores, @ ton $5 00	$7 50
27 cb. ft. of small wood @ $4 16 per cord, or 3¼ cts. per cb. ft.	88
Wages and all contingencies	2 50
	$10 88

Rough bar from the reduced Ore.

In puddling, 800 lb. of ore will produce 600 lb. loups: therefore, 2666 lb. of reduced ore is required for one ton (2000 lb.) of rough bar.

2666 lb. reduced ore @ $10 88 per ton	$13 50
100 cb. ft wood @ 3¼ cts. per cb. ft	3 25
Labor	5 00
Contingencies	3 50
	$25 25

Bar Iron from the above Rough Bar.

2352 lb. rough bar, @ $25 25 per ton	$29 69
70 cb. ft. wood	2 27
Labor	4 50
Contingencies	4 00
	$40 46

B.—PLATE IRON MANUFACTURING.

Making of Blooms from Loups or Rough Bar.

2352 lb. loups, @ $25 25 per ton	$29 69
70 cb. ft. wood	2 27
Labor	2 80
Contingencies	2 50
	$37 26

Making of One Ton Plate from Blooms.

2632 lb. blooms, @ $37 26 per ton	$49 03
70 cb. ft wood	2 27
Labor	4 20
Contingencies	3 00
	$58 50
Less the value of 320 lb. waste, @ $25 per ton	4 00
	$54 50

or 2¾ cents per lb.

The price of Russian sheet here per lb is 15@20 cents. This price renders it unnecessary for me to say anything more of the value of my process.

The production of puddle steel directly from the ore is also an easy matter, as it is only necessary to use the required amount of gas during the boiling. A cheap cast-steel would, however, render useless a puddle steel.

TO BE CONTINUED.

Engineering and Mechanical Notes.

The exact figures taken from the Silver Islet mine, Lake Superior, are interesting. They are as follows, the metal all being in silver bars, as fine as the Government standard, and deposited in the United States office in New York City:

From December 15, 1870, to April 3, 1872	532,846 47-100 oz.
From June 4, 1872, to January 27, 1873	324,607 6-100 oz.
Total	857,453 53-100 oz.

Great fires are by no means confined to America. On the contrary, Germany is at least as frequent a sufferer as the more reckless citizens of the United States. Houses in the old and small towns are so huddled together that when one takes fire the conflagration can hardly be prevented from becoming general. The latest disaster of this kind attacked the mining and manufacturing town of Joachimsthal, in the northern part of Bohemia, close to the Saxon frontier. Out of five hundred and eighty-six houses in the city, four hundred and fifty were completely burned, and five hundred persons made homeless. A magnificent church, founded in the early days of the Reformation, fell a prey to the flames, as did also valuable paintings by LUCAS CRANACH and ALBERT DÜRER. Joachimsthal is well known to mining men as the place where Von PATERA's method of treating gold ores was carried out. The town has of late years lost some of its former importance, from the fact that it has been found cheaper to treat its ores at Freiberg than at home. Its loss will be a severe blow to the mountain region in which it lies.

A discussion on the limits to the expansion of steam took place at a late meeting of the Manchester (Eng.) Scientific society, Mr. M'Knaught, engineer, of Rochdale, said he had long since come to the conclusion that it was possible for the expansion of steam to be carried too far. When they had expanded steam to six times its volume, they had got all out of it that would do them any good. He contended that there was no economy beyond this point, simply because the back pressure then not only lost its value, but operated against any economical result. If they wanted to get more expansion, they must enlarge their piston, and that would increase the prejudicial operation of the back pressure. Some members expressed a doubt as to the correctness of Mr. M'Knaught's theory, but it was thought to be a matter well worth careful consideration.

Messrs. LOWTHIAN BELL & EDWARD WILLIAMS, are referees in the novel but important question "what is scrap?" This was mooted in a suit for the recovery of $10,000 damages for the non-delivery of scrap and the decision is one that cannot fail to have importance to iron men. Easy as it is to carry general notions of the word "scrap," it by no means follows that to give the term an exact definition is a trifling task.

Chicago is building a new tunnel to supplement the one which made such an innovation in the system of water works in the Lake cities. The growth of the city taxed that construction to nearly its utmost capacity, which is 54,000,000 gallons a day. A new tunnel is accordingly under way, and has been advanced 2,000 feet under the Lake. The first tunnel was nearly circular with diameters of 5 ft. 2 in. and 5 ft., and the one now in progress is also nearly round, having diameters of 7 ft. 2 in. and 7 ft. Its capacity will be nearly 100,000,000 gallons a day. It is to be extended under the city a distance of three and five-sixths miles to the corner of Ashland and Blue Island avenues. Under the Lake it runs parallel to the old work and about fifty feet distant and will be fed by the same crib. Nine shafts will connect the land tunnel with the upper air. These works will place Chicago in a really enviable condition, as to water supply. Their cost will be about one million.

THE COAL TRADE.

NEW YORK, May 15, 1873.

One point has been definitely decided this week, and that is that the monthly advance is to come on the first of June with all its charming regularity. The Reading Company, we believe, will still sell its stock on hand at May prices, but when the sun rises, two weeks from next Monday, it will rise on "the usual advance." That company is understood to be selling its coal with more freedom, and perhaps the bold front it presents will carry off its stock faster. The combination has just one fact to sustain it, and that is that, even at present rates, its coal is offered at a lower price than the average of seven consecutive years. Since we wrote last week, the impression seems to have gained ground that the combination can hold to its schedule. We think it can do so easily, but we have not changed the opinion expressed last week, that the true course is to let the May rates run on through June. The coals of other companies continue to go off with ease.

Bituminous.

Business in the soft coal trade is still very dull, a circumstance that is attributed to the prevailing slackness in manufacturing business. New England factories are reported very quiet, indeed, and the season would be a hard one were it not for the activity in some special trades. Prices are quoted at $5 in Baltimore, and $4 60 in Georgetown. It has been a point of considerable moment to know whether the steady rise in the rates for anthracite would effect the soft coal trade. So far as we can learn there is a probability that an addition to the rates will be made within two months, and it is whether the demand continues dull or not.

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 May 10, 1873, compared with the week ending May 11, 1872.

COMPANIES.	1872. WEEK.	1872. TOTAL.	1873. WEEK.	1873. TOTAL.
*Phila & Reading R. R't..	85 252	1.511,656	89,635	1.737.342
*Schuylkill Canal	16 642	177,927	25.104	118.274
*Lehigh Valley R. R. ..	49.893	1,272.689	52.124	1,265,763
Lehigh & Sna. R. R.	37,217	554,036	39.649	674 452
" " Canal	23.421	99 522	26.042	82 088
Scranton North.	11,053	215.160	13,509	231.912
" South	45,657	765.805	55,571	791,859
Penn. Coal Co., rail.....	28,047	396,725	29,2 5	342,460
" " " canal....	239	595	119	1 506
Del. & Hnd. C. Co. Canal	52,668	171.209	44.471	165.608
" " East...	14,078	216.968	9 664	137.662
" " West	7,653	118 356	9,547	151 884
" " South	6,716	123,312	5.628	114,932
Shamokin.....	9,789	153 932	12,903	179,819
Tiezorton.....	....	....	....	....
Lykens Valley Coal Co.	....	....	....	....
Wyoming North.....	....	....	....	....
Wyoming South.....	....	....	....	....
P. N. Y. C. & R. R. Co..	12,433	236,242	14,243	254,283
Williamstown Co'y.....	....	.....	....	....
Big Lick Col	....	.....	....	....
Total..	400,573	6,013,998	437,547	6.252,814
1872.....			400,573	6.013,998
Increase			36,974	238,016
Decrease.....				

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 May 10, 1873, compared with week ending May 12, 1872.

COMPANIES.	1872. Week.	1872. Year.	1873 Week.	1873 Year.
C. & O. Canal.....	15,602	136,857	20,909	112 099
B. & O. R. R.....	29,134	414.705	27,347	474.29 1
Penn. S. Line.....	....	.....	957	35,009
H. & C. L. R. R.....	6,878	94 819	9,752	163,171
*Harrisburg & D	9,231	193,980	6,815	131,927
*L. V. R. R....	....	12,218	651	11,852
P. & N.Y.C. & R. Co.....	5,254	140.112	6,468	119,292
Cumberl'd Branch Canal	5,989	45,292	2 292	20,201
" Railroad....	884	4,532	3,315	39,047
Total.....	76,032	1,039,515	78,506	1,106,888
	....		76,032	1,039,515
Decrease.....	....			
Increase			2,474	67,373

Delaware and Hudson Canal Company.

Coal mined and forwarded by the Delaware and Hudson Canal Company for the week ending Saturday, May 10, 1873.

	WEEK.	SEASON.
By Delaware and Hudson Canal.....41,471		165,608
By Railroad, East.....	9,662	137 662
" West.....	9,597	151 884
" South	5,628	114,932
Total 1873 69,356		570,086
Corresponding time in 1872 :		
By Delaware and Hudson Canal.....52.668		171.269
By Railroad, East.....14 078		216,966
" West.....	7,658	118 356
" South.....	6,716	123,312
Total.....81,120		629,843
Decrease.....	59.757	

Philadelphia & Reading Railroad and Branches.

COAL TONNAGE

For the Week ending Saturday, May 10, 1873.

BY RAILROAD.—ANTHRACITE.

PASSING OVER MAIN LINE AND LEB. VAL. BRANCH.

	Tons. Cwt
From St. Clair.	22.555 03
" Port Carbon.	3 887 04
" Pottsville.	1.837 03
" Schuylkill Haven.	22.03 08
" Pine Grove.	3,893 02
" Tamaqua.	9,845 08
" Harrisburg.	20 13
" Dauphin.	5 9.3 18
Total	70,000 19

FOR SHIPMENT BY CANAL.

Passing Frackville Scales	9,882 00
" Mill Creek "	2,084 07
" Schuylkill Valley Scales	1 254 15
" Mt. Carbon "	1 572 13
" Cressona "	10,051 08
" Pine Grove "	.....
" Tamaqua "	1,488 17
Total	26,284 19

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

Via Catawissa & Williamsport Br.	100 01
" N. C. R. R. passing Locust Gap.	1,992 06
" " " Shamokin.	5,247 03
" " " Herndon.	....
Total	7,339 10

SHIPPED WEST OR SOUTH FROM PINE GROVE.

Via Schuylkill & Susquehanna R. R.	654 18
" Lebanon & Pine Grove Branch	605 13
Total	1,260 11

CONSUMED ON LATERALS.

From Frackville Scales.	536 06
" Mill Creek "	498 09
" Schuylkill Valley Scales.	1,064 10
" Mt. Carbon "	467 18
" Cressona "	371 00
" Pine Grove "	32 15
" Tamaqua "	520 09
Total	3,481 07

LEHIGH AND WYOMING COAL.

Received via Silverbrook Junction,	Sent East	6,030 15
Cat. & Wpt. Br.	Sent West	32 00
" " Rupert, Cat. & Wpt. Br.		....
" " Allentown, E. Penn'a Br.		81 06
" " Alburtis, " "		....
" " Oreland, G. & N. Br.		904 04
" " Willow Street R. R.		474 18
Total		7,553 03

BITUMINOUS.

From Harrisburg.	6,735 02
" Connecting R. R., G. & N. Br.	
" Junction R. R.	80 00
Total	6,815 02

COAL FOR COMPANY'S USE.

Anthracite	5,211 03
Bituminous	244 11
Total.	5,455 14

RECAPITULATION.

	Total for Week.	Corres'p'g week last year.	Increase and Decrease.
Passing over Main Line and Leh. Val. Branch	70,000 19	75,019 12	d 5,018 13
For Shipment by Canal	26,284 19	22,863 19	i 3,421 00
Shipped Westward via Northern Central R. R.	7,339 10	5,539 15	i 1,799 15
Shipped West or South from Pine Grove	1,260 11	1,702 05	d 441 14
Consumed on Laterals	3,481 07	2,012 00	i 1,469 07
Lehigh and Wyoming Coal	7,553 03	988 05	i 6,561 18
Total Anthracite paying freig't	115,920 09	102,125 16	i 7,794 13
Bituminous	6,815 02	9,230 19	d 2,415 17
Total of all kinds paying freig't	122,735 11	117,356 15	i 5,378 16
Coal for Company's use	5,455 14	4 527 04	i 928 10
Total Tonnage for Week	128,190 05	121,881 19	i 6,307 06
Previously this year	2077598 02	1972196 15	i 105.201 07
Total to date	2205789 07	2.94289 14	i 111,508 13

SHIPPED BY CANAL.

From Schuylkill Haven	23,218 10	18,829 00	i 4,389 10
" Port Clinton	1,866 00	1.912 00	i 74 00
Total Tonnage per Week	25,104 10	20,641 00	i 4.463 10
Previous y this year	93,169 10	161.281 19	d 68,115 09
Total to date	118,274 00	181,9.5 19	d 63,651 19

Delaware and Hudson Canal Company.

Coal mined and forwarded by the Delaware and Hudson Canal Company for the week ending Saturday, May 10, 1873.

	WEEK.	SEASON
North	57,514 15	957,483 01
South	5 627 16	114,931 12
Total 1873	63,142 11	972,414 13
Corresponding time in 1872 :		
North	51,624 12	855.115 11
South	6,716 04	123,312 06
Total, 1872	58,340 16	1,008,427 17
Increase North		
Decrease North		
Increase South		
Decrease South		
Increase	4,801 15	.....
Decrease	.....	36,013 04

Report of Coal Transported over the Lehigh Canal

For the week ending May 9, 1873

REGIONS SHIPPED FROM	TIDE tons. cwt.	LOCAL tons. ct.	TL WEEK tons cwt	TL. DATE. tons, cwt.
Mauch Chunk Region.	5 093 11	3,315 02	8,438 13	26,847 08
Mauch Chunk Region Hazardville				
Beaver Meadow Region	594 05	3,463 04	4,062 09	9,005 02
Mahanoy Region	95 07	378 02	473 09	1,212 15
Hazleton Region	2,005 05	5 959 00	7,964 05	24,514 12
Upper Lehigh Region		837 01	837 01	3,807 18
Wyoming Region	2,477 16	1,769 03	4 246 19	16,104 00
Wyoming Region, Hazardville				
Total.	10.266 04	15,773 12	26,042 16	82,087 15
Previously reported	24,824 16	31,.20 03	56.044 9	
Total to date	35,091 00	48,996 15	82,087 15	
Corresponding week last year	37,251 03	62,270 18	99.522 01	
Increase.				
Decrease	2,160 03	15 274 03	17,434 06	

DISTRIBUTION.	WEEK 1873.	WEEK 1872.	YEAR. 1873.	YEAR. 1872.
Consumed on line of Lehigh Canal	2,041 15	2,745 16	7,128 15	10,842 03
Passed into Morris Canal to Tidal Points	192 18	127 04	192 18	293 13
Passed into Morris Canal to Local Points	927 09	862 02	3,433 15	2,784 03
Passed into Del. & Rar. Canal to Tidal Points.	10,073 06	9,027 07	32,762 09	36,837 16
Passed into Del & Rar. Canal to Local Points	756 06	739 10	1,703 12	2,109 09
Consumed on line Delaware Div. Canal	1 758 13	1,605 13	4,110 02	6,138 08
Passed through to Bristol	10.294 03	8,313 07	32,734 04	29,396 15
	26,042 16	23,420 .9	83.067 15	99 522 01

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

Week ending May 13—Compared with same time last year.

REGION SHIPPED FROM.	TIDE. tons ct.	LOCAL. tons ct.	CANAL. tons ct	TL WEEK tons cwt.	TL DATE tons cwt.
Wyoming	28107 12	12519 14	2930 18	43458 04	616077 16
Upper Lehigh	1841 07	2904 18	611 17	3516 05	70911 08
Beaver Meadow		1066 12	2305 05	5513 01	96144 10
Hazleton		311 15	7947 17	8259 12	92241 16
Mauch Chunk	332 07	3811 10	7721 19	11885 16	139290 13
Total	30281 06	21264 19	2 087 16	72634 01	941689 03
Prev'ly reported	43 561 16	172960 19	59532 07	869955 02	
Total to date	466243 02	191225 18	60620 03	941689 01	
Same time 1872	387967 04	366800 09	57063 14	711831 07	
Increase	78875 18	1.7425 09	2356 09	229857 16	
Decrease					

DISTRIBUTION.	WEEK 1873.	WEEK 1872.	YEAR 1873	YEAR 1872.
Forwarded East by Rail to Tidal points	30280 16	27677 16	466842 12	387967 04
Forwarded East by Rail to Local points	7791 11	7570 15	170841 00	124489 03
Forwarded East by Rail nse central Divisinn	1401 00	1372 19	31951 19	27320 18
Forwarded East by Rail use L. & S.	176 03	193 03	4816 10	3362 16
Delivered at and above Mauch Chunk	1412 01	980 03	29544 15	19414 04
Deliver d at Coalport & Hazard for Canal	21278 08	13071 18	108234 02	71292 01
Delivered to L. V. R. R. at Packerton	338 17	376 13	12559 04	8736 16
Delivered to L. V. R. Rd at Sugar Notch	3063 09		34141 03	
Delivered to L. & B. R. R.at Plymouth Bridge	5991 16	4130 05	85707 18	72229 02
Total	72634 01	55355 12	941689 03	711831 07

Penn. and P. Y. R. R.—Coxton, Pa.

Coal tonnage for week ending May 10. 1873.

	Week. Tons. Cwt.	Total. Tons. Cwt.
Anthracite received :		
From Lehigh Valley R. R.	9,936 14	156,635 01
" Lack. & B. R. R.	258 07	13,530 17
" Pleasant Valley R. R.	3,083 01	70,061 13
" Sul. & Erie R. R.	914 10	14,055 15
Total	14,247 12	254 283 06
Same time last year	12,432 13	238,242 17
Increase	1,814 19	18,040 09
Decrease		
Distributed :		
To Lehigh Valley R. R.	902 00	20,495 07
To Lack. & B. R. R.	29 05	472 10
To S. Central R. R.	4,443 15	51,931 18
To Ithaca & A. R. R.	1,359 01	37,794 13
To Erie R. W. Pockets for shipm't.	5,347 05	86,639 18
To individuals on line of road....	424 03	16,319 03
To points at & above Coxton for use of Co.	707 09	12,165 08
To points between Waverley and Elmira	1, 35 14	28,444 00
Total	14 247 12	254,283 06
Bituminous received from BARCLAY R. R.		
Shipped north from Towanda	6,592 03	118.509 13
Shipped south from Towanda	75 10	782 13
Northern Central R. R.	....	.....
Total.	6,467 13	119 292 06
Same time last year	5,254 03	140,112 00
Increase	1,213 10	
Decrease	.....	20,819 14
Distributed :		
To Erie Railway	5,930 08	101,446 19
To So. Central R. R	461 15	16,910 08
To Ithaca Valley R. R.	....	117 09
Lehigh Valley, R. R.	70 10	422 14
To individuals on line of Railroad.	5 00	276 12
To points on line of road for use of Company	....	118 04
Total	6,467 13	119,292 0
Grand totals transported		
Anthracite	14,247 12	254,283 06
Bituminous	6,467 13	119,292 06
Total	20,715 05	373,575 12
Same time last year	17,686 16	276,364 17
Increase	3,028 09	
Decrease	.....	2,779

Report of Coal Transported over Lehigh Valley Railroad

Report of coal tonnage for the week ending May 10, 1873, with totals to date, compared with same time last year.

WHERE SHIPPED FROM.	WEEK. Tons. Cwt.	TOTAL Tons. Cwt.
Total Wyoming	25 402 17	328,308 06
" Hazleton	47,683 15	791,727 01
" Upper Lehigh	27 12	1,809 18
" Beaver Meadow	12,576 14	262,009 02
" Mahanoy	7,492 05	163,753 10
" Mauch Chunk	136 06	1,903 00
Total	93,.0) 09	1,549,510 16
Same time last year	71,9.4 17	1,524,098 09
Increase	21,404 12	25,412 07
Decrease	.....	.....
Forwarded East from Mauch Chunk by rail	62,123 15	1,2-5,733 03
Same time last year	49,692 16	1,272,628 13
Increase	12,430 19	6.955 07
Decrease	.....	

DISTRIBUTED AS FOLLOWS.

Forwarded East from Mauch Chunk by rail	61 001 17	1,211,176 16
do East for use L. V. R. R	1,118 18	24,5.6 13
Delivered at and above Mauch Chunk for use of L. V. R. R	1,132 10	30,597 17
To P. & N. Y. R. R	9,946 14	156,635 01
To North rn Central R. R	374 10	4,946 11
To D. H. & W. R. R	211 15	15,185 06
To L. & S. R. R. at Packerton for rail	151 07	5,787 10
Delivered at M'h Chunk	21 08	1,546 12
Delivered on line of road above Mauch Chunk	315 00	7,534 04
To L. & S. R. R., at Penn Hav., for railroad		1,541 10
Do. for canal	7,964 15	24,510 12
To Lehigh Canal Mauch Chunk	2,563 13	6,163 15
To Catawissa Railroad	...	40 00
To L. & B. R. R. at Lack. Junc	8,575 12	29,389 02
Total	93,309 09	1,549,510 16

Schuylkill Canal.

Report of coal transported over the Schuylkill Canal for the week ending Saturday, Mai 3, 1873.

	Tons. Cwt.
From Schuylkill Haven	20,576 00
" Port Clinton]	964 00
Total for week	21,.29 00
Previously this year	71,840 10
Total	93,169 20
To same time last year	153,181 09

Statement of Coal Transported over Cumberland and Pennsylvania Railroad

During the week ending Saturday May 10. 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	20,908 14	27,.16 15	957 16	49.212 15
1872	18,662 07	29 133 17	....	47,793 04
Increase	2,246 07	.....	957 06	1,416 11
Decrease	...	1,787 12	....	....

YEAR.

1873	112,099 03	474,290 12	35,009 07	6.1,39. 12
1872	136,.57 08	4.4,505 01	....	561,562 09
Increase		59,585 01	35,009 07	69,836 03
Decrease	24,758 05	....	....	....

Cumberland Branch R. R.

WEEK.

	To C. & O. Canal. Tons. Cwt.	To P. & O. R. R. Co Tons. Cwt.	Total. Tons. Cwt.
1873	2,791 16	3,314 13	5.6.6 09
1872	5,9.9 00	883 12	6,872 12
Increase	—	2 431 01	.....
Decrease	3,697 04	.....	1,266 03

YEAR.

1873	20,.00 13	39 046 19	59,247 12
1872	45,291 16	4,531 14	49,8.3 13
Increase		34,515 05	9,424 02
Decrease	25,091 01		

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 May 10, 1873.

	Tons.	Cwt.
East	658 15	
West	12,244 14	
		12 903 09
Same time last year		9,788 19
Increase		3,114 10
Decrease		.....
Total amount shipped to date		179,819 07
Same time last year		153,931 13
Increase		25,887 14
Decrease		.....

Pennsylvania Coal Company.

Shipments of Pittston Coal for the week ending May 10, 1873.

	1873. WEEK.	1873. YEAR.	1872. WEEK.	1872. YEAR.
By Railway	29,281 12	312,459 19	28,046 11	396,721 10
" Canal	1.9 04	1.5.5 11	239 09	595 00
	29,403 16	343,965 10	28,286 00	397,316 10
Decrease 1873	53,351 00			

Delaware Lackawanna & Western Rail Road Company.

Coal transported on the Delaware, Lackawanna, & Western Railroad for the week ending Saturday, May 10, 1873.

	WEEK. Tons. Cwt.	YEAR. Tons. Cwt.
Shipped North	13,509 03	231,911 17
Shipped South	55 571 03	794,858 12
Total	69,0:0 11	1,026,770 09
For the Corresponding time last Year:		
Shipped North	11,052 14	215 060 10
Shipped South	45,636 16	765,805 05
Total	56,709 10	986,865 15
Increase	12,371 01	45,904 14
Decrease	.....	.....

Prices of Coal by the Cargo.

(CORRECTED WEEKLY.)

	AT NEW YORK. May 15. R. A.	W. A.	AT PHILADELPHIA. May 15. R. A.	W. A.
SCHUYLKILL.				
Lump	$- —	$5 45	- —	4 10
Steamer	- —	5 45	- —	4 10
Broken	5 71	5 45	4 35	4 10
Egg	5 85	5 60	4 50	4 25
Stove	6 15	5 75	4 70	4 40
Chestnut	5 20	5 95	5 85	3 69
Pea	- —	- —	- —	- —
LEHIGH.				
Freight to New York 50 cents.				
Lump, (on board)	- —	5 35	- —	- —
Broken	- —	5 30	- —	- —
Egg	- —	5 30	- —	- —
Stove	- —	5 60	- —	- —
Chestnut	- —	4 25	- —	- —
Pea	- —	- —		
SPECIAL COALS*.				
Honey Brook, Le'h W. A.	4 70@5 60		- —	- —
Spring Mountain " "	- —@—		- —	- —
Sugar Loaf " "	- —@—		- —	- —
Room Run " "	4 70@5 60		- —	- —
Hill & Harris " "	4 70@5 60		- —	- —
Shamokin " "	4 70@5 10		- —	- —
Lykens Valley " "	4 85@6 10		- —	- —
Broad Top " "	6 60@- 10		5 35	- —

Company Coals.

May, 1873.

	L.	Str.	Grs.	Egg.	Sto.	Chest
*Scranton at E. Port	4 35	4 35	4 55	4 75	5 60	4 35
Pittston at Weehawken	4 80	4 80	4 80	5 00	5 50	4 70
*Lackawana at Weehawken	4 70	4 70	4 90	5 15	5 60	4 70
Wilk'b're at Hoboken	4 55	4 75	4 90	5 10	5 45	4 55
Old Co. Lehigh at Pt. John'n	5 60	—	5 35	5 35	5 50	4 70
New York Coal Exchange	5 35	—	5 20	5 20	5 35	4 65

For freights to different points see "Freights"

*To contractors only.

Prices at Baltimore—May, 1873.

Wholesale Prices to Trade.

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

* Freight to New York $2 15.

BITUMINOUS COALS.

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

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

May, 1873.

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

Prices at Havre de Grace, Md.

May, 1873.

Wilkesbarre and other White Ash for Cargoes	$ @....
Lykens Valley	@....
Shamokin Red or White Ash	....

Bituminous Coals (Cumberland).

Georgetown, f. o. b.	$4 60
Baltimore "	5 00
New York "	7 25
South Amboy "	6 75

Prices of Foreign Coals.

May, 1873.

Duty 75 c. per ton.

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

Liverpool Gas Caking	— —@— —
" " Cannel	17 00@— —
" House "	22 00@23 00
" Orrel	19 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.

May, 1873.

PROVINCIAL.

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

	Coarse	Slack.
Rock House	$2 50	$1 00
Gowrie	2 50	0 00

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

	Coarse	Culm of Coal.
Picton	nett $2 50	1 50
Sydney	2 50	1 00
Lingan	2 00	1 00
Caledonia	2 00	1 00

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

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

Foreign and Provincial Freight

May, 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 50
Lingan	3 50
Cow Bay	3 50
Port Caledonia	3 50
Little Glace Bay	3 50

TO BOSTON.

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

Freights.—May, 1873.

TO EASTERN PORTS.	Cumberland. From Georgetown.	Cumberland. From Baltimore	Anthracite. From Philadel'a.	Anthracite. From Pt. Port, Port Johnson, and Hoboken.	Anthracite. From Newburgh.	Anthracite. From Rondout.
Amesbury	3 75	— —		— —	— —	— —
Bangor	3 25	3 50		2 00	— —	— —
Bath	2 87	3 00		2 25	— —	— —
Boston	— —	3 00		2 15	2 25	2 40
Bridgeport	2 45	3 00		1 00	1 20	1 20
Bristol	— —	— —		1 40	1 60	1 70
Cohasset Nar'ows	3 00	— —		— —	— —	— —
Derby	3 25	— —		1 25	— —	— —
Dighton	2 65	— —		— —	— —	— —
East Cambridge	2 75	2 75		2 15	2 25	— —
Fall River	2 60	2 75		1 40	1 60	— —
Hackensack	— —	3 00		— —	— —	1 75
Hartford	— —	3 25		1 50	— —	65
Hoboken	2 10	— —		50	— —	65
Jersey City	2 10	— —		50	— —	— —
Lynn	— —	— —		— —	— —	— —
Middletown	— —	— —		1 25	— —	1 70
Mystic	— —	— —		1 25	— —	2 55
New Bedford	2 65	3 00		1 40	— —	1 50
Newburyport	— —	3 00		2 30	— —	1 45
New Haven	2 50	2 65		1 00	1 20	1 70
New London	2 55	2 60		1 25	1 40	65
Newport	— —	2 65		1 40	1 60	1 20
New York	2 50	2 15		50	— —	1 55
Norwalk	2 75	2 75		1 00	1 20	1 75
Norwich	2 65	2 75		1 35	1 50	— —
Pawtucket	3 00	3 00		1 50	— —	— —
Portland	3 87	3 00		2 00	— —	1 70*
Portsmouth, N. H	3 10	3 00		2 25	— —	— —
Providence	2 50	2 7		1 40	1 60	— —
Rockport	— —	— —		— —	— —	— —
Saco	— —	— —		— —	— —	— —
Sag Harbor	— —	— —		1 25	— —	1 20
Salem	— —	3 00		2 15	— —	1 45
Stamford	— —	— —		1 00	1 20	— —
Stonington	— —	— —		1 25	— —	— —
Taunton	— —	— —		1 90	— —	— —
Warren	— —	— —		1 40	— —	— —
TO RIVER PORTS						
Albany	— —	— —				
Catskill	— —	— —				
Cockaskie	— —	— —				
Coeyman's	— —	— —				
Cold Spring	— —	— —				
Fishkill	— —	— —				
Haverstraw	— —	— —				
Hudson	2 50	— —				
New York vessels	2 00	— —				
Nyack	— —	— —				
Poughkeepsie	— —	— —				
Rhinebeck	— —	— —				
Rondout	— —	— —				
Saugerties	— —	— —				
Sing Sing	— —	— —				
Stuyvesaut	— —	— —				
Tarrytown	— —	— —				
Troy	— —	— —				
West Point	— —	— —				
Yonkers	— —	— —				

* And Towing.

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

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., 2c., 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	66
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	00
Total	$2 23

TO SOUTH AMBOY.

L. V. R. R.	72
B. & D. R. R.	1
Cam. & Am. R. R.	
Shipping Expenses	35
Total	$2 23

PENN HAVEN TO ELIZABETHPORT.

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

MARKET REVIEW.

NEW YORK, May 15, 1873.

IRON—The business is confined almost entirely to small parcels for immediate wants of consumers. The expectation of an active trade at the opening of navigation has not been realized, and the market has a dull and weak tone; the only sale we hear of is 150 tons Carnbro, reported at about $47.50@$48. American Pig is quiet, but there is no quotable change in prices. The same may be said of old and new English Rails. Scrap is quiet; we understand that 500 tons were sold, but the particulars we did not learn. Bar continues weak at our quotations, for lots as wanted from store, for consumption.

LEAD—Pig is in moderate demand and is firm; sales have been made of fifty tons Spanish at $6.75; 50 do., $6.72½, time and interest; and 75 do. American, Selby,

from wharf, $6.35, all gold. Bar 9¼ cents, Sheet and Pipe 10½, and Tin-lined Pipe 16½, all less 10 per cent to the Trade.

COPPER—The manufactures of Copper and Yellow Metal are steady at our quoted rates. For Ingot there is very little inquiry; receipts from the Lake region are expected within three or four weeks, and buyers hold off meanwhile. We have only to note small sales of Lake at 32½ cents, cash, and of English 30½, 30 days.

Withdrawals from bond for consumption 9th, 10th and 12th May—

Copper, Liverpool.....casks.971
Copper, Liverpool.....bars 147

SPELTER—Is dull, and we only to note small sales Silesian at 7⅞@7¾ cents gold. Domestic 10 cents currency.

Withdrawals from bond for consumption 9th, 10th and 12th May—

Spelter, Germany.....pigs

STEEL—There is no point of interest to note except that the stock continues light, though the supply has been slightly augmented, and prices are firm.

REGULUS ANTIMONY—Is quoted nominally 14½ cents gold.

TIN—Pig is still dull, and prices are irregular, the tendency continuing in buyers' favor; 100 slabs Straits sold at 31⅞ cents, and 200 do. 32@32¼; English L. & F. nominally 31⅞@31½, 30 days; and Banca 37½, all gold. Plates remain quiet, but prices are without further change; we note sales of 500 bxs. Charcoal Tin at $11.87½ for I. C.: 250 do. Coke Tin, 10 by 15, $10.12½; and 500 do. Charcoal Terne $10.50, ll gold.

ZINC—Sheet is steady but quiet at our quotations—10 casks Mosselman, sold by a dealer, at 9 cents net gold. Manganese black oxide 3½ cents, peroxide gray 5½ cents

METALS.

NEW YORK, May 16, 1873.

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

	Store Prices.
Pig, Scotch—Coltness ₱ ton	58 00@62 00
Gartsherrie	57 00@58 00
Glengarnock	50 00@51 00
Eglinton	48 00@49 00
Pig, American, No. 1	49 00@50 00
Pig, American, No. 2	46 00@47 00
Pig, American, Forge	40 00@42 00
Bar Refined, English and American	110 00@— —
Bar Swedes, assorted sizes gold	131 50@142 50
	Store Prices, Cash.
Bar, Swedes, 1¼ to 5 x ½ & ⅝ 2 sq. & 6 to 12 x ⅜ & ½	150 00@160 00
Bar, Refined, ¾ to 2 in. rd. & sq. 1 to 6 in. x ⅛ to 1 in.	— —@100 00
Bar, Refined, 1½ to 6 by ¼	— —@105 00
Bar, Refined, 2½ to 2⅞ round 1 & 1½ by ¼ & 5:16	— —@107 50
Large Rounds	110 00@120 00
Scroll	120 00@165 00
Ovals and half-round	125 00@145 00
Band	— —@117 50
Horse Shoe	105 00@125 00
Rods, ⅜ to 3-16inch	150 00@150 00
Hoop	150 00@172 50
Nailrod	9¼@ 9¾
Sheet, Russia, as to assortment (gold)	16 @ 17
Sheet, Singles, D. and T. Common	—6¼@— 7¼
Sheet, D. and T. Charcoal	—7¼@— 8½
Sheet, Galv'd, list 10 per cent, discount	—@— —
Rails, English (gold), ₱ ton	70 00@— —
Rails, American, at Works in Pennsylvania, currency	80 00@ 82 50

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

	All Cash.
Copper, New Sheathing, ₱ lb	— @— 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.	— @— 32½
Copper, American Ingot	30 @— 30½
Copper English Pig	— @— 30½
Yellow Metal, New Sheathing & Bronze	— @— 27
Yellow Metal Bolts	— @— 32
Yellow Metal Nails, Sheathing and Slat'g	27 @— 30

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

Galena, ₱ 100 lbs	$— —	@— —
Spanish (gold)	6 75	@6 87½
German, do.	6 75	@6 87½
English do.	6 75	@7 00
Domestic	6½@	6¾
Bar.....(net)	9 25	@ —
Pipe.....(net)	— —	@10 50
Sheet	— —	@10 50

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

English Cast (2d and 1st quality) ₱ lb	— 18½@— 23
English Spring (2d and 1st quality)	— 9½@— 10¾
English Blister (2d and 1st quality)	— 14 @— 18½
English Machinery	— 14½@— —
English German (2d and 1st quality)	— 12¾@— 14½
American Blister "Black Diamond"	— — @— 11½
American, Cast, Tool do.	— — @— 17
American, Spring, do.	— — @— 11
American Machinery do.	— 11½@— 12
American German, do	— 3 @— —

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

	Gold ₱ lb.
Banca	— @37½
Straits	31 @32¼
English	3.½ @31⅛

PLATES.

	Fair to Good Brands. Gold.	Currency
I. C. Charcoal, ₱ box	$11 75 @12 00	$14 25 @14 50
I. C. Coke	9 50 @10 50	11 37½ @12 50
Coke Terne	8 87½@ 9 50	10 00 @11 25
Charcoal Terne	10 25 @11 00	12 25 @13 00

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

Plates, Foreign	(gold) p. 100 lb.	7 62½@ 7 87½
Plates, Domestic	p lb.	9 @—11

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

Sheet	per lb.—10¾@11

San Francisco Stock Market.

BY TELEGRAPH.

NEW YORK, May 15, 1873.

Our report from the San Francisco Stock Board is dated 13th inst. Gould & Curry, "probably not having foundation sufficient for the unusual pressure brought to bear last week," has declined $3 per share, being the only exception to the continued upward movement of the list. The most noticeable feature in the report is the rise in Chollar and Yellow Jacket, both of which will soon reach $100 per share at their present rate of advance. Indications from nearly all of the mining districts point to an unusual prosperity in this most important branch of industry, reports from the mines, almost without exception, containing favorable mention of the unexceptionable working of the machinery, a fact which may be attributed to the rapid strides recently made in valuable improvements to nearly everything pertaining to extracting and manipulating ores. The following is the report of the Board:

	May 13.	May 15.
Savage	—	124
Crown Point	—	130
Yellow Jacket	—	91
Kentuck, "New Issue"	—	13¼
Chollar Potosi	—	79
Gould & Curry "New Issue"	—	16
Belcher "New Issue"	—	90
Imperial	—	9½
Raymond & Ely	—	63½
Meadow Valley	—	23½

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.

V. The annual meeting for 1873 will take place in Philadelphia, May 20. Communications in reference to it can be addressed to the secretary.

Members will rendezvous at the Bingham House, southeast corner of Eleventh and Market streets.

The meetings of the Institute will be held at the Board of Trade Room, Mercantile Library Building, Tenth street, below Market.

A meeting of the Council will be held at the office of the Secretary, on May 20th, at noon.

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

THE ENGINEERING AND MINING JOURNAL.

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

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

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THE SCIENTIFIC PUBLISHING COMPANY.

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

CONTENTS FOR THIS WEEK.

MEMBERS of the Institute of Mining Engineers will find themselves welcomed at Philadelphia in a most agreeable manner, and the prospects are that a good attendance and an interest at least equal to that of former meetings will mark the proceedings. In addition to the papers which will be read, the importance of which shows a gratifying progress with every meeting, there are radical questions of organization to be discussed. It is very important, therefore, that the Institute should be well represented, in order to prevent the adoption of regulations by a small part only of the Institute. However unintentional and unavoidable such an adoption may be, and though made by the most active and interested portion of the members, it is always to be regretted. The Institute has no disputes internal or external, but it is nevertheless better to have its rules and proceedings discussed by the full membership if possible. There is another reason why the annual meeting should receive the support of the members. It is the fact that the Spring is the time for similar conventions of many societies of like character to our own. A proper pride and proper interest in our profession, should lead us to make what effort we can to place our own anniversary among the successful ones of the year. The excursion to Pottsville will take place Thursday, and is certain to be a very enjoyable and profitable affair.

PROFESSOR R. H. THURSTON, of the Stevens Institute of Technology, sails for Europe on the 24th instant, as one of the Commissioners to the Vienna Exposition. His special department will be machinery, on which subject he will prepare a report. We are glad to know that this job, at least, is in capable hands. Professor THURSTON desires us to say that he will be pleased to receive from exhibitors detailed descriptions of their machines, accompanied with verified statements of performances.

THE Railway Master Mechanics began their Sixth Annual Session in Baltimore, May 13, with an attendance of seventy-eight members. Seventeen new members signed the constitution. An attendance so large as this, drawn from a class of men as busy as railway men, is proof of the interest taken in the Association. The yearly work of the Master Mechanics is in fact among the most important that is supplied by the technical pursuits. There is a compound of scientific spirit and practical knowledge among these gentlemen that always commands for them the respect of the world.

THE American Iron and Steel Association, and the iron-masters associations generally, in this country, cut a sorry figure with regard to the promotion of technical knowledge in their business. Examples are too numerous to be given at length; but two or three cases will suffice. For instance, here are the iron masters of the country, petitioning for a Commissioner to collect and analyze American ores for the Centennial Exhibition at Philadelphia. But we are informed that it will be difficult or utterly impracticable to get from them the means to pay the expense of this important work. With regard to the Vienna Exposition, their course is equally economical. The Executive Committee of the American Iron and Steel Association, after two months' consideration, has just decided not to have any report prepared on the European iron-industry, as represented at Vienna. The reason given is the scandal attached to the management of the American department; but the real reason is that the Association cannot afford two thousand dollars to pay an expert for preparing such a report. Its funds are imperatively required for the issue of pictorial tracts, and other less laudable operations, in behalf of a protective tariff. Millions for defence, but not a cent for progress! Of course, our "infant" iron manufacturer must be protected; but even infants attain an age at last when it does them good to send them to school; and a slight expenditure in the way of acquiring knowledge would not be utterly thrown away.

A NUMBER of Congressmen have gone to St. Louis to hear what the residents of the Mississippi Valley have to say in regard to their demands for the improvement of navigation on that great river. The idea of sending for the Congressmen to come and see for themselves, instead of sending a delegation to talk them into acquiescence, is certainly a good one. The St. Louis people think that by loading vessels at that city for Europe and New York they can reduce the cost of carrying wheat to Liverpool from 50 cents, which is the cost now *via* New York, to 27 cents; while the water route will lower the freight to New York itself one half. They represent that at 27 cents to England they can compete easily with Baltic wheat, which costs 35 cents for freight, and with Black Sea wheat at 45 cents. The fact that they have secured the attendance of a hundred members of Congress is substantial evidence that their views will receive attention. It cannot be doubted that the Mississippi Valley is on the eve of rising into very great prominence in every aspect—commercial, agricultural, and industrial. That other regions are to be mute because the interior States are to ring with activity, we do not believe, and we think it both unwise and incorrect to present the question in that light. It is perfectly true that the mind can hardly grasp the idea of what that region may become when it is filled with the population it is capable of supporting. But it is also true that its influence has hitherto overbalanced its real strength, and this condition of things is likely to obtain for some time to come.

The Drummond Colliery Fire.

A dreadful disaster in the Drummond Colliery, Pictou County, Nova Scotia, comes as a new warning to managers of mines. Work had been suspended for some time to settle certain disputes with the workmen, but was resumed May 13. There must have been a large accumulation of gas, for at half past eleven in the morning, a shot fired in one of the upper levels, ignited the gas and a severe explosion was the consequence. The fire seems to have spread with great rapidity and the lists of the killed contain the names of 48 men, while 6 others are wounded, some fatally. It is reported that these, or some of them could have escaped, but, remaining to fight the fire, they became the victims of a second explosion which took place at two o'clock. The accumulation of gas was so great that the flames are reported to have risen a hundred feet in the air, and explosions followed each other in rapid succession for many hours.

The daily press is laying great stress upon the fact that the mine had but one hoisting shaft, though the reports all speak of an air shaft which appears to have been in good order. The true cause of the disaster was the incautious resumption of work after a stoppage. The mine is known to be very fiery, and though the manager is reported to have been careful about his ventilation, it is evident that he was not careful enough. The fragmentary reports received from the coroner's inquest lay the burden of the mishap upon special occurrences rather than general conditions. The Inspector of Mines, for instance, is reported to think that "the direct cause was in not exercising proper care in firing shots in the bench. The first two were merely blown out, causing fissures in the body of coal where gas accumulated. When the third shot was fired the coal ignited, and all attempts then to quench the flames were unavailable." However that may be, it is evident that the laws should require more care in starting mines which have been closed. It is well known that a large part of the accidents occur on Mondays, and at other times immediately after rest. The circumstances rank the present occurrence in the same category, and there is no doubt that the requirements of the law, relating to the resumption of work, after a stoppage, should be increased.

The Use of Gas Fuel in Metallurgy.

MR. ALOIS THOMA requests us to say that in our brief editorial allusion, last week, to his early connection with the use of gaseous fuel in metallurgy, we claimed for him more than he is willing to assert for himself. Messrs. THOMA and BISCHOF were not the first to use gas in this way, but the first to construct and successfully operate an entire establishment, employing exclusively gas from generators as fuel.

AS HARTMANN remarks in his *Fortschritte der Eisenhüttenkunde*, a supplement to KARSTEN'S *Handbuch*, the "brilliant discovery" of the use of tunnel-head gases as fuel for fining, puddling and re-heating iron, is due to Bergrath W. VON FABER DU FAUR, who introduced this method in 1837 at the Royal Wurtemberg works of Wasseralfingen. He published in 1842, for private circulation, a treatise on the subject, which we do not find among the references made by HARTMANN in his edition of 1851, but of which we have seen a copy. Already in 1841, however,

KARSTEN himself, in speaking (in his *Handbuch*) of this use of tunnel-head gases, remarks that the success of this method indicates the probability that carbonic oxide may be advantageously manufactured out of inferior fuels for a similar purpose. This is a prophecy of the gas-generator, which indeed was a good deal discussed at that time among progressive ironmasters, and was experimentally tried at Wasseralfingen somewhat later. But Messrs. THOMA and BISCHOF, after a series of experiments, put in operation in 1844 the first successful works depending for fuel upon gas-generators; and the former published in 1851 in the *Berg und Hüttenmännischen Zeitung*, a translation—from the Russian—of his official report on the subject to Prince LEUCHTENBERG, the chief of the mining department of the Russian Empire. Of this report, HARTMANN remarks that it constitutes the best practical treatise on the employment of gaseous fuel in metallurgy.

Arctic Expeditions.

ARCTIC expeditions seem to grow more exciting with time. In 1870 the world was thrilled with the rescue of fourteen men, who, having been wrecked on the German exploring brig *Hansa*, had floated for a hundred and ninety-three days on a sheet of ice, passing over nine and a half degrees of latitude. They began their voyage on a vast field of ice, and at first lived in some comfort in houses made of coal, cemented by ice. But every day their situation grew more critical, as their floe broke up and left them only a small cake for a home. Within a week news has been received of the rescue of ten white men, two Esquimaux men, two women, and five children, who had been members of Captain HALL's expedition. They report that Capt. HALL died upon his return from a sledge journey, and that their separation from their vessel was caused by accident. The vessel was in danger, and preparations were made to take to the ice, when a sudden breaking up set the ship free, and she steamed off in the darkness and storm. It has been suggested that there may be a tale of mutiny behind all this, and it is certainly somewhat remarkable that there is no account of any effort made by the ship to recover her lost crew. She was without boats, the only two which had escaped destruction during the voyage being on the ice with the now-rescued party. Still this question of mutiny is one which we, like others, can only guess at. After the separation the ice-voyagers were carried southward from October 15, 1872, to April 30, 1873, or 197 days in all, until they were picked up by the *Tigress*, which in a dense fog ran into the very floe on which they rested. They had several times been driven from one piece of ice to another, and appear to have had altogether a very exciting voyage. It began in latitude 77°35′, and ended in latitude 53°35′. The party was under the command of Capt. TYSON, who is reported to have been a fast friend of Capt. HALL. It cannot but be considered remarkable that although Arctic exploration has gone on from the time of CABOT and HUDSON till now, adventures of this kind should have never developed themselves until now. This and the similar experience which befell the *Hansa's* crew are leading people to enquire with increasing earnestness into the utility of Polar explorations. That many scientific questions can receive great light from northern exploration, and that former voyages have been productive of knowledge is undoubtedly true; but on the other hand this information has been gained at an expense of life and suffering which is out of proportion to the results. The *Polaris* was fitted out by the United States Government, and we think it will not be easy to get another appropriation from Congress for a similar undertaking.

The Vienna Opening.

THE correspondents of the daily press have already produced some pre-Exhibition letters about the great opening at Vienna. The backwardness of the United States, though arising from circumstances which make it especially unpleasant is, in truth, not very much greater than that of other nations. We stand lowest on the list in point of preparation, and, strange to say, Austria comes next. This Exhibition in fact is likely to suffer from the delays which have proved such a drawback to every similar undertaking. One writer says, that though there is no official postponement, there is a real one, for the directors of the different sections close their doors against visitors, and must keep them closed for some time to come. The city is filling up and prices are already extravagant. A letter in the New York *Times* gives some useful details taken from the regulations. It says: "A new set of rules and regulations for the great "Weltausstellung, 1873, in Wien" have just been issued, the first paragraph stating that the Exposition will be opened on the 1st of May, and remain open until the 31st of October. It is useless for me to give all the petty details in this document, about the manner and place of obtaining tickets of admittance, but one or two paragraphs are of general interest. For instance, the thirteenth paragraph states that the entrance fee for Sundays and fête days will be 50 kreutzers, (about 27 cents,) and on every other day of the week, 1 gulden, Austrian money, or about 54 cents of our money. I must confess that I have not yet found time to assimilate the values of the different moneys to get the exact fraction, for this varies a little from time to time. My Louis d'or or Napoleons were worth 8 florins 70 kreutzers a week ago, and to-day they are worth 8.79. Hence Americans would do well to change as little as possible when the price is rising, for this makes a difference of about a florin for every 10 Louis. A florin and a gulden are the same, the bank bills bearing the word gulden, but the people always count in florins. The stranger will also remark the frequent use of the two letters, "ö. W.," which means Austrian currency, and this specification is necessary by the difference in values, and the great varieties of moneys in the German States. A gulden in Bavaria is not the same, or has not the same value, as a gulden in Austria. To return to paragraph 13. The entrance free will be fifty kreutzers on Sundays and holidays; one florin on other days. The entrance fee for the day of opening and the day for bestowing the prizes will be twenty-five florins; for the 2d and 3d of May, five florins; for the 4th and other days, two florins. A season ticket for the duration of the exposition will cost 100 florins for a gentleman and 50 florins for a lady. But—and here is a very respectable detail—tickets for ladies will only be issued to gentlemen who present themselves provided with a season ticket. Another detail not noted in the regulations, which I get from the director: One million tickets at twenty kreutzers will be set aside for those who are unable to pay the regular fees. There will also be a large reduction for soldiers. Tickets of admission for the assistants of exhibitors will only be issued to applicants upon a recommendation of their employers, and such tickets will cost six florins a month."

NEW PUBLICATIONS.

ILLUSTRATED CATALOGUE *of the Pascal Iron Works (Morris Tasker & Co. Philadelphia), and the Tasker Iron Works, New Castle, Delaware. Tenth Edition.*

This magnificent catalogue is divided into eight parts, each corresponding to a class of the manufactures of the old and celebrated establishments above named. The Messrs. TASKER, who represent these works, have judged rightly in deciding that what the public asks of them is not unnecessary puffing of their wares, but clear and full descriptions, by the help of which orders can be sent from a distance, with certainty on the part of the sender as to the size, form and price of the articles. As for the *quality*, the brand of this concern is guaranty of that. We cannot better serve our professional readers than by the simple enumeration of the objects comprised in the eight classes of this catalogue, and illustrated in its numerous lithographic plates.

Class I, includes boiler tubes; steam, gas or water tubes; wrought and cast iron fittings; manifolds; coil fittings; flanges; return bend and wrought iron coils; galvanized iron fittings; gas fittings, etc. We notice particularly in this class the excellent tuyeres with coils of wrought iron pipe for water-cooling. These are sold, by the way, (unless the prices have been raised lately, of which we are not informed) at eighteen cents per pound for the coils, and five cents per pound for the castings. Some of our friends in Utah might figure on this with advantage.

Class II. comprises an endless variety of valves, cocks, and joints, including the globe, check, and safety-valves, the Rock Patent Ring valve (which never needs grinding, has a vertical motion only, and leaves a horizontal flow of the liquid), and no end of gauges, stop-cocks, throttles, etc.

Class III. consists of gas-fitters' supplies, such as taps, reamers, drills, screwing stocks, screwing machines, vises, tube cutters, tongs, wrenches, pliers and chisels.

Class IV. comprises plumbers' fixtures, such as drain pipes, bath tubs and boilers, hoppers, traps, sinks, hydrants, gutters, and water-closet arrangements.

Class V. embraces heavy pipes, valves, etc., for gas, water or steam, adopted to the use of railroads, fire and water departments, and gas companies.

Class VI. is more varied in character. In it we find cooking and laundry apparatus, including steam-supplied tables for meat or soup, coffee and tea, such as are required in hotels; mangles, ranges, steam-kettles etc., for large culinary operations. Following these are the steam-pumps, among which WORTHINGTON'S patterns are deservedly prominent. The Worthington "Duplex" is the pumping engine of the future, as the water-works people all over the country are rapidly finding out—and MORRIS, TASKER & Co seem to know already. Their patterns of blowing fans we do not altogether like. Their boilers and boiler fronts are simple, strong and convenient of design. Their wringing machine—well, there is a limit to our knowledge, if not to their manufacturing zeal. We must draw a line somewhere; and we draw it at wringing-machines. Wringing-machines are out of our line.

Class VII. contains hot water and steam fittings for warming dwellings and greenhouses. Of these the Tasker self-regulating hot-water furnace is the most important. Some valuable notes on heating are given in the accompanying text, to guide builders in the choice of size and location for flues, etc.

Class VIII. is devoted to apparatus for boring artesian wells. All the approved instruments, including augers, bits, drill-stocks, rod or cable fittings, jars, pulleys, derrick-irons, etc., representing the American practice followed in the oil-regions, for instance, are here figured, and prices given. There is even a "boulder-cracker," the special value of which we may be permitted to question. It remains to be seen whether the diamond drill will entirely supersede the older methods of boring. Probably a limit will be found in depth, at which the difficulty of using it will counterbalance its great advantages. Meanwhile, it must be confessed that the American modification of the ancient Chinese system of cable-boring has been on the whole very successful, and reflects credit on the inventive genius of our people.

American Society of Civil Engineers.

The following list of papers to be read at the Convention of the Society of Civil Engineers, May 21 and 22, is published. By Hon. W. J. MCALPINE, of Pittsfield, Mass., on "Foundations of the New Capitol at Albany;" by General J. G. BARNARD, of New York, on "Beams;" by General T. G. ELLIS, of Hartford, Conn., on "The Cause of the Formation of Bars at the Mouths of Rivers;" by Mr. MARTIN COXELL, C. E., of Wilkesborre, Pa., on "Transportation of Freight and Passengers;" by Mr. E. THATCHER, C. E., of Louisville, on "Columns of Timber and Cast Iron;" by Professor D. WOOD, of Hoboken, N. J., on "Back Water in Rivers as Caused by Dams;" by Mr. WILSON CROSBY, C. E., of Brooklyn, on "Economy of Railroad Curvature;" by Mr. M. S. BELKNAP, C. E., of Louisville, on "The Water Power of the Falls of the Ohio;" by Mr. G. W. R.

BAYLEY, C. E., of New Orleans, on "The Operation of the Teredo in Southern Waters;" by Mr. J. Y. CUYLER, C. E., of Brooklyn, on "Planting Considered as an Element of Engineering Construction;" by Mr. C. G. FORSHAY, C. E., of New Orleans, on "Levee Building on the Mississippi River;" by General W. SOOY SMITH, of Boonville, Mo., "An Account of Bridge Work on the Western Rivers;" Mr. E. S. CHESBROUGH, C. E., of Chicago, will continue his account of the "Detroit River Tunnel;" by Mr. G. JORDAN, C. E. of Montgomery, Ala., on "Foundations under Water;" by Mr. THEODORE ALLEN, M. E., of New York, on "Light Draft Iron Boats on Western Rivers;" and Mr. T. C CLARKE, C. E., of Philadelphia, will give some "Memoranda on the Resistance to Compression of Wrought Iron Struts."—*Railway Gazette.*

Petroleum.

We give below some interesting statistics of the Petroleum trade, originally published by the Titusville *Herald*. It will be noted that the barrels at the Oil Wells are calculated at 45 gallons each, while the barrels under the head of exports are calculated at 43 gallons each.

The past year has witnessed the formation and collapse of the most speculative combinations which were ever gotten up for the purpose of controlling the markets and production of petroleum. In the producing districts of Pennsylvania development was not carried on quite so extensively as in the previous year, but it met with an extraordinary and most unprecedented success, the production for the year having averaged over 2,000 barrels daily larger than the previous year. The production of the United States and Canadas reached the enormous figures of 7,394,000 barrels, or 20,271 barrels daily.

THE SHIPMENTS.

The shipments from the Pennsylvania oil district of crude or its equivalent, in 1872, was 5,712,365 barrels of forty-five gallons—an increase of about 300,000 barrels over the previous year.

The following were the shipments of crude, or its equivalent, from the oil region of Pennsylvania for 1872, and the six previous years:

	1872.	1871.	1870.
To New York	1,957,944	1,537,652	1,324,922
" Cleveland	1,174,511	1,727,833	1,828,631
" Boston	197,130	179,678	169,363
" Philadelphia	742,455	476,119	425,142
" Pittsburgh	1,177,424	1,128,953	1,132,834
" Other points	460,918	409,975	337,837
Total barrels	5,712,365	5,460,210	5,219,129

THE PRODUCTION.

In January the production of the Pennsylvania district averaged nearly 16,300 barrels daily. In February there was an increase to 17,000 barrels, but in the succeeding month the average was but 15,500 barrels.

The annexed table gives the production of Pennsylvania each year since 1859:

	Barrels.
Production in 1859	87,000
" " 1860	500,000
" " 1861	2,118,000
" " 1862	3,056,000
" " 1863	2,631,000
" " 1864	2,116,000
" " 1865	2,497,000
" " 1866	3,597,000
" " 1867	3,347,000
" " 1868	3,715,000
" " 1869	4,415,000
" " 1870	5,650,000
" " 1871	5,795,000
" " 1872	6,539,000
Total gallons	45,940,000

The production of America in 1872 was as follows:

	Barrels.
Total product of Pennsylvania oil region in 1872	6,539,000
Total product of West Virginia, Ohio, and Kentucky oil regions in 1872	325,000
Total production of Canada in 1872	530,000

In Canada the yield is estimated at 530,000 barrels for the year. At one time there was a production of more than 2,000 barrels daily. In West Virginia and Ohio the production is given at 325,000 barrels.

THE STOCK.

The greatly increased production of the year was so much in excess of the consumption that there was a large increase in stock. In Pennsylvania the increase was steady from January to June 1st, when the total was over 1,000,000 barrels. In July and the four following months there was a decrease, but in November and December there was a rapid increase, and the stock January 1st, 1873, reached over 1,100,000 barrels.

THE EXPORTS.

For the first time in the history of the trade there was a falling off in the export, the total in 1872 of crude, refined, naphtha, &c., being, in round numbers, 5,000,000 gallons less than for the preceding year. After reducing the crude export to refined, the total quantity of refined exported shows a falling off of more than 300,000 barrels, equal to fully 13,000,000 gallons.

The following were the total exports from the United States of crude, refined, naphtha, &c., of barrels of forty-three gallons, for the years indicated:

	Barrels.
Total export in 1872	3,497,344
Total in 1871	3,758,442
Decrease in 1872	251,098

In 1872 the export of crude increased about 118,000 barrels, while the refined export fell off 376,000 barrels, and the export of naphtha, residuum, &c., remained without material change.

Annexed are the exports of crude, refined, naphtha, lubricating oil, &c., since 1861:

	Gallons.
Exports in 1861	1,500,000
" 1862	10,887,801
" 1863	28,250,721
" 1864	31,872,972
" 1865	29,805,523
" 1866	67 930,451
" 1867	67,052,029
" 1868	99,281,750
" 1869	102,748,604
" 1870	141,208,155
" 1871	155,074,791
" 1872	150,385,869

The figures for '70, '71, '72, and '73, differ slightly from those we gave last week.

The above figures fairly represent the rapid increase that has taken place in the consumption of the article abroad. It will be noted that the export of 1872 was more than double that of 1867.

The following were the stocks in the world, January 1st:

	1873. BBLS.	1872. BBLS.	1871. BBLS.
In United States	1,841,000	1,151,000	1,190,000
In Canada	475,000	449,000	400,000
In and afloat for all foreign ports	1,553,000	1,629,000	1,283,000
Total barrels	3,849,000	3,269,000	2,873,000

The stock January 1st, 1870, was 1,860,000 barrels. The stock in the world has, it will be noticed, more than doubled in three years.

THE CONSUMPTION OF THE WORLD.

The total consumption of crude in 1872 was 6,664,000 barrels, an increase over the previous year's consumption of 662,000 barrels, or eleven per cent. The rate of increase in consumption in 1871 over 1870 was over two and one-half per cent. greater than the rate of increase in 1872 over 1871. Among the causes that lead to the falling off in the rate of increase in 1872 was the increased manufacture of shale oils and the unnaturally high prices demanded by the refiners of petroleum in America.

The following table shows the consumption in the world in 1872:

Production, 1872, bbls.			7,394, 000
Stock, January 1, 1872, bbls.	3,269,000		
Stock, January 1, 1873, bbls.	3,849,000		
Deduct increase Jan. 1, '73, bbls		580,000	
Deduct losses by fire, &c., in '73		150,000	730,000
Total consumption in 1872, bbls. crude			6.664,000
Consumption in 1871, barrels.			6 002,000
Increase in 1872, or about ten and eight-tenths per cent.			662,000

The average daily consumption in 1872, was nearly 18,500 barrels.

ENGLISH CORRESPONDENCE.

Meeting of the Iron and Steel Institute.

[From our Special Correspondent.]

LONDON, May 1, 1873.

TO THE EDITOR:

Sir—The Iron and Steel Institute of Great Britain commenced its Annual Session at WILLIS's Rooms, in London, on April 29th.

Mr. HENRY BESSEMER, the retiring president, occupied the chair.

There were about 200 members present.

The report of the Council was read by the Secretary, Mr. JOHN JONES. At the last general meeting the number of members was 424, since which 109 have been elected, and 65 additional elected at the present meeting, making a total of 598. During the year 1872, two meetings have been held. The Council have under consideration the providing of suitable permanent accommodations in London, and the erection of a building for the accommodation of this and other learned societies is being talked of. This would be eminently proper, in view of the fact that the annual business meeting is always held in London.

The Institute has been invited by the Belgian Government to hold its next meeting at Liège on Aug. 18th, and the invitation was accepted.

An International Metallurgical Congress is to be held in Vienna on the 24th of August, and it is believed that a large number of the members of the Institute will go from Liège to Vienna for the purpose of being present at that Congress.

Mr. SCHNEIDER moved a vote of thanks to Mr. BESSEMER for the able manner in which he had discharged the duties of his office for the past two years, and for the very lively interest which he had always manifested in the prosperity of the Institute.

Mr. BESSEMER replied in a very feeling manner, and called attention to the great good which the Institute had already accomplished. He further said that he did not leave the chair with regret, for in Mr. BELL the Institute secured as its

president a man whose experience was second to none, and whose science was on an equal footing.

Mr. BELL, on taking the chair, delivered the address which I enclose, and which is worthy of being reprodnced in full in the columns of the ENGINEERING AND MINING JOURNAL.

The address was received with the warmest applause, and Mr. SIEMENS spoke of it as among the most perfect of Mr. BELL'S many and admirable productions.

The men most eminent in the development of iron metallurgy in England were present. Such a combination of practice and science can hardly be found elsewhere in the world.

American metallurgy and mining must hold a secondary position until the *practical* men take the scientific men by the hands, and together form a body which will march on to victory.

In the evening Mr. BELL gave a dinner to the Council at WILLIS'S Rooms.

The morning session of Wednesday was taken np by the reading and discussion of Mr. SIEMENS' paper, of wh ch an account will fol'ow by the next steamer.

The social phase of the meeting is of the most delightful character. M.

Iron in Russia.

RECENT Legislative action has, in some degree, turned the eyes of the nations of Europe, and, above all, of England, to the vast Empire of the Czar, the political movements of which have been so fruitful a source of speculation and perplexity with our statesmen, while the aggressive character of its policy in every direction has tended to fill the minds of not a few with apprehension and alarm. From a political point of view the extension of this already powerful Empire may, perhaps, be looked upon with pardonable jealousy by neighboring Powers, but there can only be one opinion as to the advantages which must arise out of the increased and ever increasing activity that has been manifesting itself during the past few years, alike in matters social, political, and industrial, throughout the Empire. Any considerations that we bestow upon the subject of the development of Russia, must necessarily be confined to matters industrial, we leaving the political and social questions to be dealt with by those who make it their special mission to discuss them.

The supply of iron, as well as of the materials for its production, in Russia, is practically unlimited and inexhaustible, and we propose, in the present paper, after as briefly as possible describing the advantages that the country possesses for its production, to sketch rapidly the origin and growth of this branch of industry, and then to give some details of its present condition. The extraordinary plenitude in which iron ore exists gives the country an advantage over every other at the very outset. The soil of Russia may be said to be impregnated with iron ore throughout, and the variety of ore that is to be found is only equalled by the abundance in which it exists. The ore lies always very near the surface, and in the ordinary acceptation of the word, an iron *mine* is unknown, so that the labor or expense of mining the ore is, comparatively, of the most trifling character. In some parts the ore is extracted by means of small wells of from six to sixty feet deep, which, when exhausted, are abandoned for others, and in other parts the ore exists in quarry. A singular freedom from phosphorus and sulphur characterizes the ores used in Russia, and although phosphoric and sulphurous ores are to be found in considerable quantities, they are not used.

As lime is very generally found in Russia, flux is easily obtained; a kind of lime-sand very free from sulphuric acid is a general favorite.

Magnetic ore is deposited to an enormous extent in the ranges of the Oural and the Altai. The mountains of Blagodal, which lie in a straight line to the north of Russia, are the most famous. It is also found, but in lesser quantities, in small hills, near the river Abako, and in the Ufaleeh district. The ore is calcined in heaps containing, sometimes, as much as 16,000 tons. A kidney-red ore, found in large patches or bunches to the south of Ekatarinoburg, is considered the next in order of quality. This ore, which is of an exceedingly fine and clear nature, is very extensively worked, and is said to produce iron of the very best character. An ordinary red ore abounds in every part of the Oural, and in most places the deposits of it are very large.

Central Russia produces no magnetic ore, at least none has been discovered in that region. A red oxide, and a white ore containing an admixture of manganese, are chiefly used, and they both produce excellent metal. There is also another red ore, which is strongly inpregnated with lime; the iron that this yields is of an extremely soft or liquid nature, and when it is mixed with the hard red ore just referred to, it yields a good iron.

The average produce of these ores may be stated somewhat thus: Magnetic ore, about 68 per cent. of metal. The kidney-red ore, 35 to 60 per cent. The ordinary red ore of the Oural, 45 to 50 per cent. The red oxide of Central Russia, 45 to 48 per cent. The white ore yields about the same percentage, and the red ore with the admixture of lime produces abont 39 per cent. The most inferior kind of ore used in Russia produces about 35 per cent.

The fuel which has always been used for smelting the ore is wood and charcoal, and the supply of these seems to be co-extensive with the supply of the ore. Although considerable damage has been done by the reckless waste of timber that was practised in earlier years, yet since the forests have come under the careful supervision of the State, a vast improvement has already been effected. The business of the State in this matter is to see that the forests are properly divided into patches, and each year's supply marked ont. The wood grows to maturity in about sixty years, and in mapping out the forest care has to be taken that the supply in the first instance is equal to a consumption of sixty years, allowing time for the yonng wood growing, and also for fires that might occur. In one forest in the Central Oural the wood is mapped out with such care and precision as to provide sufficient fuel to make 8000 tons of iron *ad infinitum*, and to allow eighty years for re-growth. Nowhere in the country is wood dear—in most places it may be considered cheap. Charcoal is prepared from the pine, the fir, and the birch, and is always manufactured in the summer for use in the autumn and winter. The cost of cutting and burning is not heavy, and the advantage of charcoal is that it can be carried so much farther than wood. In a country like Russia, of such enormous extent, and where facilities of intercommunication are so few, the proximity of the forests to the iron-works is an absolute necessity, and wherever this contiguity does not obtain the manufacture will of course be crippled until the difficulties of transit are obviated, and, what is of far greater importance, the working of coal is more fully developed. On this subject we shall have occasion presently to dilate.

There are two other raw materials necessary for the iron-works—fire-stone and fire-clay. Fire-stone is abundant in the Oural, and generally in the North of Russia, and fire-clay is plentiful there, as also in the Central regions. Fire-stone, however, has to be conveyed to the Central works—in which region it is very scarce—over long distances from the north.

Another important advantage which Russia possesses, to which, however, the inhabitants are not yet sufficiently alive, is the existence in abundance of the fuel—of which our supplies have been recently curtailed—coal. As yet, however, notwithstanding the fine field for the development of the production of this mineral in Russia, scarcely any steps have been taken in the direction of doing so. There is a magnificent deposit of extraordinarily fine black gas coal near the River Kama. It is thick, near the surface, easily worked, and easily transported to the river-side—owing to the apathy of the owners of the estate this field is now lying *perdu*. Brown coal exists in the central districts, large quantities of anthracite in the south, and immense deposits in the basin of the Donetz—all of which only await the enterprise that shall dig it from its bed and utilize it in the manufacture of its companion-world civilizer—iron.

We do not hesitate to express our conviction that by a rightful appreciation of the importance of the mineral riches which lie so near to their hand, and energy and vigor in rendering them available, together with a proper liberality in opening their markets and manufactures to the world, Russia might materially improve her position, if not place herself in the van of continental Europe in the important industry of which we are treating.—*Iron.*

Crampton's Coal-Dust Furnace.

Engineering gives the following descriptions of CRAMPTON'S furnace for using powdered coal to which we referred in an editorial paragraph last week. During the past two or three years we have upon several occasions noticed the progress made in the development of one of the most important and ingenious devices for obtaining perfect combustion in furnaces with ordinary coal fuel that modern times have produced. We allude to the coal-dust furnace of Mr. T. R. CRAMPTON, which it is satisfactory to know has been recently brought to a successful issue by its inventor, and is now regularly at work in the Royal Gun Factories Department, at Woolwich Arsenal, under the superintendence of Colonel CAMPBELL. This success, however, has not been achieved without several years of labor, and the expenditure of a considerable sum of money, and the consumption of nearly 3000 tons of cool in furnaces of various descriptions, in which practical trials have been carried on in different places. The principle of the Crampton furnace consists in the use of finely powdered coal dust, mixed with air, and delivered in several streams into a combustion chamber, and its success depends upon the perfect combination of the fuel and air at the point of combustion. The heat thus generated passes into a second chamber where it is utilized, the waste products of combustion passing away in the ordinary manner. The system is applied at Woolwich to a revolving puddling furnace, which is about twelve feet long and 7 feet in diameter externally, and is carried at each end on a pair of bearing wheels. It is driven through toothed gearing by a small steam winch having a pair of five inch steam cylinders with ten inch stroke, and it revolves with the greatest regularity and steadiness. The coal dust is ground very fine, and is conveyed direct to the feeding apparatus at a cost of about 1s. per ton. The feeding apparatus consists of a hopper, in which a couple of stirrers revolve, and deliver the fuel through an aperture on to a pair of horizontal rollers, between which it passes down a shoot placed over an opening in a horizontal tube, through which a current of air is blown by a fan. This causes an induced current at the point at which the fuel is delivered, and draws it into the furnace. The delivery of both fuel and air are nicely regulated, and can be varied as occasion may require. It is this part of the apparatus which has required the most careful consideration, and which has taxed the ingenuity of its inventor to the utmost to perfect. He has, however, succeeded in perfecting it, and in so regulating the streams of air and powdered fuel that a thorough re-mixing of them takes place, and those volumes of air which may be surcharged with fuel, are mixed with other volumes that may be undercharged. By this means the required equilibrium of the fuel charge is maintained, or when it happens to be temporarily disturbed it is properly restored, the result being that every particle of fuel is consumed, none being carried forward in the solid condition into the working chamber.

The Woolwich furnace is lined with a refractory material, and is divided midway of its length by a diaphragm of the same material, having a aperture for the flow of the heated gases from the combustion, to the working chamber. The

stream of fuel is injected at one end of the cylinder, whilst at the other the heated products of combustion pass off into an iron flue which is removable and leads to the chimney stack. This flue-piece is lined with fire-brick, and has a counter-balance weight attached to it, so that it is easily removed and replaced before and after the charging or drawing of the furnace. The iron casing of the furnace is double, and between the inner and outer skin a constant stream of water plays. It is admitted through a pipe carried through the center of the fuel-tube, and the heated water finds its way out by a similarly-placed pipe. The water enters cold, and leaves the furnace-casing at about 80° Fahr. The flue-piece is kept cool in a similar manner, the water, however, leaving it at a very low temperature. The arrangement for keeping a constant stream of water flowing over the whole surface of the furnace is very simple, and it keeps the ontside absolutely cool. Hence there can be no distortion from contraction or expansion, the furnace thus working with a minimum of destructive action, and with a very small expenditure of power. The proper complement of hands for working the furnace is a puddler and helper, and a man at the coal-grinding machine, with extra hands when the charge is being drawn from the furnace. The economy of working as regards the interior of the furnace is secured by giving the firebrick lining a protective covering of slag, which renews itself, and costs nothing. The fettling used is the mill-tap from the coil furnaces in the Royal Gun Factory, and which contains about 50 per cent. of iron. The work of fettling is a very simple operation, being rendered so mainly by the effectual cooling of the exterior surfaces of the furnace. In working the furnace at Woolwich, it is found that eight heats of 5 cwt. each can be got out in a 12 hours' shift, the iron being melted in the furnace itself. A cupola, however, has been erected, in which it is proposed to run down the cast scrap first, and deliver it into the puddling furnace in a molten condition. By this means MR. CRAMPTON anticipates working off eight or ten charges of 12 cwt. each in the same time. Having several times visited this furnace of late, we are able to state from observation that it does its work most efficiently, the balls being delivered in excellent condition. The furnace runs very smoothly, and the exterior remains perfectly cool. The air and coal are kept intimately mixed during flotation, and perfect combustion is insured, so that there is no deposit of carbon either in the combustion or the working chamber, and no smoke. The yield of the furnace is found to be from 5 to 10 per cent. in excess of the charge, the surplus being of course due to the fettling used. The quality of the metal produced, too, compares well with that of iron made under the ordinary system, which, after being three times rolled, usually stands a tensile strain of about 22 tons per square inch. The puddled ball from the Crampton furnace, samples of which we inspected, after being only once reheated and rolled, is found to stand a minimum strain of 23 tons, which frequently rises to 26 and 28 tons. Some samples of this same iron, after being hardened, gave strains of 39 and 46 tons to the inch, the metal being of very high quality.

Although the system has only at present been applied to a puddling furnace, its use is by no means limited to furnaces of that description. It is equally applicable to the furnaces of steam boilers and reverberating furnaces. In the earlier stages of the invention it was, in fact, applied to the furnace of a steam boiler, and during a 24 hours' trial the temperature of the gases in the smokebox was found never to vary more than 20 deg., or from 380 to 400 deg. This power of equal combustion is of the utmost importance for superheating steam, which is at present of doubtful practical advantage, in consequence of the uncertain heats to which superheating apparatus is exposed. Although entertaining a high opinion of the Crampton furnace, our present remarks are comparatively brief and general. They are purposely so, as we intend illustrating and fully describing this important invention at an early period. We, however, wish the inventor every success which we believe his invention is destined to command. He has unquestionably succeeded in effecting that which has never been effected before, viz., the employment of streams of air and powdered fuel, not only with great regularity and efficiency, and without smoke, but also with the requisite economy for the heating of furnaces of any ordinary construction.

MINING SUMMARY.

Nevada.

From the Gold Hill *News* of April 26; continued from page 299.

YELLOW JACKET.—Drifting north and south on the 1490-foot level, is making good progress, with no change in the character of the rock. Drifting east on the 1500-foot level was resumed last Monday. The pumps keep the water down so that it does not interfere with work on this level. Cross-cutting at the 1300-foot level north, progresses as usual, with no new developments. This mine is hoisting about 160 tons per day for the Belcher Company, the ore coming from the 1300-foot level.

CROWN POINT RAVINE.—Have cleared out the main shaft down to the first station, 250 feet from the surface, and the old west drift at that point a distance of forty feet. This drift has been driven ahead during the last week twelve feet in new ground, composed of a clay and porphyry formation, being evidently the east wall of the ledge. The increase of water was so great that further drifting had to be suspended and new hoisting arrangements erected, which will be completed and drifting resumed next Monday.

BALTIMORE CONSOLIDATED.—Twenty five feet have been added to the main west drift during the week, and the face is in very promising vein matter showing quartz which gives low assays, and which improves as further development goes on.

JUSTICE.—Drifting south on the 400-foot level in ore. A cross-cut will be started soon to ascertain the width of the body. On Wednesday the company levied an assessment of $1 per share, amounting to $21,000, delinquent May 28th.

JULIA.—The cross-cut north from the west drift, 1030-foot level, is in 110 feet, the face showing seams of quartz and clay The cross-cut south, at the same level, continues in good ore and improves in quality as progress is made.

ALAMO.—Sinking in the lead and continuing to show good ore. Intend sinking 100 feet before starting to drift. The lead being of good size, will yield large quantities of ore when full preparations are made for extracting.

UNION CONSOLIDATED.—A second cross-cut from the main north drift has been commenced and is now in about ten feet, in good lively quartz, which gives low assays, and improves as the cross-cut is continued farther east.

INDUS.—Still drifting north on the lead and showing good ore. Will do so as long as the ore holds out. Intend sinking as soon as the best point in the ore chimney is ascertained. No trouble from water.

SUCCOR.—The mill has been running steadily the past week on ore from this mine, and from the appearance of the metal in the riffles, good returns may be looked for. All parts of the mine look well.

LEO.—During the past week the incline has run through a vein that assays very well. The incline will be sunk 25 feet deeper, when drifting for the ore bodies passed through will be commenced.

JACOB LITTLE.—Some more free gold specimen ore has been occasionally met with during the week in the upper tunnel, following the main ore ledge, giving a higher general average than usual.

GLOBE.—The raise from the tunnel continues in fair milling ore. As soon as connection is made with the old upper works ore will be extracted and sent to the mills for reduction.

ARIZONA AND UTAH.—Making good progress sinking the shaft, the rock in the bottom working easier than at last report. Water comes in freely but the pumps keep the shaft dry.

KNICKERBOCKER.—The west drift, 480-foot level, is in quartz and vein matter, giving indications of a body of ore near at hand. The expenses of this mine are very light.

CONSOLIDATED VIRGINIA.—Main shaft down 352 feet below the 500-foot level. Ground works favorably, allowing of good progress. The great heat in the drift north from the Gould & Curry, at the 1167-foot level, does not prevent very fair progress being made under the circumstances. No new ore developments.

HALE & NORCROSS.—Daily yield about 50 tons, principally from the second station level, aided by contributions from the ninth, tenth, and twelfth stations. The main shaft is being retimbered for a distance of 300 feet, where the timbers are defective or settled out of shape. General prospects good, with no new level opened.

CHOLLAR-POTOSI.—Daily yield 160 tons, assays of which average about $33 per ton. The face of the drift at the 4th station, is in quartz, carrying stringers of ore. The various breasts and stopes of the ore producing stations are holding out well, with good prospects ahead.

OVERMAN.—The main shaft is cleaned out and sinking deeper will be resumed forthwith. No new development in the main west drift, 1000-foot level. Machinery and all else working well and to the best advantage. South drift going ahead as usual.

SILVER MILL.—Yielding some very good ore—enough to keep the Bacon mill running constantly. The main north drift at the first station is getting along finely and so is the prospecting and development of the mine generally.

SAVAGE.—Producing no ore at present. The main south drift at the 1700-foot level is driving ahead in favorable indications, and the north drift at the 1600-foot level to connect with the south drift from the Gould & Curry is making as good progress as could be expected considering the great heat. No new ore developments to report, but everything in and about the mine is working well and advantageously.

Utah.

The Emma Directors publish the following report from the new manager, Mr. ATTWOOD:

LITTLE COTTONWOOD CANYON, March 8th.—As the prospects seem to brighten I could not well refrain from giving one encouraging word on this my last day at the mine. After I had mailed my letter yesterday, we struck a small vein of Galena ore in the bottom of the shaft, about four inches thick. Mr. ROBERTS sent up about 200 pounds of the ore, which we find to assay 68 per cent. lead and 179-82 oz. silver. This I think very encouraging, to say the least, and I now have strong hopes that a continuous vein may be struck in this vicinity. The little vein now struck may, and probably will, disappear for a while; but it is certainly very encouraging to find that every deposit we strike is longer and richer than the last. We have seen no such ore as this in the whole extent of it from the 58-feet level—foot of old whim shaft. I shall look with a good deal of interest for the results of further explorations.—SILAS WILLIAMS.

SALT LAKE CITY, U. T., 25th March.—I now beg to forward you my preliminary report of your properties in Utah, and knowing your anxiety for information at the earliest possible date, have not delayed waiting for full plans to be made, but have enclosed a rough sketch, which I hope you will be able to understand. I left Salt Lake City on the morning of the 20th at seven o'clock, and on account of the fearful bad state of the roads did not reach the mine until after eleven o'clock at night, being sixteen hours travelling the eighteen miles from Sandy Station to Alta. The narrow gauge railway is not yet completed as far as Granite City, and consequently they do not carry freight or passengers, but in a few weeks they hope to have it completed to the latter place, which will save some seven miles of carriage by teams. The snow is very deep in Cottonwood Canyon, in some places forty feet deep; but as it is now melting rapidly during the day time it makes freighting extremely difficult. The ore is brought down part of the way on raw hides, then sleighs, and finally on wagons.

MINE.—I found about an average of ten feet of snow on the surface at the mine and in many places very much more. I have examined carefully all the old and new workings that it was possible to get into, and succeeded in viewing nearly all of them except some of the stopes that were all crushed in at the time of the cave.

Ore reserves as described in the map entitled "Profile of mine from main tunnel to present end of workings" shows by the same that the mine still contains a very large amount of reserves or ore in sight, but I find that the greatest proportion has already been extracted. Commencing at the Woodman Discovery shaft and going to the New Emma shaft, between which places there is a note on the plan stating "extent of ore unknown," I find little or no pay ore left, in fact, nothing but limestone with an occasional trace of vein matter; which shows plainly that the pay ore has all been extracted to what may be termed the limestone cap. Above the drift No. ten, and about twenty feet south of winze (see map), I find a small quantity of ore. Above

the drift No. seven I find some ore still remaining; also a small quantity above tunnel level or track floor. Below the track floor, and extending from Pascoe winze to end of mark "ore reserves" we have the greatest amount of pay ore in sight that I found in any portion of the mine, and have a gang of men engaged daily in extracting it. Commencing from principal hoisting shaft and extending to and about twenty feet beyond ladder winze on the top of stope, above Pascoe tunnel, we have still some good ore left but not of great extent. Below Pascoe tunnel and extending north, and also in the bottom of new winze, some fifty-three feet in depth, I find some good pay ore, especially in the bottom, which is very encouraging, although I cannot yet estimate what quantity we are likely to obtain from it.

The quantity and value of reserves available are not of the great extent that it would appear, comparing the large amount of ore that has been taken out in the ground marked "worked out" with what I now mark as "still in sight," because the pay ore is widely disseminated through the mass and requires very careful assorting, it being much mixed up with limestone, and scarcely one-tenth being of sufficient value to save for shipment or treatment. It is therefore a most difficult matter to give you a very close estimate of the quantity and value of the actual reserves. As near as I can ascertain, I estimate that we have about two months' work in sight, extracting pay ore at the rate of thirty (30) tons per day, containing about fifty to fifty-five ounces of silver to the ton, and carrying from thirty-five to forty per cent. lead, say (1,450) fourteen hundred and fifty tons all told.

Explorations have been pushed very vigorously since my arrival, and I have started about forty miners entirely on prospecting for new deposits of minerals, and have already found, in a cross-cut from the main hoisting shaft, about 80 feet below the level of the Pascoe tunnel, a small leader of eight to ten feet in length, and some six inches in thickness, assaying over 160 ozs. of silver to the ton, and containing 50 per cent. lead. This appears to be a continuation of the same streak of ore reported to have been found more than a month ago, under the late management, and looks very promising. I am in hopes it will guide us to another good chamber of ore. The main hoisting shaft is now down to the depth of ninety-three feet below the Pascoe tunnel, the bottom of which shaft is in limestone, but think it is over the vein, as the leader above mentioned was found at eighty feet, pitching under the shaft. This I consider fortunate for the future working of the mine, as it is always advisable, if possible, to have the main hoisting and pumping shaft some distance from the vein for the safety of the shaft, enabling the miners to extract all the pay ore, without having to leave any pillars for the protection of the same. At the depth of eighty feet in the shaft an excavation is now about finished, nearly eight feet by seven feet, and six feet high, for the purpose of putting in the new pump, a Knowles's force steam pump, which is capable of raising about 300 gallons of water per minute. This pump will be in place and ready for work in about two weeks from date, and will be ready in case any water gets into the mine from the snow melting. At present we have no water in the shaft, and only a very little in the mine, which runs out of the main tunnel, and is evidently caused by the melting of snow. The engine-shaft is now being thoroughly timbered, and by the end of this month will be in good order and perfectly secure as far as drift No. 8. You will perceive by the plan it has been straightened, to facilitate hoisting ore and waste. It is now six feet by four feet in the clear, and supported by 10-inch square timbers, and I intend to finish the remainder in the same manner as soon as possible. The explorations are now being carried on from six points.

TO BE CONCLUDED NEXT WEEK.

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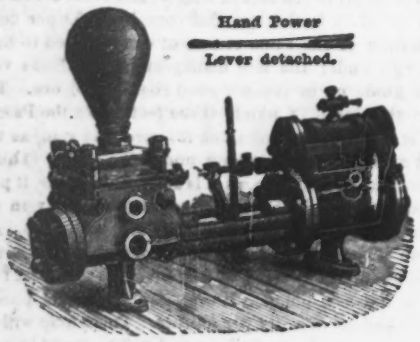

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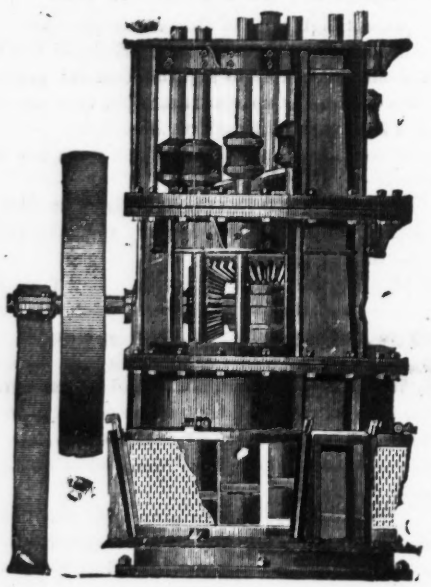

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