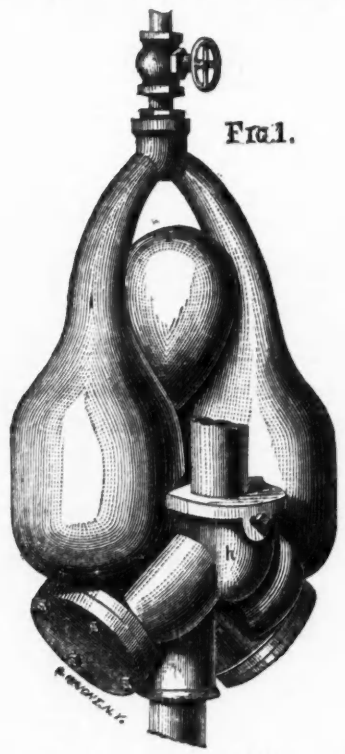
THE ENGINEERING AND MINING JOURNAL.

VOL. XVI.—No. 5.—FOURTH SERIES. NEW YORK, TUESDAY, JULY 29, 1873. PRICE 10 CENTS PER COPY.

The Pulsometer, or Magic Pump.

WHEN it is considered that the whole gold and silver mining territory of the United States was discovered long before civilization had reached such localities, and that in nearly every instance quite a long period must pass before the growth of population is such that foundries and machine shops can be sustained by neighborhood orders, it will be seen how important it is to have mining machinery of the simplest and most durable character. Among the appliances to be used by the operative miner, none is more necessary than the pump, so soon as the vein is gone down upon, either for prospecting or in actual work. Hitherto no piece of machinery exceeded the pump in liability to disorder and irregular work. None gave the miner so much trouble, and, as a general thing, the draining of deep workings became the most seriously difficult and most troublesome part of mining economy. This has, to a great extent, been remedied within the last few years by the wonderful progress made in a great variety of mining pumps. Choice can now be made from the many devices offered to the public, each of which has its particular claims to patronage. Among these there is a new competitor of rather unusual pretensions — a pump which according to the inventor and manufacturers, absolutely works unremittingly, so long as there is the required steam pressure; without the least visible machinery, without attention, with no perceptible wear of the parts, and almost wholly free from all liability to interruption from sand, wood or mud. Our readers well know that any device for avoiding casualities from these causes, is worthy of attention for they include the most frequently occurring and troublesome sources of accidents. Pumps of this character are capable of raising enormous quantities of water, and for short lifts, especially, have done very good work. Economical of steam they cannot be, but they are economical of labor, repairs and care.

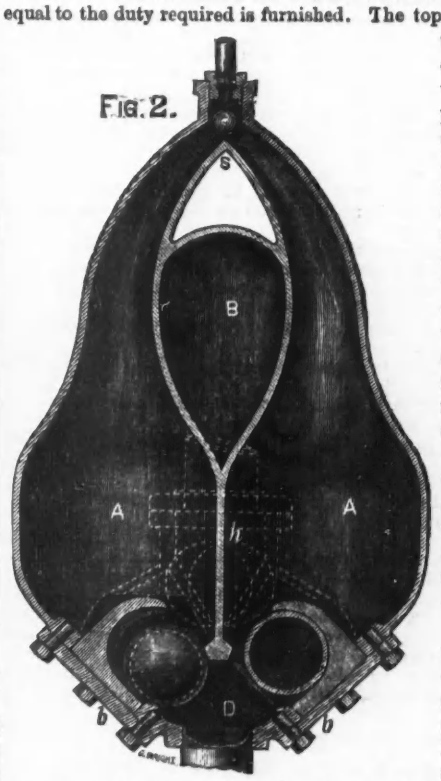
FIG. 1.



A reference to the accompanying cuts, one of which is a figure- representation of the pump, and the other a section showing the internal structure and valves, will show that absolute simplicity has been attained. The following brief description will also prove that unremitting work, a minimum of wear, little or no attention, and an almost non-liability to interruption from sand or mud must be assured. There are two chambers with long curved necks, ending at the top in a common orifice. Here the steam pipe is to be fitted. A ball or shell valve will be seen in Fig. 2 at this point, so fitted that it will alternately shut one and open the other neck or chamber. At the bottom of each chamber is to be seen a like ball or shell valve, each opening and shutting its chamber, and also the ingress to the delivery pipe, seen in Fig. 1 at h. As to each chamber, its own valve shuts off the supply by steam pressure and opens egress to the delivery pipe, while the same valve is reversed by the power of vacuum, and so opened for the ingress of water from the supply pipe, seen at D, Figure 2. These valves oscillate alternately, answering to the pressure of steam and the vacuum. No machinery aids this constant alternation of forces, which causes an almost unremitting stream of water or other liquid to be forced upward through the small pipe, a pulsating motion only being noticed, the origin of the name Pulsometer. The name "Magic Pump" may be deemed fanciful by some, but on examination it will be seen that the automatic action of cut-off delivery and supply is somewhat akin to magic, since the whole is done within, and independent of all outside aid.

When the pump is in place and filled with water the top steam valve, Fig. 1, is turned. The work commences and continues just so long as steam pressure equal to the duty required is furnished. The top shell valve at S, Fig. 2, is sent to one side; the steam presses down the water through the valve to and into the delivery pipe. When the water level is depressed to a certain line in A, Fig. 2, the whole of the steam is condensed as well by impulsion as by admixture with the rushing water. An instant vacuum is the result, reversing the valves. The steam takes to the other chamber, A, while the vacuum caused in the first chamber fills. Constant work is but a repetition of this automatic action. The shell valves are the only wearing parts, which get smooth and tight to their duty, requiring years before showing a sensible wear in ordinary service. As a sand pump, the construction offers the best guarantee of continued efficiency.

FIG. 2.



Those interested in using a mining pump, which on sight offers these peculiar advantages, would do well to investigate for themselves. The Magic Pump is now to be seen daily at No. 20 Cortlandt street, this city, where circulars can be had and information given. They are manufactured at the extenisve works of the Patentee in Jersey City, corner of Hudson and Sussex streets. A large number of all sizes may there be seen in every stage of manufacture.

Manganese a Substitute for Nickel in Alloys.

DR. PERCY, the well-known English author on metallurgy, has written to the London *Times* the following letter on the substitution of manganese for nickel in alloys. It should be stated, however, that the firm for whom the experiments cited were made deny the favorable results which the Doctor claims, and say that the experiments were every way a failure.

"With your permission, I will now disclose, for the first time, a fact which may, perhaps, surprise, and will certainly interest, electro platers. More than twenty years ago I was engaged, at the largest German silver works in this country, in an investigation which had for its object the discovery, if possible, of a substitute for nickel in German silver. The result was successful; every difficulty was surmounted, and an alloy was produced on a manufacturing scale, which so perfectly resembled German silver that it was sold as such, by way of experiment, to electro platers accustomed to the use of that alloy, without their discovering any difference between the two. The subject was the metal manganese; and, although this metal cost very much less than nickel, yet it was decided, for commercial reasons, not to proceed further in the matter, the manufacture of German silver being at the time highly remunerative. The firm to which I have alluded has it in its power at any time to introduce the manganese alloy, and if it should be unwilling to do so, it will certainly be done by other persons. At present I refrain from making known either the composition of this alloy or the details necessary to guide the manufacturer, though it is my intention to publish both on a future occasion. What I here announce will, I trust, serve as a hint to practical metallurgists, and may induce them to work at the subject."

In consequence of the interest which this subject is now causing, it will, perhaps, be useful if we remind our readers of a paper on "Alloys of Copper, Tin,

Zinc and Lead with Manganese," by J. FENWICK ALLEN, F.C.S. This paper was read at the Liverpool meeting of the British Association in 1870. We extract the following :

"Having obtained a comparatively pure oxide of manganese, and having mixed this with oxide of copper, together with wood charcoal, all finely ground and intimately mixed, the charge was put into a plumbago crucible, then heated in an air furnace at an intense heat for from three to four hours. It was found when the pot was taken out, that still suspended in the charcoal, and not run down to the bottom, were innumerable fine shots of bright white metal ; these being separated by washing, and placed again in the crucible and heated, fused, I may say easily, into a prill, or button, covered with a green layer of vitreous slag.

"The process was continued until some ingots were produced and with these experiments were made as to their malleability and ductility. This knife blade is the first piece that was successfully passed through the rolls.

"The alloy was found to be very hard and very brittle when hot, but when cold, although still hard, it rolled with ease and was highly elastic.

"The proportions of the alloy were about

Copper	75 per cent.
Manganese	25 "

"When the simple alloy had been produced in sufficient quantities, compound alloys with zinc were tried in various proportions, and these again rolled with complete success.

"Certain mixtures of copper, zinc and manganese possess the advantage both over German silver and yellow metal, that, whereas the one will only roll cold and the other hot, the manganese alloy rolls from hot to cold.

"The laboratory experiments having been completed, an air furnace was built in which a 100 pound plumbago crucible was used.

"The results were precisely the same as those obtained in the laboratory, only it was found that by stirring the charge a few minutes before the crucible was taken out of the fire, by far the greater portion of the metal that before was in small fine shot, needing very careful washing, now settled to the bottom of the pot, and could be poured out as a bar or ingot, the slag also melting, and the unconsumed charcoal floating on the top. This experiment was continued until several hundredweights of the alloy were produced, so that it could be subjected to various tests, and also that some approximate estimate of its cost and value could be found.

"As a simple alloy, in which the proportions of manganese range from five per cent. to thirty per cent., it is both malleable and ductile, with a tenacity considerably greater than that of copper.

"With zinc, a compound alloy very closely resembling some of the qualities, not the best, of German silver, is obtained. The alloy of copper and manganese would also combine with the lead and other metals, and from these castings were made, which were applied as bearings for machinery.

"A furnace planned by Mr. SIEMENS has supplied the intense heat needed, with a non-oxidizing flame, in a quiet atmosphere.

"It merely remains for me now to place before you the following series of specimens :

"1. Manganese and copper in various proportions from thirty-five to five per cent. of iron, as ingot, sheet, or wire.

"2. Copper, zinc and manganese, also in different proportions and in a variety of applications.

"3. Copper, zinc, manganese and tin as ingots and as bearing.

"4. Copper, manganese and tin in several different proportions as bars.

"5. Copper, manganese and lead."

The metallurgy of manganese has, perhaps, received its most important development from the researches of Hugo Tamm, first published eight months ago. He says : "The metal obtained by the new process is not pure manganese ; it is to manganese that what cast-iron is to iron, and I will henceforth call it cast manganese. But it is prepared with common materials, and the superiority of the process consists in this, that with a given manganese ore the cast manganese is purer than the corresponding metal extracted by another process, and, lastly, it is obtained with greater facility, greater security, and at less expense than with ordinary means, and, what is most important of all, it may be prepared in unlimited quantity.

"My endeavors were directed, from the first, to the reduction of manganese ores in presence of a flux.

"*Preparation of the Fluxes*—Two fluxes are required for successful and really practical operations in the smelting of manganese. One, which I will call flux No. 1, or white flux, and which is obtained by mixing well together common ground bottle glass, free from lead, quick lime and flour spar.

"The second flux, flux No. 2, or black flux, is theoretically required for the smelting of manganese, and it can be used in practice. It is formed by mixing together flux No. 1, native oxide of manganese of good quality, very fine charcoal powder, and soot or lamp-black.

"This flux may be used just as it is obtained after mixing. But it is best to incorporate the mass by adding enough of an oil to form a thick paste, and heating the whole at a high temperature in a closed crucible. The oxide of manganese is reduced to the state of protoxide ; the flux assumes a fine olive-green color.

"But, on the whole, the best and safest mode of operating is the following : A mixture is made of

Flux No. 1	34 parts.
Lampblack or soot, of good quality	5½ "
Peroxide of manganese, native, of good quality	60½ "

When it is smelted as will hereafter be described, 17½ parts of cast manganese are obtained, and the slag, which presents a fine olive-green color, is ground. It is saturated with protoxide of manganese, to which it owes its color, and it forms an admirable flux, either for the smelting of manganese ores, or for their docimastic assaying.

"*Preparation of the Crucibles.*—The following plan, which I devised, is so simple and so effective, that not only is every difficulty removed, but special advantages are attached to its use.

"Three parts of plumbago and one of loam or fire clay are mixed together and made into a thick paste with water, and the crucible is as equally as possible lined with this paste, which holds firmly to its sides. The thickness of the lining varies with the size of the crucible, but with the largest crucibles it should not exceed half an inch.

"*Smelting of Manganese Ores.*—Any crucible which will stand a white heat for several hours without softening can be used. It is lined with loam and plumbago, as I have previously described, and then the following mixture is introduced into it :

Native oxide of manganese, of good quality	1,000 parts
Lampblack or soot, of good quality	91 "
Green flux	635 "
Oil in sufficient quantity to merely wet the mixture.	

"The mixture is introduced in the crucible and slightly pressed in, and a round cover of thick wood is placed over it. It is carbonized during the smelting, and forms a charcoal fire, which protects admirably the mixture from oxidation, and it can be used several times.

"The clay or plumbago cover is used over the crucible, and the joint is luted with a little thin fire clay. A small aperture is kept to allow the gas to escape.

The crucible is then placed in a wind or blast furnace, and slowly heated so long as fumes escape from the crucible ; the heat is rapidly increased until it reaches white heat, and the furnace is maintained at that high temperature for several hours.

"When it is thought that the operation is done, the fire is allowed to burn away and the crucible is left to cool. The cover is then removed by means of a chisel introduced in the joint. The crucible is turned upside down, and shaken until the slag and metal fall down. The button of metal is detached from its slag with a hammer, and introduced into well-corked or stoppered vessels perfectly dried.

"The slag, which has a fine olive-green color, breaks up in fragments with large faces, affecting a pseudo-crystalline structure, but the grain is really crystalline. It is ground and used as flux in a second smelting. It is advisable after each smelting to add to the slag, in order to make it more fusible, about one-tenth of the white flux.

"The mixing of manganese, ore, lampblack and flux is not an indifferent operation, and to ensure perfect success it should be done in the following way : The oxide of manganese should be first of all thoroughly mixed with the lampblack. This mixture should be pretty roughly mixed with the flux and then oil should be added. By so doing, lampblack and oxide of manganese remain united during the mixing and act upon each other during the smelting, before the flux begins to melt, so that the oxide is reduced to the metallic state before the flux can dissolve any portion of it. The residue of carbon left by the burnt oil assists in reducing the oxide of manganese, and in preventing the flux from acting upon it before it has been reduced to the metallic state.

"The only real improvement of importance would be the addition to the flux of a substance which, in small quantities, would assist in obtaining a cast manganese of a superior quality.

"*Refining of Cast Manganese.*—There is little doubt that as soon as the manganese is prepared on the large scale, and at a comparatively low price, some uses will be found for it. I think that, in certain operations, it might form a good substitute for potassium and sodium ; and in that case cast manganese, such as is obtained after the smelting of its ore, could be used with advantage ; but should a purer kind of metal be required for the manufacture of certain alloys, cast manganese would have to be refined.

The simplest way of refining manganese is the method which has been proposed by BERTHIER, I believe, and consists in remelting the cast manganese coarsely powdered, with about one-eighth of carbonate of manganese. The mixture is introduced into a refractory clay crucible and covered with a wooden cover similar to the one used in smelting, to prevent oxidation."

NOTES ON A METALLURGICAL JOURNEY IN EUROPE.

The Lead and Silver Works of the Hartz Mountains.

BY JOHN A. CHURCH, E. M.

(CONTINUED FROM PAGE 51.)

THE copper matte is roasted in the kilns described above. Fusions take place in what are called in Germany "spectacle" furnaces. They are 10 ft. 8 in. high, have a section of from 18 to 36 in. × 3 ft. 4 in., and owe their name to the fact that they have two reception basins in front. They have one tuyere each, use 250 cubic feet of air per minute at a pressure of 7 to 9 lines of mercury, and smelt from 9,300 to 10,000 lb. of roasted matte in 24 hours. The composition of the charge is the same as in smelting lead matte, except that instead of ore slag a siliceous slag from another operation in the copper process is charged. A very basic slag is produced which eats away the furnace wall so rapidly that the campaigns do not exceed 24 to 30 days. The roasting and fusion is repeated five times, and KUHLEMANN gives the following summary of the charges and products:

FUSION NUMBER		1	2	3	4	5
Charge :	Roasted copper matte....cwt.	5075	2400	1050	300	125
	Siliceous slag..... "	3787	1801	788	225	95
	Slag from same operation.. "	988	480	210	60	35
Fuel :	Coke..... "	1375	715	365	95	30
	Peat for warming...pieces	8590	3000	1400	750	250
	Charcoal furnace.....cu. ft.	10	—	—	10	—
Matte melted in 24 hours .....cwt.		86¾	81¼	100	66¾	83½
Coke used per 100 cwt. matte.....		27	29·8	34·7	29·4	—
Products:	Work lead=0·38 p.c. silv..cwt.	40	—	—	—	—
	Black copper..... "	20	408	384	125	44
	Matte ..... "	2400	1050	300	125	60
	Slag..... "	6100	2600	1160	290	140
100 cwt. matte give	Work lead..... "	0·79	—	—	—	—
	Black copper... "	0·40	17·0	36·57	41·66	35·20
	Matte..... "	47·30	43·75	28·57	41·66	48·0
COMPOSITION OF THE PRODUCTS.						
Black copper :	Copper.....per ct.	40	70	93·5	94	95
	Lead..... "	55	25	1	2	2
	Silver..... "	0·235	0·22	0·160	0·100	0·085
Matte :	Copper..... "	40	66	70	73	73
	Lead..... "	9	5	3	2	2
	Silver..... "	0·0725	0·078	0·065	0·045	0·030
Slag :	Copper..... "	1·	1·	1	1·5	1·25
	Lead..... "	0·75	1·5	0·75	1·25	1
	Silver..... "	0·00093	0·00125	0·00063	0·00063	0·00063

The charge in each fusion was therefore

Roasted matte	100
Siliceous slag	75
Slag from same operation	20

and the time required for its fusion was about 28 hours. To pass 100 cwt. of the first matte through the 5 fusions in succession requires about 51 cwt. coke, 49 hours actual smelting time, and in the 5 fusions 179 cwt. matte will be treated. The data above given are, however, only a portion of the expenses. Counting them as 100 we have to add as follows:

Expenses in fusion,		for labor,	100	for fuel,	100
"	roasting,	"	45	"	28
"	removing slag,	"	13½		
"	transporting matte	"	25		
"	general expenses		97		

The entire cost will be about 165 per cent. of the cost of labor and fuel consumed in the fusions.

The slag used as siliceous flux had the following composition:

Silica	34·67	Lead oxide	1·07
Alumina	4·38	Iron oxide	48·25
Lime	3 53	Sulphur	1·25
Manganese oxide	2·00		
Zinc oxide	2·89		98·64

The following analysis of the slag from the 5th fusion is a fair representation of the same product from all the operations:

Silica	30·994	Lime	4·314
Antimony oxide	0·196	Magnesia	0·253
Iron oxide	58·605	Alumina	5·732
Copper oxide	0·933		
Lead oxide	0·021		101·048

The preceding tables show that a certain amount of black copper is made in each fusion. That from the first operation is, however, small in quantity and quite impure, containing a good deal of lead and silver. The total amount of black copper from all the operations is 19½ per cent. of the first matte. The greater part of it is obtained in the 2d and 3d fusions.

The black copper from all the fusions is mixed with purchased copper containing silver, and "blown" in a reverberatory furnace. The mixture contains from 0·16 to 0·20 per cent. silver and 80 to 83 per cent. copper. The furnace is a cupel hearth of the old form. That is to say, the roof is fixed and must therefore be high enough to permit the workman to enter the furnace to make the hearth. This is formed of clay and coke screenings, with a border of mergel, and is nearly 10 feet in diameter. In front of the furnace is a water basin in which the copper is granulated as it comes out. From 50 to 53 cwt. of black copper is charged, melted in 5 hours, a "carcase" or alloy of higher fusing point than the black copper is drawn off from the surface, and air is blown upon the bath, at first in a feeble current but at length at the rate of 250 cubic feet a minute. Lead, iron, zinc, cobalt, nickel, antimony and some copper are oxidized and, drawing silica from the hearth, form a slag which is drawn or run off from the surface. After blowing 10 or 11 hours the refined copper is tapped and granulated. It contains 91 to 97 per cent. copper and 0·20 to 0·40 per cent. silver. The analysis of a black copper made in this way in 1870 was as follows:

Iron	0·070	Copper	95·00
Lead	2·71	Antimony	1·53
Nickel, cobalt, zinc	0·048	Arsenic	trace
Silver	0·30		
			99·658

In the Notes on Freiberg, the necessity of excluding iron from the matte which was to be treated with acid, and the means used to accomplish this, were spoken of. It will be observed that the same result is reached at Altenau by repeated roastings and fusions, and finally, by an oxidizing fusion of the resulting black copper.

In addition to the black copper, two products are obtained. One is the carcase drawn off from the bath immediately after fusion. It contains 15 to 20 per cent. silica, 5 per cent. nickel oxide, 3½ per cent. cobalt oxide, 10 to 12 per cent. copper oxide, and 35 to 40 per cent lead oxide. The amount produced is small, but when enough has accumulated, it will be smelted with arsenical ores and heavy spar to produce a speise rich in nickel. The other product is the very impure litharge obtained by blowing the black copper, and containing 51½ per cent. lead, 16 per cent. copper, and 0·016 per cent silver. It is mixed with the hearth, which is saturated with the same product, and smelted to a black copper containing a great deal of lead and some silver. This is liquated to remove the lead, and then blown like the ordinary black copper, furnishing, however, a much greater proportion of side products.

The following are the details of the operations in 1869:

Number of charges		74	
Black copper	cwt.	3,225¾	100
Products, Granulated copper	"	2,201	68½
Carcase	"	63	2
Litharge	"	976	30¼
Faggots		39,450	1220
or Bituminous coal	cwt.		42

The faggots mentioned are now replaced by bituminous coal, and experience shows that 1,000 faggots are equal to about 34½ cwt. coals.

The granulated copper is treated with dilute sulphuric acid, by which the copper, iron, nickel, and cobalt are dissolved, leaving a residue composed of gold, silver and arsenic in the metallic state, lead sulphate and basic antimony sulphate. The vats in which the solution is accomplished, are 4 feet high and 3 feet 4 inches in diameter. They are lined with lead, and have a perforated false bottom 4 inches above the floor of the vat. Great care is taken in filling the vat, for it is important to have the mass of granules as open and porous as possible. While copper oxide dissolves readily in dilute sulphuric acid, the metal itself requires hot concentrated acid for its solution. At Altenau the metal is oxidized by allowing the acid in the vat to run out, the air filling the spaces between the granules, which, being hot and moist with acid, oxidize, and the oxide is taken up by the succeeding charge of acid. To ensure the complete access of air, the layer of copper must not be more than 40 inches thick, so that the vat holds about 2,200 lb. It is filled up as often as the surface falls 10 inches below the normal level, which occurs two or three times a week. The vat is cleaned out once in eight or ten weeks. One vat suffices to dissolve about 93 lb. of copper per day, yielding about 360 lb. of vitriol.

The sulphuric acid is taken direct from the chambers, and marks 48 to 50 deg. B. It is thinned to 32 deg. B. in a tank heated by steam to 65 deg. R. The diluted acid is thrown on the copper, by means of a lead pipe furnished with a rose, every half hour. The acid runs through rapidly, but has time to dissolve the oxides formed, and the force of its flow is sufficient to carry along the fine insoluble residues. This is an important point, for without this removal of the residues not only will the granules be covered with an insoluble coat, but the interstices will also be filled up. A turbid liquor discharging from the spout in the bottom of the vat is therefore the sign of a good operation. This spout being left open, air draws through the mass as soon as the interstices are free from acid, the draft being aided by the heat of the copper, derived from the acid. A high temperature hastens the operation, but is liable to cause solution of the silver. The six vats at Altenau discharge into a trough 360 feet long, where the warm solution deposits first the insoluble residue it has brought along, and then, as it cools, the copper sulphate crystallizes out. The trough is 30 inches wide and 7 inches deep. The mother liquor, which is still very acid, is raised to the diluting tank by means of a Gifford's injector, made of lead.

The succeeding operations are for the purification of the copper vitriol and the reduction of the residue. To accomplish the former, the raw vitriol is dissolved in hot mother liquor, the solution marking 28 deg. B. It is filtered through granulated lead, and then through granulated copper to remove by precipitation any dissolved silver, and also to retain residues that were too fine to settle in the trough. In 1½ months the lead and copper have taken up 1 per cent. of silver, and are removed. The copper vitriol is crystallized in vats lined with lead, and with strips of the same metal hanging in the liquor. The vats are emptied every eleven days, and the crystals dried. Their composition is:

Iron	0·0107 per cent.
Antimony	0·0123 "
Arsenic	0·0064 "
Zinc	trace
Nickel	0.0006
Silver	trace
Total impurity	0·0300 per cent.

Nine dissolving vats and three re-dissolving pans treat 2,500 cwt. of copper yearly, producing about 9,000 cwt. of vitriol. Nine men are employed in 24 hours, five by day and four by night.

The argentiferous residues are thrown into a tank, washed, dried, and made up into balls with an equal quantity of litharge. An analysis shows that they contain:

Silver	3.10	Antimony	14.33
Gold	0.004	Arsenic	3.15
Copper	7.15	Sulphuric Acid	16.67
Lead	34.46		

The copper is partly sulphate and partly fine particles which are washed down by the acid. The subsequent treatment consists in smelting the mixed litharge and residue in a shaft furnace and cupelling the metal. Care is taken to treat all the products by themselves, as they are very rich in silver. The details of the foregoing operations are

I.—VITRIOL MANUFACTURE.

Granulated copper treated	cwt.	2305	100
Copper vitriol produced	"	8239	357½
Raw vitriol	"	392	17
Argentiferous residues (one-half litharge)	"	342	14⅞
Sulphuric acid consumed, 50-60 deg. B	"	4373	189¾
Coal	"	8336	361½
In twenty-four hours copper treated	"	6·4	
vitriol made	"	2¼·88	

II.—SMELTING THE RESIDUES.

Charge:	Residues	cwt.	342	100
	Litharge and hearth	"	674½	197¼
	Iron	"	7	2
	Siliceous slag	"	508	148½
	Basic slag	"	372	108¾
Products:	Rich work lead	"	481	140¾
	Rich copper matte	"	49	14½
	Slag	"	1347	394
Coke		"	290	84¾

Thirty cwt. residues were smelted in 24 hours.

III.—CUPELLATION.

Charge:	Work lead	cwt.	536		100
Products:	Auriferous silver	lb.	424	}	105¼
	Ordinary silver	"	150 1·5	}	
	Abstrich	cwt.	114		21¼
	Litharge	"	339		63¼
	Hearth	"	148		27⅞
Fuel:	Faggots		2862		495

It will be observed that while 100 parts pure copper should yield 393·37 parts vitriol, the product from the impure copper used was 357·29 parts of merchantable vitriol, and 17 parts retained by the intermediate products, a total of 374·29, or about 95 per cent. Nor does the use of sulphuric acid correspond with the theoretical requirements, being 189·65 instead of 154·57, as required. The dif-

ference is due to the fact that the acid used is really below 66 deg., and that the intermediate solutions hold a considerable amount of acid, not accounted for.

Labor averages 54 cents a day, and the coal, which is of good quality and bears a high charge for transportation, costs about $4.80 per ton (2240 lb.), and coke $6. Under these conditions, the items in the manufacture of vitriol bore the following proportions:

	VITRIOL MANUFACTURE.	TREATMENT OF RESIDUES.
Sundries	8	7
Labor	20	32½
Acid	52	—
Coal	20	—
Coke		34½
Wood		17
General Expenses		9
	100	100

The cost of treating 100 cwt. of 40 per cent. copper matte was, in 1869, 301 thalers 7½ sgr., or (thaler=72 cents gold) $216.90. While this is apparently high, it is to be remembered that much of it is due to the acid employed, which, however, does not go to waste, but is sold as a part of the finished product. Compared with the old liquation process, the present system extracts about eight per cent. more silver, and is in every respect superior.

The results of the treatment described above are very remarkable in respect to the percentage of the different metals obtained from the ore. KOCH gave the production by the "combined" process or fusion of roasted matte with the ore as,

Silver, 102·5 per cent. of assayed value of ore.
Lead, 100·8 " " "
Copper, 100·3 " " "

Thus the smelting operations gave more metal than the assay calls for, a circumstance that is, of course, due to the fact that losses take place in making the assay which are not accounted for. WEDDING & BRÆUNNING found that by the desilverization process now in use the amount of silver extracted is 2·372 per cent. more than the assay shows to be present in the lead. If, however, the silver absorbed by the cupel is allowed for at 3 per cent., there would be a real loss of 0·628 per cent. of silver. Similar corrections would make still larger differences between the apparent and the real extraction of the other metals. But the Hartz process is, nevertheless, remarkable for the closeness with which it works to the assay. The exact loss is not known, but it is less than 4 per cent. of lead, and probably less than 1 per cent. silver. These results are especially significant from the fact that the Hartz works treat unroasted ore, and they sustain the view of PLATTNER, who looked upon the process of roasting as one decidedly wasteful of metal, by volatilization. Another cause of the small loss is the persistence with which intermediate products of only moderate richness are reduced to metal and again desilvered, a method which would not always pay in America.

But the close extraction of metal is not the only proof of good work in the Hartz. The directors of the various smelting works there are the first to solve the problem of utilizing the sulphur in galena for the manufacture of acid. Pure galena contains only about 13 per cent. of sulphur, a quantity too small to be utilized with profit. It is only by concentrating this element in a matte that it can be made to give sufficiently concentrated fumes for oxidation in the lead chambers. But this matte usually contains so much lead that it sinters at a low heat, a difficulty that has heretofore barred the way to its use in kilns, as a source of acid. The introduction of the precipitation by slag taught the Clausthal metallurgists that it is possible to make a matte poor in lead from lead ores. It seems to be probable that precipitation is more thoroughly performed when the ore trickles through a bath of slag rich in iron than when it is brought in contact with metallic iron, even when the heat is sufficient to melt the latter. The introduction of precipitation by slag increased the amount of matte produced, but it decreased its percentage of lead from 40 to 7 or 10 per cent., and the latter limits have been retained in the matte from the combined fusion of ore and matte. In addition to the metals they contain, the Hartz ores, which are true galenas, are now made to yield a part of their sulphur as acid.

I have found it impossible to obtain any trustworthy calculations of the cost of the above treatment. The following is probably not very far from the truth, rather under than over. The calculation is made on one European ton, 1000 k 2200 lb.:

Ore and lead matte fusions, 2200 lb. ore	$7.82
Treatment of copper matte, 110 lb	2.60
Treatment of lead matte, 1227 lb	2.76
	$13.18 (coin)

The products are about as follows, allowing the production of copper to form 1 per cent. of the ore:

Lead.....1210 lb., or a loss of about 1½ per cent.
Sulphate of copper, 78¾ lb.
Silver.....2 lb.; loss supposed to be about ¾ oz.

Skilled labor costs in the Hartz from 48 to 54 cents coin, and ordinary labor, say from 36 to 43 cents. Coke costs $6.70 per ton; soft coal, $4.80; a "schock," or 60, faggots of wood (equal to 225 lb. soft coal in use), 96 cents; and the copper slag used as a flux in the ore fusion is brought from Oker at a cost of 96 cents a ton.

THE OPERATIONS IN 1871.

Doctor WEDDING contributes every year to the *Preussische Zeitschrift für Berg, Hütten und Salinen Wesen*, which is the official mining journal of the Prussian Government, an account of the current experiments and improvements in the smelting works of that Government. His report of the progress made during 1871 gives so much relating to the Hartz, that I take from it the following details:

The mines of the Upper Hartz yielded in 1871: 154,622 tons (2204 lb.) of ore, which by concentration was reduced to 13,546 tons of smelting ore, having a composition similar to that given above. The smelting ore, therefore, formed 8·7 per cent. of the mine ore, and the latter, as it was hoisted from the mine, must have averaged about as follows: Lead, 5·4 per cent.; Copper, 0·065 per cent.; Silver, 0·0085 per cent., or 3½ oz. to the ton. During that year the smelting works treated 13,911 tons of home and 497 tons of foreign ore, and produced 7,930 tons lead, 47½ tons litharge, 41·58 lb. gold, and 37,523 lb. silver. Of this ore, 9,150 tons were smelted at Clausthal, seven furnaces being used for the first fusion. Five of them were round furnaces, of the KAST and PILTZ pattern, three having 4 tuyeres, one 5, and one 8 tuyeres. Two RACHETTE furnaces, each with 12 tuyeres, were also in operation.

The charge consisted of 100 ore,
" " 51 roasted matte,
" " 67 copper slag,
" " 43 matte slag,
" " 47 slag from the same operation,
308——
1·2 scraps.
1·0 flue dust,
0·5 lead scraps.
2·7——
310·7

The fuel, including the small coke used in making the "gestübbe," which forms the fore hearth, and also that used to warm the furnaces, amounted to
45·17 coke,
2·55 charcoal,
47·72——
or 15½ per cent. of the total charge, and 47¾ per cent. of the ore.

The products were:
58·77 work lead,
76·09 matte.
124·86——

If the amount of matte charged is deducted from that produced, only 25 per cent. remains, which is a very much smaller proportion than that obtained in any former modification of the Clausthal process. In working the 8-tuyered furnace, which at first had a crucible of 4 ft. 8 in. diameter, it was found impossible to blow to the center of the charge, where a pillar of unsmelted material always remained. By shoving the tuyeres toward the center until the diameter of the working hearth was reduced to 1 meter, or 3 ft. 4 in., this difficulty was removed, and this has, therefore, been fixed upon as the standard of a new Piltz, which will have but 4 tuyeres. The other round furnaces do very good work, running through 20 tons of charge (6·7 tons ore) in 24 hours.

At Altenau, 202·6 tons of black copper were treated, producing 288,700 lb. copper, 822·56 lb. silver, and 4,275 tons of sulphuric acid.

From the four establishments at Clausthal, Lautenthal, Altenau and Andreasberg, there were produced in 1871 the following amounts:

43·63	lb.	gold,
37,523·0	lb.	silver,
7,929·4	tons	lead,
47·5	"	litharge,
602·0	"	refined copper,
5,132·0	"	copper vitriol,
427·5	"	sulphuric acid,
22·5	"	lead paint.

This had a value of $1,497,965.

On the Mineral Oils of Puxiere la Grue and Cordessa.

These oils have been examined by JOFFRE in order to ascertain in what point they differ from the petroleum of America. These oils, obtained by distilling bituminous schists, present at first sight a close analogy with the petroleums. They agree very closely in color, fluidity, specific gravity, and in boiling-point. But on the application of certain reagents a difference is at once recognized. The American petroleums, composed of hydrocarbons of the general formula C^nH^{2n+2}, are not attacked by fuming sulphuric acid and monohydrated nitric acid does not form with them nitro-compounds. On the other hand if our mineral oils are treated with the former of these agents, about the half is absorbed. If they are acted on by the second, about the half also is attacked with formation of nitro-compounds. These oils, therefore, are composed of a mixture of several bodies, some of which resist sulphuric and nitric acids while the others are attacked by them. Both these portions have been studied. The oils were first purified by rectification over sodium; and they were then divided by fractional distillation into several groups according to the boiling-point. The portion not attacked by fuming sulphuric acid presents all the reactions of the saturated or formenic hydro-carbons, C^nH^{2n+2}. It resists the action of the most energetic reagents. Neither fuming nitric acid nor a mixture of nitric and sulphuric acids attacks it in the cold. At a boiling heat, however, it is attacked, under formation of acid products which remain dissolved in the excess of oil. The boiling-points and specific gravities correspond with those of the saturated hydrocarbons. Elementary analysis give results which point to the general formula C^nH^{2n+2}. This part of the mineral oils is therefore formed of saturated or formenic hydro-carbons. They seem either identical or at least isomeric with those which Pelays and Gheurs extracted from the American petroleums. By acting upon portions of the oil with more or less elevated boiling-points, each of the hydro-carbons of the saturated series is obtained, from the hydride of octyle C^8H, to the hydride of myristyle $C^{14}H^{31}$. In the portions which distill over at the end we find the hydrides of pentadecyle $C^{15}H^{32}$, of hexadecyle $C^{16}H^{34}$, and of heptadecyle $C^{17}H^{36}$. The proportion of the saturated is about 50 per cent. The portion attacked by acids consists of hydrocarbons of the ethylenic series C^nH^{2n}, mixed with a certain quantity of hydro-carbons still less hydrogenised. These oils contain neither benzole nor naphthalin. At first sight we might be surprised at the absence of the bodies so generally met with among pyrogenous products. But on further reflection, we cannot help admitting that this is quite natural. The manufacturer of mineral oils seeks to distil the schists at the lowest possible temperature, in order to avoid the formation of gas and to secure the largest possible yield of oil. In consequence, his retorts never reach a temperature sufficiently elevated to permit the formation of benzole and naphthalin.

THE COAL TRADE.

NEW YORK, July 19, 1873.

Anthracite.

There is little of importance to note this week in the coal trade. A fair business is done in deliveries on contract for the season, and a slight increase may be noted for the past week in the sales made by some of the leading concerns in the trade. Prices are steady at the advance, and there appears no reason to doubt that the large companies will be able to carry out their programme of an "ascending series" from month to month, so that an average may be realized for the season, which shall, in some measure, offset the low prices obtained in '72.

The daily press, as is its wont in dealing with the coal question, is just now striking out at it more wildly than is the habit of the Traditional Irishman at a Donnybrook Fair. It is certain that if the press can induce buyers to delay their purchases till later in the season, prices will then be advanced beyond the reasonable figures of what is called the "Combination," by the rush to secure supplies before the season closes. To the mere speculator in the trade this would be a delightful state of things, but not so to those who have permanent interests in it. Steady, fair prices and regular delivery of the coal as it comes to tide, are the conditions which the latter are seeking to establish—and these conditions are evidently precisely those most desirable for both producer and consumer.

The monthly auction sale of Scranton coal takes place on the 30th instant, when 75,000 tons will be offered for sale as per advertisement in another column.

As usual, the several companies have fixed their prices on the 22d, and for the guidance of our readers we publish the following circulars, which explain themselves:

Lehigh Coal and Navigation Company, Circular No. 6.

NEW YORK, July 22d, 1873.

"OLD COMPANY'S LEHIGH," "ROOM RUN," "PLYMOUTH," AND "NEWPORT" COALS.

The following prices have been fixed for coal mined by this Company, delivered at Port Johnston, N. J., during the month of August.

	Old Co's. Lehigh,	Room Run,	Plymouth,	Newport.
Lump	$5 80	$5 65	$	$
Broken	5 65	5 50	5 15	5 15
Egg	5 65	5 50	5 40	5 30
Stove	5 70	5 95	5 60	5 50
Chestnut	5 00	4 95	4 90	4 90

WM. H. TILLINGHAST, N. Y. Agent

New York Lehigh Coal Exchange.

NEW YORK, July 22, 1873.

At a meeting held this day, the following prices were adopted for August shipments at Elizabethport, Port Johnston, and Hoboken.

Lump	$5 65
Broken	5 50
Egg	5 50
Stove	5 65
Chestnut	4 95

E. BELKNAP, Secretary.

PENNSYLVANIA COAL COMPANY.

NEW YORK, July 19th, 1873.

Lump	$4 80	per ton.
Steamer	4 80	"
Grate	4 90	"
Egg	5 00	"
Stove	5 30	"
Chestnut	4 80	"

Freight to New York, sixty cents per ton.

GEO. A. HOYT, Treasurer.

PHILADELPHIA & READING COAL & IRON CO.

NEW YORK, July 19, 1873.

The following prices will be charged for the coals mined by this Company, deliverable on board vessels at Port Richmond, Philadelphia, from Aug. 1st to Sept. 1st, subject to our printed conditions.

The Company reserve the right to withdraw or change these prices at any time during the month except on sales made prior to such changes.

	Lump	Steamer	Broken	Egg	Stove	Chestn
Hard White Ash Coal	$4.40	4.40	4.50	4 50	4.70	3.75
Free Burning White Ash Coal	$4.40	4.40	4.50	4 50	4.70	3 75
Schuylkill Red Ash Coal			4 50	4.65	4 85	3.80
Alaska Red Ash "			4.50	4 50	4 70	3.75
Shamokin White Ash "			4 60	4.80	4.90	4.00
Shamokin Red Ash "			4 60	4.80	4 90	4.00
North Franklin "			4.75	4.90	4.90	3.80
Lorberry "			5.05	5.05	5.05	4.10
Lykens Valley "				6.00	6.00	4 60

Parties having application contracts with us and wishing their quota for next month at the above prices, will please fill out enclosed blank and return to us by the first proximo, the failure of which will be considered a refusal on their part to accept the same.

Canal freight to New York in the Company's boats will be one dollar and twenty cents, alongside. Consignees to pay the cost of unloading.

E. A. QUINTARD, Gen'l. Sales Agent.

The Wilkes-Barre Coal and Iron Co. Circular No. 9.

NEW YORK, July 19th, 1873.

WILKES-BARRE COAL.

The following will be the prices for coal deliverable on board vessel at Port Johnston, N. J. during the month of August.

The Company reserves the right to change same at any time, except on contracts made prior to such variation. All subject to our printed conditions.

Lump	$4 85
Steamer	4 95
Broken	5 05
Egg	5 20
Stove	5 40
Chestnut	4 85

JNO. F. WILSON, Sales Agent.

The Philadelphia and Reading Railroad Company issue also the following freight circular.

PHILADELPHIA, July 19th, 1873.

The charge for freight on Anthracite Coal carried on the Schuylkill Canal, in boats of the Philadelphia and Reading Railroad Company, on and after August 1st, 1873, will be as follows, and so continue until further notice:

	From Schuylkill Haven.	Port Clinton.
To Orwigsburg Landing	.30	.25
" Hamburgh	.30	.25
" Mohrsville	.35	.30
" Althouse's	.35	.30
" Reading	.40	.35
" Birdsboro	.44	.39
" Monocacy	.48	.43
" Port Union	.50	.45
" Pottstown	.52	.47
" Lawrenceville	.59	.54
" Royer's Ford	.59	.54
" Phœnixville	.59	.54
" Port Providence	.60	.55
" Pawling's Dam	.60	.55
" Valley Forge	.60	.55
" Port Kennedy	.60	.55
" Norristown	.62	.57
" Bridgeport	.62	.57
" Plymouth Dam	.62	.57
" Conshohocken	.62	.57
" Spring Mill	.62	.57
" Manayunk	.65	.60
" Philadelphia	.65	.60
" Bridesburg, add $10 per boat	.65	.60
" Beverly, N. J	.80	.75
" Florence, N. J	.80	.75
" Bordentown, N. J	.82	.77
" Trenton, N. J	1.00	.95
" New York	1.75	1.70
" Cooper's Creek, N. J	.70	.65
Up Darby Creek		
To S. Morton and Son	.85	.80
Up Ridley Creek to near its mouth	.85	.80
" Chester—to all points below railroad	.85	.80
" Chester Creek—Hospital	.90	.85
" " " Crozer's	.95	.90
" Wilmington, Del	.85	.80
" Brandywine	.90	.85
" Newport, Del	.95	.90
" New Castle, Del	.90	.85
" Delaware City	1.10	1.05
" Salem, N. J	1.15	1.10
" Bridgeton, N. J	1.60	1.55
" Odessa		
" Port Deposit, Md		
" Baltimore		

The above rates are exclusive of the cost of unloading, as per circular.

C. W. WHARTON, Supt. of Canal.

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 July 19, 1873, compared with week ending July 20, 1872.

COMPANIES.	1872. Week.	1872. Year.	1873 Week.	1873 Year.
C. & O. Canal	15,422	320,284	23,337	325,615
B. & O. R. R.	25,705	678,271	33,349	765,832
Penn. S. Line	....	.....	602	45,165
H. & B. T. R. R.	6,806	159,002	5,902	241,277
*Harrisburg & D.	8,032	277,585	5,652	195,203
*L. V. R. R.	888	17,561	604	17,935
P. & N.Y.C. & R. Co.	8,382	213,800	6,437	180,752
Cumberl'd Branch Canal	6,840	105,336	6,164	58,709
" Railroad	529	10,269	252	56,655
Total	72,603	1,782,098	82,299	1,867,143
			72,603	1,782,098
Decrease	....			
Increase	....		9,696	105,045

Pennsylvania Coal Company.

Shipments of Pittston Coal for the week ending July 19, 1873.

	1873. WEEK.	1873. YEAR.	1872. WEEK.	1872. YEAR.
By Railway	29,313 18	640,162 03	25,486 18	635,956 14
Canal	251 17	3,902 12	119 00	2,392 07
	29,535 15	644,064 15	25,605 18	637,449 01
Increase, 1873	6,015 14			

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 July 19, 1873, compared with the week ending July 20, 1872.

COMPANIES.	1873. WEEK.	1873. TOTAL.	1872. WEEK.	1872. TOTAL.
Phila & Reading R. R†	99,417	2,537,275	121 37	2,773,899
Schuylkill Canal	21 796	416,903	21,900	343,176
Lehigh Valley R. R.	67,816	1 9.8.245	70,961	1,943,095
Lehigh & Sus. R. R.	38,351	900,800	34 3?2	1,046.8 1
" " Canal	24.741	336,.58	28,757	312,536
Scranton North	16,633	371,9?8	2.,875	430,975
" South	42,225	1,182,849	31,524	1,220,7?4
Penn. Coal Co., rail	25,487	626,057	22,324	640,102
" " " canal	119	2,392	252	3,067
Del. & Hud C. Co. Canal	45,228	6?8 958	44,098	644,525
" " East	4,722	326,55	8,264	212,909
" " West	12,264	209,123	13,129	262,248
" " South	1,143	209,117	1,221	126,206
Shamokin	15,265	285,369	14,106	316,245
Trevorton	....	....	....	....
Lykens Valley Coal Co.	....	....	....	....
Wyoming North	....	....	....	....
Wyoming South	....	....	....	....
P. N. Y. C. & R. R. Co.	12,980	357,517	16,703	403,137
Williamstown Col'y	....	.....	....	....
Big Lick Col	....	.....	....	....
Total	429,067	10,305,309	453,937	10,691,710
1872			4.9,067	10,305,309
Increase			24,870	386,401
Decrease				

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

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

Report of Coal Transported over Lehigh Valley Railroad

Report of coal tonnage for the week ending July 19, 1873, with Totals to date, compared with same time last year.

WHERE SHIPPED FROM.	WEEK. Tons. Cwt.	TOTAL Tons. Cwt.
Total Wyoming	18,198 02	513,866 08
" Hazleton	32,665 13	1,277,187 16
" Upper Lehigh	25 07	2,099 09
" Beaver Meadow	14,594 01	399,321 11
" Mahanoy	14,165 11	281,947 05
" Mauch Chunk	25 16	2,340 19
Total	99 672 09	2,476,188 11
Same time last year	84 7.0 16	2,375,428 13
Increase	14,951 13	100,754 18
Decrease	.....	.....
Forwarded East from Mauch Chunk by rail	70,981 02	1,943,085 05
Same time last year	62.8 6 06	1,908,245 02
Increase	8,164 16	34,830 03
Decrease	.....	.....

DISTRIBUTED AS FOLLOWS.

Local East of Mauch Chunk	951 13	47,044 00
Forwarded East for use L. V. R.	1,126 00	33,806 00
Delivered to Furnaces and Manufacturing Companies	12,4(0 10	435,258 12
Delivered to Cat & Fog. R. R.	53 02	3.6.8 02
" " East Penn R. R.	90 06	6,346 17
" " North Pennsylvania Railroad	5 212 15	196,.75 10
" " Port Del	5,705 14	97,9.8 07
" " East Amboy Railroad	.....	.....
" " Morris and Essex Railroad	5,222 14	180,079 18
" " Bel. Del Railroad	29,214 00	594,132 04
" " Central Railroad	11,014 06	348,950 15
Delivered at and above Mauch Chunk for use of L. V. R. R.	1,187 07	43,646 02
To P. & N. Y. C. R.	13,741 09	2.8,145 04
To Northern Central R. R.	979 04	9,877 18
To D. H. & W. R. R.	257 17	21,257 18
To L. & S. R. R. at Packerton for rail	45 10	6,020 06
To Individuals at Mauch Chunk	251 00	1,778 04
To Individuals above Mauch Chunk	.....	9 3.8 11
To L. & S. R. R., at Penn Hav., for railroad	.....	1,541 10
Do. for canal	8,479 06	91,543 15
To Lehigh Canal Mauch Chunk	5,609 14	88,493 09
To Catawissa Railroad	.....	50 03
To L. & B. R. R. at Lack. June	.....	57,910 06
Total	90,672 09	2,476,183 11

Report of Coal Transported over the Lehigh Canal

For the week ending July 18, 1873.

REGIONS SHIPPED FROM	TIDE. tons. cts.	LOCAL. tons. cts.	TL. WEEK tons cwt.	TL. DATE tons, cwt.
Mauch Chunk Region	5,251 12	4,280 14	9,532 06	97,355 07
Mauch Chunk Region Hazardville	866 07	196 03	1,062 10	6,496 10
Beaver Meadow Region	774 06	4,660 11	5,435 02	51,160 08
Mahanoy Region	241 01	770 01	1,158 02	8,734 19
Hazleton Region	1,926 19	6,632 07	8 4?9 06	91,347 15
Upper Lehigh Region		1,031 13	1,031 13	12,651 05
Wyoming Region	933 16	958 14	1,892 04	43,866 02
Wyoming Region, Hazardville	475 12		475 12	738 08
Total	10,509 07	18,247 09	28 756 16	312,535 04
Previously reported	1:5813 13	177964 15	283,778 08	
Total to date	116323 00	196212 04	312,535 04	
Corresponding week last year	130960 10	205299 02	336,.57 12	
Increase				
Decrease	14,646 10	9,075 18	23,722 08	

DISTRIBUTION.	WEEK 1873.	WEEK 1872.	YEAR. 1873.	YEAR. 1872.
Consumed on line of Lehigh Canal	3,429 17	1,429 11	29,655 02	33,794 17
Passed into Morris Canal to Tidal Points		127 16	916 18	2,262 13
Passed into Morris Canal to Local Points	876 14	1,138 11	11,284 19	9,884 13
Passed into Del. & Rar. Canal to Tidal Points	10,509 07	10,095 07	115,406 02	128,716 17
Passed into Del & Rar. Canal to Local Points	189 01	287 16	5,782 10	7,684 11
Consumed on line Delaware Div. Canal	1,821 01	1,742 17	15,870 18	20,750 16
Passed through to Bristol	12,980 16	9,220 15	133,018 15	133,184 11
	28,756 16	24,740 13	312,535 04	336,?

Penn. and P. Y. R. R.—Coxton, Pa.

Coal tonnage for week ending July 19, 1873.

	Week. Tons.	Cwt.	Total. Tons.	Cwt.
Anthracite received:				
From Lehigh Valley R. R.	13,731	09	263,145	04
" Lack. & B. R. R.	514	02	17,179	00
" Pleasant Valley R. R.	1,929	12	101,717	14
" Sul. & Erie R. R.	576	14	21,095	11
Total	16,751	17	403,137	09
Same time last year	12,860	01	357,516	14
Increase	3,891	16	45,620	15
Decrease				
Distributed:				
To Lehigh Valley R. R.	288	7	23,568	01
To Lack. & B. R. R.	49	13	820	06
To S. Central R. R.	1 629	11	90,451	07
To Ithaca & A. R. R.	6,137	14	75,105	00
To Erie R. W. Pockets for shipm't.	5,534	13	140,166	01
To Erie Railway, Watkins direct.	1,153	12	3,375	14
To individuals on line of road	147	10	17,902	05
To points at & above Coxton for use of Co.	869	05	16,965	01
To points between Waverley and Elmira	551	12	34,933	14
Total	16,751	17	403,137	09
Bituminous received from BARCLAY R. R.				
Shipped north from Towanda	6,360	04	179,289	03
Shipped south from Towanda	77	00	1,270	19
Northern Central R. R.			91	14
Total	6,437	04	180,751	16
Same time last year	8,382	07	213,799	17
Increase	1,945	03		
Decrease			33,048	01
Distributed:				
To Erie Railway	6,235	13	159,693	01
To So. Central R. R.	64	09	19,479	06
To Ithaca Valley R. R.	62	02	275	19
Lehigh Valley, R. R.	6	00	592	16
To individuals on line of Railroad.	71	00	691	10
To points on line of road for use of Company			118	04
Total	6,437	04	180,751	16
Grand totals transported				
Anthracite	16,751	17	403,137	09
Bituminous	6,437	04	180,751	16
Total	23,189	01	583,889	05
Same time last year	21,242	08	571,216	11
Increase	1,946	13	12,572	14
Decrease				

Statement of Coal Transported over Cumberland and Pennsylvania Railroad

During the week ending Saturday July 19, 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	24,336	15	33,349	02	602	10	57,287	07
1872	15,422	10	25,765	06	....		41,127	16
Increase	7,914	05	7,613	16	602	10	16,160	11
Decrease	....		....		....		....	

YEAR.

1873	325,614	14	765,891	11	45,164	18	1,136,611	03
1872	320,284	06	678,271	07	....		998,555	13
Increase	5,330	08	87,620	04	45,164	18	138,056	10
Decrease	....		....		....		....	

Cumberland Branch R. R.

WEEK.

	To C. & O. Canal. Tons.	Cwt.	To B. & O. R. R. Co Tons.	Cwt.	Total. Tons.	Cwt.
1873	6,161	02	252	00	6,416	02
1872	6,839	18	521	13	7,360	11
Increase	....		....		....	
Decrease	675	16	277	13	953	09

YEAR.

1873	58,709	01	56,655	19	115,365	03
1872	105,336	02	10 2 9	09	115,605	11
Increase			46,386	10		
Decrease	46,626	18			240	08

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

Week ending July 19—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	21202 11	8951 02	2823 16	29977 09	860011 07
Upper Lehigh		3042 10	962 03	4004 14	108595 11
Beaver Meadow	2506 16	18 2 06	3093 04	7401 18	117377 08
Hazleton		227 01	8431 14	8706 15	99674 15
Mauch Chunk	1207 04	33 6 01	10096 81	1.189 09	2-3358 04
Total	249 6 01	14979 05	25396 19	65292 05	1,5869 6 17
Prev'ly reported	727429 03	543653 12	250561 17	1521614 12	
Total to date	752345 04	558612 17	276918 16	1586906 17	
Same time .1872	663310 13	440642 13	212308 01	1216531 07	
Increase	108734 11	119900 04	63640 15	79 375 10	
Decrease					

DISTRIBUTION.	WEEK 1873.	WEEK 1872.	YEAR 1873	YEAR 1872.
Forwarded East by Rail to Tidal points	24916 01	26531 01	752345 04	643910 13
Forwarded East by Rail to Local points	7735 18	10103 04	278290 01	210021 18
Forwarded East by Rail use Central Division	1760 04	1716 13	49632 16	42535 01
Forwarded East by Rail use L. & S.	203 11	131 15	6786 19	4763 13
Delivered at and above Mauch Chunk	1292 15	1051 15	4 941 03	29430 22
Delivered at Coalport & Hazard for Canal	26389 11	19434 13	308185 01	239074 00
Delivered to L. V. R. R. at Packerton	120 09	199 13	14972 08	8282 11
Delivered to L. V. R. Rd. at Sugar Notch	1382 01		5771 06	
Delivered to L. & B. R. R. at Plymouth Bridge	1502 15	5372 07	117124 16	116763 09
Total	65292 05	64531 01	1586906 17	1296531 07

Northern Central Railway, Shamokin Division.

Below is the return of Coal sent over the Shamokin Division of the N. C. R. W., for the 7 days ending July 18, 1873.

	Tons.	Cwt.	Tons.	Cwt.
East	213	07		
West	13,892	09		
			14,105	16
Same time last year			15,264	14
Increase				
Decrease			1,158	18
Total amount shipped to date			316,245	08
Same time last year			286,269	01
Increase			29,976	07
Decrease				

Prices of Coal by the Cargo.

(CORRECTED WEEKLY.)

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

Company Coals.

August, 1873.

	L.	Bkr.	Gra.	Egg.	Sto.	Chest
*Scranton at E. Port	— —	— —	— —	— —	— —	— —
Pittston at Newburgh	4 90	4 80	4 90	4 90	5 30	4 80
*Lackawana at Rondout	4 85	4 95	5 05	5 20	5 40	4 85
Wilk'b're at Hoboken	4 85	4 95	5 05	5 20	5 40	4 85
Old Co. Lehigh at Pt. John'n	5 85	—	5 65	5 65	5 70	5 60
New York Coal Exchange	5 65	—	5 50	5 50	5 65	4 95

For freights to different points see "Freights"

*To contractors only.

Prices at Baltimore—July, 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	
Tyconnel f. o. b.	$7 00

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

July, 1873.

George's Creek and Cumberland f. o. b. for shipping $5 00@— —

Prices at Havre de Grace, Md.

July, 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 "	7 50

Prices of Foreign Coals.

July, 1873.
Duty 75 c. per ton.

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

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

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

PRICES FROM YARD.

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

Per ton 2,000 lbs. delivered.

Prices of Gas Coals.

July, 1873.

PROVINCIAL.

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

	Coarse.	Slack
Block House, f. o. b. at Cow Bay	$2 50	$1 25
Gowrie	2 01	0 00

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

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

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

AMERICAN.

	Nominal quo Currency.
Westmoreland f. o. b.	$6 00 @7 00
Fairmount Gas Coal Co. of N. Y. "	6 50 @7 00
Despard Coal Co. "	6 50 @7 00
Penn. "	6 50 @7 00
Newburg Orrel Gas "	6 50 @7 00
West Fairmount Gas Coal "	6 50 @7 00
Redbank Cannel, at Pa "	12 00 @0 00

AT PHILADELPHIA.

Westmoreland "	7 50 @0 00

Rates of Transportation to Tide Water.

BY RAILROAD.

TO PORT RICHMOND, PHILADELPHIA.

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

MAUCH CHUNK TO ELIZABETHPORT.

L. V. Railroad from Mauch Chunk to Phillipsburgh	$0 72
C. R. R., N. J., Phillipsburgh to Elizabethport	06
Shipping expenses at Elizabethport	25
Wharfage	10
Total	$2 23

MAUCH CHUNK TO PORT JOHNSTON.

L. V. R. R., or L. & S. R. R. from M. C. to Phillipsb'g	$0 72
C. R. R., of N. J., Phillipsburgh to Pt. Johnson	1 06
Shipping expenses	25
Wharfage	10
Total	$2 23

TO HOBOKEN

L. V. R. R., Mauch Chunk to Phillipsburgh	72
Morris & Essex R. R. Phillipsburgh to Hoboken	1 06
Shipping expenses	25
Wharfage	00
Total	$2 23

TO SOUTH AMBOY.

L. V. R. R.	72
B. & D. R. R.	1
Cam. & Am R. R.	
Shipping Expenses	25
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 25

Freights.—July, 1873

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

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

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

Foreign and Provincial Freight

July, 1873.

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

TO NEW YORK.

Provincial

Sydney	
Lingan	$3 75
Cow Bay	4 00
Port Caledonia	4 00
Little Glace Bay	4 00
	4 00

TO BOSTON.

Sydney	3 50
Lingan	3 60
Cow Bay	3 70
Port Caledonia	3 50
Little Glace Bay	3 50

TO MONTREAL.

Caledonia	3 75 gold

TO CUBA.

Caledonia	9 50 gold.

MARKET REVIEW.

NEW YORK, July 23, 1873.

IRON—Most of the purchases of Glengarnock Scotch Pig sold to arrive, as noticed in our previous issues, have been received and are now going in yard, being held for better prices than those now ruling; there are but few lots now on the market outside of speculators' hands, who are now asking $45 for Eglinton, and $46 for Glengarnock; seventy-five tons Coltness sold at $51 50, which is an advance on previous late sales—the market, on the whole, shows a better inquiry and a somewhat more active business; Garlsherrie may be quoted $48. No. 1 American Pig is without any particular change of note; there is a fair jobbing demand at about our quotations; No. 1 may be quoted $46@$48 (some companies asking higher), No. 2 $43@45, and Gray Forge $35@$37. New Rails are dull. Holders of old English are not pressing their stocks at present rates, the market is consequently in a very quiet position. Scrap is not active—a sale of 100 tons Machinery was reported sold at $40. Refined Bar from store continues quiet and unchanged in value.

DECLINE IN THE ENGLISH MARKETS.—Late mail advices from England report a material decline in Iron, during the early part of July, throughout the Iron districts. The reduction is very large, amounting in some cases to three pounds sterling to the ton, and in one at least to four pounds, being a reduction of 16 per cent. There is no visible cause for this drooping, which has not been in operation during the last six months. Labor is quite as high as it has been, and coal is higher than ever, a large advance being announced simultaneously with the decline in Iron. The most plausible theory is that the steady decline in the demand for Iron from abroad has opened the eyes of English manufacturers to the danger they are in of losing their foreign markets. This would be at any time a sufficient reason for making the charges as low as possible; but such considerations have been neglected during the past year. It is by no means certain that the decline will be maintained, as many of the Iron men have yielded most reluctantly to the pressure upon them, and regard the movement at this time as premature.

LEAD—The demand for Pig is limited; fifty tons Spanish sold at 6¾ cents gold, and 100 do. Domestic sold at a private price. Bar 9¼ cents, Sheet and Pipe 10½, and Tin-lined Pipe 16½, less 10 per cent. to the Trade.

Withdrawals from bond for consumption 18th, 19th, and 21st July—

Lead.....pigs.696
Lead, England, &c.....500

COPPER—Manufactured is unchanged; we quote New Sheathing 38 cents, and Bolts and Braziers 40; Bronze and Yellow Metal Sheathing 27, and Y. M. Bolts 32, net cash. The demand for Ingot continues very light, and we have only to notice the sale of 50,000 lb. Lake at 26¾ cents; at the close there was rather a better feeling, and 27@27½ cents was asked.

SPELTER—Foreign is dull and prices are nominal at 7½@7¾ cents, gold.

REGULUS ANTIMONY—Is dull, and can be bought at 13¾ cents gold.

STEEL—There is no new feature to note in the market.

TIN—The Cable quotations for Pig from London come a little lower, and the market here is dull and easier; the sales are 250 slabs straits at 31½ cents, and five tons English to arrive 29; we quote English on the spot 29¾@30 cents, Straits 31½@31¾, and Banca 35½ on the spot and 34¾ to arrive, all gold. Plates are quiet; the jobbing demand is light and the market is heavy; sales have been made of 500 bxs. Coke Tin at $9.12½; 1,000 bxs. do. Wasters, $8.50@$8.62½; and 4@500 do. Charcoal Terne, $10.12½@$37½, all gold. We quote Charcoal Tin $11.25@$11.37½, Coke Tin $9@$9.50, Coke Terne $8@$9, and Charcoal Terne $10@10.50 gold.

Withdrawals from bond for consumption 18th, 19th and 21st July—

Tin from England.....bxs.355

ZINC—Sheet continues quiet, the agents' price of Mosselmann being still 10 cents, less 4 per cent. gold. French 9¼@9½, Am. Oxide 8½@9, Manganese 4½.

METALS.

NEW YORK, July 23, 1873.

IRON.—Duty: Bars, 1 to 1½ cents ₩ lb; Railroad, 70 cents ₩ 10 lbs.; Boiler and Plate, 1½ cents ₩ lb; Sheet, Band, Hoop, and Scroll, 1¼ to 1¾ cents ₩ lb; Pig, $75 ₩ 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	$1 50@52 00
Garlsherrie	47 50@48 00
Glengarnock	— —@46 00
Eglinton	45 00@— —
Pig, American, No. 1	46 00@48 00
Pig, American, No. 2	43 00@45 00
Pig, American, Forge	35 00@37 00
Bar Refined, English and American	— —@— —
Bar Swedes, assorted sizes (gold)	— —@137 50
Bar, Swedes, 1¾ to 5 x ⅜ & ¾ 2 sq. & 6 to 12 x ⅜ & ½	175 00@185 00
Bar, Refined, ¾ to 2 in. rd. & sq. 1 to 6 in. x ⅜ to 1 in.	92 50@ 95 00
Bar, Refined, 1⅛ to 6 by ¼	97 50@100 00
Bar, Refined, 2⅛ to 2⅝ round 1 & 1¼ by ¼ & 5-16	100 00@102 50
Large Rounds	102 50@117 50
Scroll	112 50@145 00
Ovals and half-round	120 00@140 00
Band	110 00@112 50
Horse Shoe	— —@122 50
Rods, ⅜ to 3-16 inch	97 50@147 00
Hoop	1.0 00@170 00
Nailrod	9¼@ 9½
Sheet, Russia, as to assortment (gold)	17 @ 18½
Sheet, Singles, D. and T. Common	— 6 @— 7
Sheet, D. and T. Charcoal	— 7 @— 8¼
Sheet, Galv'd, list 15 per cent. discount	— —@— —
Rails, English (gold), ₩ ton	68 00@ 70 00
Rails, American, at Works in Pennsylvania, currency	78 00@ — —

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

	All Cash.
Copper, New Sheathing, ₩ lb	— @— 38
Copper Bolts	— @— 40
Copper Braziers, 16oz. and over	— @— 40
Copper Nails	— @— 45
Copper, Old Sheathing, &c. mixed lots	26 @— 27
Copper, Old, for chemical purposes, 14@16 oz.	— @— —
Copper, American ingot	26¾@— 27
Copper English Pig	— @— 28
Yellow Metal, New Sheathing & Bronze	— @— 27
Yellow Metal Bolts	— @— 32
Yellow Metal Nails, Sheathing and Slat'g	27 @— 30

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

Pipe and Sheet, 2¾ cents ₩ lb.	
Spanish (gold)	6 50 @6 62½
German, do.	6 50 @6 62½
English do.	6 62½@7 00
Domestic do.	6 12½@— —
Foreign, Refined	7 25 @— —
Bar.....(net)	9 25 @— —
Pipe.....(net)	— — @10 50
Sheet	— — @10 50

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

English Cast (2d and 1st quality) ₩ lb	— 18½@— 21
English Spring (2d and 1st quality)	— 9½@— 10½
English Blister (2d and 1st quality)	— 14 @— 18½
English Machinery	— 14½@— —
English German (2d an 1st quality)	— 12½@— 14½
American Blister "Black Diamond"	— — @— 11½
American, Cast, Tool do.	— — @— 17
American, Spring, do.	— — @— 11
American Machinery do.	— 11½@— 12
American German, do	— 2 @— —

TIN.—Duty: Pig, Bars, and Blocks, 15 ₩ cent. ad val.; Plate and Sheets and Terne Plates, 25 ₩ cent.; Roofing 35. ad val.

	Gold ₩ lb.
Banca	35½@—
Straits	31¼@31¾
English	29¾@30

PLATES.

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

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

Plates, Foreign.....(gold).....p. 100 lb.	7 50 @— 7 75
Plates, Domestic.....p. lb.	8¾@— 11

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

Sheet	per lb.—10½@11

American Institute of Mining Engineers.

OFFICIAL BULLETIN.

Announcements to Members and Associates.

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

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

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

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

THOMAS M. DROWN, Secretary.

1123 Girard street, Philadelphia, Pa.

SUPERIOR RAIL MILL.—CAPACITY: 1,000 TONS PER WEEK.

Harbaugh, Mathias and Owens,

Manufacturers of

RAILROAD IRON,

Office, corner Fifth Avenue and Smithfield Street, Pittsburgh.

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

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

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

MISCELLANEOUS.

The Largest Organ Establishment in the World.

SEVEN EXTENSIVE FACTORIES.

J. ESTEY & COMPANY,

BRATTLEBORO, VT., U. S. A.

THE CELEBRATED

ESTEY COTTAGE ORGANS.

The Latest and Best Improvements.

Everything that is new and novel. The leading improvements in Organs were introduced first in this establishment.

ESTABLISHED 1846.

SEND FOR ILLUSTRATED CATALOGUE.

April 1:6m

116th Auction Sale.

75,000

TONS SCRANTON COAL.

On WEDNESDAY, JULY 30th, 1873.

NEW YORK, July 21, 1873.

The Delaware, Lackawanna and Western Railroad Company will sell, by MESSRS. JOHN H. DRAPER & CO., Auctioneers, at the Company's Sales Room, 26 EXCHANGE PLACE, corner of William Street, NEW YORK, on WEDNESDAY, JUNE 25th, at 12 o'clock, noon,

75,000 TONS

OF

COAL, FROM THE LACKAWANNA REGIONS,

of the usual sizes, deliverable at the option of the Company at their Coal Docks either at Hoboken or Elizabethport during the month of August, 1873.

The sale will be positive; each lot put up will be sold to the highest bidder; no bids, in any form whatever, being made for account of, or on behalf of the Company. The conditions will be fully made known at the time of sale.

TERMS: FIFTY CENTS PER TON, payable in current funds, on the day of sale, and the balance, within ten days thereafter, at the office of the Company.

SAMUEL SLOAN, President.

THE PULSOMETER,

OR

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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.

We publish elsewhere an interesting statement of the results of an examination of the mineral oils of Puxiere la Erne and Cordesca, by JOFFRE. These oils present, in many respects, a very close analogy to our petroleum, and the object of the examination was to ascertain the points of difference.

The new Tariff Act of Germany makes a sweeping reduction in the duties on raw and manufactured iron, and prepares the way for their entire repeal. According to the provisions of the bill, raw iron and old iron will be admitted free of duty after the 1st of October, and blooms still containing the scoriæ, at 10s. per ton; at the same time the duty on hammered and rolled iron and double-angle iron and thick sheet, will be reduced from 35s. to 20s.; rough castings and forgings and unfinished articles in steel, sheet iron, iron or steel wire, or joined with woodwork, will pay 50s.; locomotives, tenders and boilers, 40s.; and steam and other engines and machinery, 25s. per ton. The bill also provides that all these duties shall cease on the 1st of January, 1877. The measure is much more sweeping in its provisions than had been anticipated, and the result of its workings will be awaited with interest by the iron-masters and manufacturers of this country and Great Britain.

THE cable informs us of the death of the distinguished German chemist and mineralogist, GUSTAV ROSE, at Berlin, in the seventy-sixth year of his age. ROSE was a native of Prussia and was educated at the University of Berlin, where he received the degree of doctor of philosophy in 1821. He devoted himself to the study of chemistry in its application to mineralogy. After spending some time in the laboratory of Berzelius at Stockholm, where he pursued his investigations with great zeal and success, he was appointed Assistant Professor of Mineralogy in the University of Berlin and Conservator of the Collection of Minerals. ROSE was first brought into general notice by the part which he took in the expedition sent out by the Emperor of Russia in the year 1829, to explore Northern Asia. The explorations were conducted by HUMBOLDT, EHRENBERG and ROSE. The part which the latter took in this expedition is described in his interesting work entitled, "A Journey to the Ural, Altai and the Caspian Sea." He was appointed Titular Professor in the University of Berlin in the year 1839. He is most widely known as the author of several standard works on mineralogy and a treatise on crystallography which was published in 1838.

Silver Mining in South America and Mexico.

WE are frequently inquired of, concerning the chances for mining engineers in South America and Mexico; and the following brief notes, based upon recent and trustworthy private information, may be of interest and value to many of our readers.

Peru is at present one of the most unpromising fields for mining enterprises. In the interior there are no roads; and mules, labor and fuel are also wanting. The ores, with the exception of those of Cerro del Pasco, are extremely rebellious, being complex sulphurets, highly charged with antimony. Roasting is as difficult as it is necessary. In the absence of ordinary fuels, lama dung (*tacia*) is used at several establishments, as Buffalo "chips" were formerly employed on our plains. But large operations in roasting could not be based upon this fuel; the lamas would not be equal to the demand. Discoveries of coal are making all over Peru; but it is as yet altogether unproved and undeveloped. At this time, the interior of the country is about as cheerful a mining field as Death Valley, in Nevada.

There cannot be many paying mines now in operation in Peru. The famous Cerro del Pasco has come to grief, and is, in depth, in the same condition as the big flooded mines of Guanajuato—full of water, and pretty sure to yield lean and refractory ores if pumped out. The work at present is confined to surface ores, yielding about $16 coin per ton. But even these can scarcely pay expenses on a less yield than $20. The district is now calling for Government protection. The once celebrated mines of Potosi, in Bolivia, are said to be in a similar predicament.

The ores of Cerro del Pasco, down to the depth at which the mines are flooded, are easily worked by the patio; but all the other Peruvian silver ores appear to require roasting or smelting. The country is full, however, of undeveloped veins; and when the system of railroads, now in progress, shall have been completed, and sufficient time shall have elapsed to permit a little modern civilization to penetrate the interior, a revival of industry may be looked for.

These railroads are under construction by the MEIGGS Brothers, two "live men," who have undertaken to build about $120,000,000 worth for the Peruvian Government. The difficulty of the work may be inferred from the fact that parts of the roads are at an altitude of 15,000 to 16,000 feet above the sea-level. The success of such an undertaking as an investment of money may be problematical; but it will no doubt be a great benefit to the Peruvian people; and meanwhile, the great expense has the good effect of keeping the Treasury empty, and the country, consequently, free from revolutions. There is nothing in politics to fight about. The annual export of precious metals from Peru is now less than $3,000,000, all of which is silver.

In Chili, the state of affairs is very different. The Chilenos, whether by reason of their more temperate climate, or from historical and social causes, are more intelligent and energetic than their neighbors. In their mining industry, they have the advantage of abundant capital, enterprise and skill. Their own engineers understand the problems with which they have to deal; and if any foreign engineer goes there, it should not be with the notion that he can enlighten the natives, or that his advent will be hailed as a boon. The silver ores at Copiapó and in the new and rich district of Caracoles are chlorides, and of course easy to handle.

A very favorable field for silver mining is found in the Mexican State of Sinaloa, and along the western slope of the Sierra Madre of Durango and Chihuaha. This region has Mazatlan for its base of supplies and door of communication with the world. In Sinaloa, the country is well wooded and watered; the roads are good; there is more labor than in Peru, and the ores are largely true silver ores, which can be treated by the Freiberg or the modified Washoe process. Some of the mines in the interior are exporting rich silver ores to Europe; others are reported to be earning good profits with stamp mills. Transactions in mining shares appear to be unknown; but this deficiency, if such it be, can be remedied by San Francisco ingenuity. We hear of some *bona fide* American enterprises in progress in Sinaloa; and we trust that their success may be solid and satisfactory.

The Coal Trade in England.

Though we have already said so much upon the condition of the coal and iron trades in England, the testimony of so notable an authority as Mr. I. LOWTHIAN BELL will not fail to be read with interest. He was lately before the Coal Committee of the House of Commons, and the foreign papers give the following summary of his evidence:

"The idea that the rise in the price of coal was due to any combination of masters and men was, in his opinion, utterly absurd. He considered it was due to increased demand on producers, and a notable falling-off in the supply. There used to be great waste, and reliance was placed on the coal in stock; whereas the coal-owners were now thrown on the unworked coal. Anterior to 1850, the quantity of pig-iron produced in the north of England was 110,000 tons, and the total consumption of coal for iron purposes was under half-a-million tons a year; and in 1872, there were 1,968,972 tons of iron produced. The number of puddling furnaces had increased from 250 in 1850 to 1,650 in 1872. Many of the coal-owners suffered when the rise of coal took place, because they had already entered into contracts for coal and coke at a fixed price per ton for three years. So great was the demand for coal that they, during the late pressure, brought coals from South Wales to Newcastle. There had been a falling-off in the quantity of coal carried on the North-Eastern Railway (of which he was a director) of half-a-million tons between 1871 and 1872, and they looked likely to have a falling-off in 1873, as compared with 1872, of nearly a million tons. In one of his own collieries, hewers used to work twelve hours per day for 4s. 7½d., and would get 4¼ tons each per day; now the same hewers could earn 7s. 5d. per day of 9½ hours, and reducing the outfall to 3¼ tons per day. His firm were opening fresh pits for the supply of themselves and the market; and others were doing

the same, and that was how the quantity was kept up. To raise artificially the price of coal, would require a combination of the whole of the masters of the United Kingdom who met in the London markets, and that, of course, was hopeless. He had endeavored to get additional labor for the mines, but that meant building small towns at a price three times as much as it used to be. Many of the bar iron works in the North of England were being discontinued on account of the high price of coke and pig-iron. In his opinion, the whole of the coal of the North of England would be required to smelt the whole of the iron, and that the coalfields would be exhausted much sooner than the ironstone. Witness spoke of the economy of fuel in the manufacture of iron, a subject he went fully into in his address before the Iron and Steel Institute, published in these columns. He did not believe that the exhaustion of coal was so dangerously near as Sir William Armstrong had stated a few weeks ago. The excess of demand for coal over supply in his own district was about 600,000 tons. An export duty on coal was not desirable. They were raising coal all over Europe as cheaply as we were doing it, but the whole quantity would not suffice to keep the English ironworks going. There was nothing to fear from foreign competition on the use of coal for the manufacture of iron. In America, notwithstanding the dearness and irregularity of labor, the increase in the manufacture of pig-iron since 1871 was 18 per cent. ; but still it was a fact that America afforded the largest market for English iron."

Machine Tools at the Vienna Exhibition.

MACHINE tools of all kinds form a very important section of the exhibits collected in the Machinery Hall at Vienna, and there is probably no class in which the examples shown are so numerous. The number of instances in which real originality of design is shown, is, however, far from being great, and where it does exist it far more generally shows itself in the improvement of constructive details rather than in the introduction of machines of entirely new types. For the number of machines it includes there is in fact no collection of tools in the Machinery Hall which can compete for real originality of construction with that to be found in the American section. Setting aside the wood-working machinery, we have in this section three chief exhibitors, namely, Messrs. W. SELLERS & Co., of Philadelphia, Messrs. PRATT & WHITNEY, of Hartford, and the BROWN & SHARPE Manufacturing Company, of Providence, all of whose exhibits will well repay careful examination. We hope on a future occasion to illustrate the chief of these exhibits, meanwhile we propose to describe some of their leading characteristics.

Messrs. W. SELLERS & Co., of Philadelphia, are well known as the Whitworths of America, and their exhibits at Vienna well sustain their reputation both by their design and excellence of workmanship. The most prominent exhibit at Messrs. SELLERS' stand is a revolving puddling furnace constructed on Messrs. SELLERS' plans, and intended as a rival to the Danks furnace. This furnace is undoubtedly a machine tool according to the strict sense of the term, but it belongs to a class of exhibits connected with the manufacture of iron and steel with which we propose to deal separately, and we shall therefore not enter into particulars of it, but shall merely remark that it includes some very convenient points of arrangement which render the invention well worthy of attention. Two other exhibits of Messrs. SELLERS, namely, a small steam hammer and a rolling mill, we must also leave for notice in future articles devoted to that class of machinery, and we must pass on those which come specially within the province of the present notice.

First amongst these is a small planing machine of Messrs. SELLERS' well-known type, with framing of good rigid design, and with the table driven by a worm gearing into a straight toothed rack fixed to its underside. The teeth of this rack stand at right angles to its center line, and the worm which gears into it has its axis inclined to the axis of the machine at such an angle that the upper part of the screw thread which is in gear moves parallel to the teeth of the rack. When this mode of driving planing machine tables was introduced by Messrs. SELLERS some sixteen years ago, it was a matter for surprise that the worm did not show signs of rapid wear. Experiments made with a large-sized model, however, showed that owing to the relative positions of the worm spindle and the axis of the rack the combined rotary onward motion of the latter, combined with the rotary motion of the worm, produced what was approximately a rolling contact between the worm and teeth surfaces, the amount of sliding movement being very small. As a fact, this combined rack and worm movement is run on Messrs. SELLERS' machines without any lubrication beyond that which may leak on to the worm from the adjoining bearings of the worm spindle, and so far one of these worms has never required renewal. In the revolving furnace, to which we have already briefly alluded, a similar mechanical movement is used for another purpose, and we are informed that in this case it is intended purposely to run this gear without lubrication during the time of the Exhibition, so as to show its action perfectly. In the planing machine, of which we have been speaking, the worm spindle is by means of bevel gear connected to a shaft placed parallel to the axis of the machine, this shaft carrying the belt pulleys. It follows from this arrangement of the belt pulleys that instead of the machine standing at right angles to the line of shop shafting, as is usually the case with planing machines, it stands parallel with that shafting, and in the same line as the lathes and other machine tools. This appears to us to be a decided advantage.

The machine under notice is also fitted with a very neat arrangement of belt gear, this being so contrived that, in reversing the machine, the open belt is shifted from the last pulley on to its proper loose pulley before the crossed belt is moved at all, and *vice versâ*, the belt first shifted then remaining stationary, while the other belt is being changed on to the fast pulley. The effect of this arrangement is to reduce the lateral traverse of the belts one half, and thus not only to allow of the employment of narrower pulleys, but also to reduce the wear and tear of the belts. Another neat point in this machine is the arrangement for lifting the tool during the return traverse, the lifting motion being transferred to the toolholder by a light cotton cord, which acts at whatever angle the toolholder may be set. One feature of all Messrs. SELLERS' machines we may also mention here, as it is especially noticeable in the machine of which we are now speaking, and that is the mode of finishing the flat surfaces. Surfaces which require it are of course finished by scraping in the usual way, but other flat surfaces, as, for instance, the top of the table of the machine under notice, are left just as they come from the planing machine, and the marks on them show that the finishing cut has been taken with a ¼ in. feed. This exceedingly broad feed for the finishing cut gives Messrs. SELLERS' tools, when new, a characteristic appearance, which is different to that of any other maker with which we are acquainted. The finish is excellent.

Another good tool at Messrs. SELLERS' stand is a screw-cutting lathe, in which a very neat arrangement has been adopted for securing accuracy of position for the back stock. Of course the opening in the bed of a lathe gradually widens by wear, and as this wear takes place it is possible, according to ordinary arrangements, that the back-stock, after being shifted longitudinally, may be refixed so that its axis is not exactly coincident with that of the lathe spindle. To avoid this, Messrs. SELLERS form on the underside of the lathe table close to the back edge of the opening, a rib of tapered section, and they make the clamping plate of the back-stock of such form that it tightens on the tapered side of this rib, and in so doing draws the back-stock hard up against the back edge of the opening in the lathe bed. This edge of the opening thus acts as a kind of straight edge against which the back-stock works, and the effect is that any looseness of the back-stock in the opening in the lathe bed is of no consequence.

A neat detail about this lathe also is the arrangement adopted for clamping the spindle of the back-stock. Instead of the back-stock being fitted with a set screw tending to force the spindle to one side, as is too often the case, the spindle is made to pass through a cone split into three parts, a kind of screw cap applied to the cone tightening these parts together, and clipping the spindle in such a manner as to secure its being held in a truly central position. The proportions of the parts are so arranged that, although the spindle is clipped sufficiently firm to prevent it from slacking back during work, yet it is not held so tightly as to prevent it from being moved—but with some difficulty--by the handwheel at the outer end. This arrangement is adopted to prevent any parts from being strained or injured in the event of an attempt being made to move the spindle without loosening the clip. The rate of feed of the lathe is adjusted in a very simple manner by Sellers' friction disc feed, this consisting of a pair of discs slightly curved on their inner sides, placed so as to clip two other discs, from the one to the other of which they thus communicate motion. The center on which the pair of transferring discs—as we may call them—turn, is carried by a lever, which gives the power of adjusting the pair of discs in any desired position between the driving and driven discs, thus varying the rate of motion communicated from the former to the latter. We may mention here that Messrs. SELLERS finish the centers of their lathes in a special machine, and such is the truth and accuracy of the finish that the centers of the running and back-stock spindle may be interchanged with each other or with the centers of any lathe of a similar size without giving rise to any error in the work which the lathe produces.

Another good machine at Messrs. SELLERS' stand is a slotting machine, the chief feature of which, apart from its generally good design, is that the guide for the plunger is itself movable in fixed guides on the frames, the arrangement being such that when the machine is employed in making short strokes, and taking a heavy cut, the guide can be lowered close down to the work, so as to give an efficient support to the plunger close down to the level at which the tool is doing its work.

The last machine exhibited by Messrs. SELLERS which we have to notice here is a wheel-cutting machine, with self-acting feed and dividing motion. It would be difficult, without occupying an undue amount of space, to convey by verbal description a clear idea of the details of this machine, and as we hope on a future occasion to publish complete illustrations of it, we shall content ourselves here by remarking that its design includes many novel and excellent points, and by directing to it the special attention of those who may visit Vienna. We may add that it is Messrs. SELLERS' practice to cut all the gear used on their tools, even if it is machine moulded.

A point well worthy of the notice of English engineers and millwrights in connection with Messrs. SELLERS' exhibits is the extreme lightness of the belt pulleys they employ, both on the machines themselves, and on the main line and counter-shafts. To English eyes such pulleys look weak both in the rims and arms, but we are informed on good authority that a failure from weakness is almost unknown with Messrs. SELLERS's pulleys, and the enormous experience of the firm as millwrights is sufficient guarantee that the results of the practice are satisfactory. Of course the pulleys are proportioned with care, and a high quality of iron is used in their manufacture, while special arrangements are made for moulding them, the result being that they are so true when cast, that the amount of metal cut away in turning the rims averages only 4 per cent. of their

weight. That the lightness to which we have above referred, so long as it does not involve weakness, is an important advantage—particularly when high speed shafting is employed—cannot be denied, and we consider therefor that Messrs. SELLERS' practice in this respect is worthy of careful attention in this country. Messrs. SELLERS also show at their stand specimens of their admirable couplings and hangers for shafting, which were described in the lectures on shafting delivered by Mr. COLEMAN SELLERS, at the Stevens Institute of Technology.—*Engineering.*

On the Incidental Results of Danks' Puddler."*

BY THOMAS M. DROWN.

REMARKABLE as have been the direct results of DANK's puddler, there are some indirect and incidental results, which are well worthy of study for their intrinsic value and suggestiveness. The success of DANKS' machine is due mainly to the nature of the lining and the manner in which it is attached to the walls of the revolving chamber. Herein lies DANKS' merit and good fortune. Given such a lining, and the success of the machine, as far as puddling iron is concerned, could easily be predicted.

Other important results have, however, been obtained with this machine, which, though clearly explicable, were, nevertheless, unanticipated. These are the increased yield of bar iron over the pig iron charged, and the elimination of phosphorus, which, though not absolutely complete, is yet more so than in the case of hand-puddling. As regards the increased yield, this is merely what we have a right to expect if we consider the puddling process to consist in the oxidation of the carbon and silica of the pig by the oxygen of the oxide of iron. That this result is attained—nearly to the extent that the theory requires—in DANKS' puddler, and has never been more than partially attained by the most careful experiment in hand-puddling, points clearly to the fact that the contact of the molten pig iron with the oxide of iron is much more intimate and complete in the one instance than in the other.

The action of puddling in DANKS' machine may be considered to be two-fold: first, the removal of the carbon, silicon and phosphorus of the pig, which is the primary object, and, second, the production of wrought iron direct from the ore, which is entirely an incidental result. Intelligent metallurgists were not long in recognizing in this latter result a fact of deeper import and greater value than the attainment of a perfect puddling process. A new method was thereby suggested to solve the vexed problem of the direct production of wrought iron and steel. It is true that the conditions existing in DANKS' puddler cannot be readily imitated in practice, for, in the first case, we have the reduction of the ore effected by fluid carbon and silica, which may reasonably be supposed to be much more intense than the same elements in the solid state.

The recent experiments of Dr. SIEMENS, however, prove that the action of solid carbon at a high temperature is very energetic, and the combination of a revolving chamber and SIEMENS' furnace has given results that enable us to hope for a practical solution of the problems of the direct production of wrought iron and steel without the intermediate production of sponge.

The economical side of the question cannot yet be considered settled, although Dr. SIEMENS gives astonishingly low figures for the amount of fuel consumed.

In a recent article by the celebrated Austrian metallurgist, PETER VON TUNNER, in the *Oesterreichische Zeitschrift* (Feb. 17th, 1873), this subject is discussed from an economical standpoint, and the author does not anticipate a favorable result, as far as Austria is concerned, principally on account of the lack of pure rich ores, the only ones applicable to direct processes.

TUNNER suggests that if the operation could be conducted at first at a very high temperature, and a product approximating to pig iron produced with a cinder containing very little iron, and then this carburetted metal puddled with the further addition of iron ore, a better result would be obtained as far as the complete reduction of the ore is concerned. This gain might, however, be more than counterbalanced by the increased amount of fuel required. Certain it is, that complete reduction of the ore can only be obtained under the conditions supposed, at a very high temperature, and that the waste of iron in the cinder, other things being equal, depends directly on the amount of silica in the ore. It is impossible to avoid the loss of iron as silicate unless we have conditions similar to those existing in the blast furnace.

The effectiveness of DANKS' machine in puddling, it seems safe to assert, depends mainly on the thorough contact of the molten pig iron with the lining of the furnace. It is highly questionable whether the effect would be the same were the lining to be formed of a refractory, inert material and the requisite amount of oxide of iron be charged with the pig in the revolving chamber. Although the ordinary practice is to charge iron scale with the pig, yet it seems reasonable to suppose that it is the ore of the lining which plays the most important part in the oxidation of the carbon and silicon. If this view is correct the idea naturally suggests itself that, where the DANKS machine is used for the reverse process from puddling—viz., deoxidation, the reducing agent—carbon—should be in the lining. Dr. SIEMENS claims to have obtained efficient reduction by the mixture of the melted ore with carbon in a revolving furnace lined with a refractory material—mainly Bauxite—containing a small percentage of graphite. Now, it seems not unreasonable to suppose that, were the lining to contain a large amount of coal or coke, the reduction of the ore would be much more uniform and regular.

How such a lining could be made, it is not intended at present to discuss, but that a large amount of carbonaceous matter could be incorporated with a suitable lining there can be no doubt—that it would require frequent renewal seems also probable.

The comparatively large amount of phosphorus removed by the Danks puddler is due primarily to the intimate contact of the contents of the furnace with the oxide of iron of the lining, and the abundance of basic slag, and, doubtless, also to the fact that the slag formed in the initial stage of the process is tapped off before boiling begins. It is a fact often overlooked, that the elimination of phosphorus in the conversion of pig into wrought iron, whether by puddling or the Bessemer process, depends first on the oxidation of phosphorus to phosphoric acid in the cinder. The practical difficulty lies not in the oxidation of the phosphorus, but in retaining it in its new combination. To do this, we must have an abundant basic cinder. In the ordinary puddling process, as is well known, phosphorus may be very largely removed by the abundant use of oxide of iron. In DANKS' furnace there is always a surplus of oxide of iron, the contact of which with the products of oxidation of the pig metal is so very intimate that a still more complete and thorough action might be expected. Whether any of the phosphoric acid would be reduced at a high temperature, were the cinder allowed to remain in the chamber during the entire process, is doubtful, although this procedure would probably entail a considerable waste of lining.

The Bessemer process is a notable example of the non-retention of phosphoric acid in the cinder. Here it is impossible to have a basic cinder as the lining of the converter is siliceous.

But not only is a high degree of basidity of cinder favorable to the retention of the phosphoric acid, but the stronger bases are more active in this regard than the weaker ones. The energetic effect of soda—formerly used in the form of nitrate in the Hargreaves and Heaton processes—has been well shown. Lime has been used as a "dephosphorizer" in many forms, as for instance chloride and fluoride of calcium. SCHEERER has lately proposed the use of a mixture of chloride of sodium and chloride of calcium. A great deal of vague theorizing has been indulged in with reference to the action of these "dephosphorizers;" the dissipation of the phosphorus in the form of some volatile combination being the favorite method of disposing of it. It is, however, most probable that in those cases where basic substances have proven themselves to be of value, it is simply by the retention of the phosphoric acid in the cinder by the strong base. If this view is correct, and if the action of the Danks machine is what we have supposed it to be, then we may expect a still more favorable result in dephosphorizing pig iron in the Danks puddler if we make the lining more active by the addition of alkalies or alkaline earths.

There can be no reasonable doubt that with a lining composed of a mixture of iron ore and lime, and possibly soda, the elimination of phosphorus would be nearly perfect.*

On Some Evidences of the Very Early Uses of Iron.

BY ST. JOHN VINCENT DAY, C.E., F.R.S.E.

WE give below, in a concise form, the subject-matter of two papers read by Mr. DAY before the Philosophical Society of Glasgow, in which the author has brought together much matter in relation to the extensive use of iron by man at a considerably earlier period than that which has been generally accepted:

"That iron was amongst the very earliest of all the metals with which man was acquainted, we have abundant literary evidence. We are now in a position to show by two kinds of proof that iron was well known to man during the very remotest ages which can be reached with any degree of certainty—viz., that of the hieroglyphs and certain material specimens. These two evidences appear to establish the solid truth of that literary testimony which, in these latter days, has come to be doubted.

"When examining works on the history of iron, I have noticed the scantiness of the attempts to indicate what is absolutely ascertained, as distinct from traditions, concerning the use of this metal in pre-historic ages. I am disposed to believe this defect is merely a result of the trust placed in the teachings of a certain modern school, which, going dead against all literary testimony, declares for, and only for, the extremely high antiquity of copper and its alloys. When, too, certain researches into the 'antiquity of man' claim that the appearance of iron marks a decided step on the road to a higher civilization, it is strange that their inquiries into the remotest limits of time, when man became an iron-using animal, bear no stamp upon them of having ever been directed to the earliest ages of those countries where contemporary testimony might be appealed to.

"BELZONI has pointed out, that before the Persian invasion of Egypt by CAMBYSES, there was enough iron in the country to make instruments of agriculture with. Under the feet of one of the sphinxes at Karnak he found an iron sickle, now in the British Museum. The statue could not have been placed there subsequent to the age of the PTOLEMIES, for it appears that since CAMBYSES destroyed the gods of Egypt, the country has never been invaded, so as to compel the people to conceal their idols. Sickles of the same form are to be seen in many agricultural representations in the tombs. This is a sufficient proof that about B. C. 600 the blacksmith's art was practised in Upper Egypt. The evidence to be hereafter dealt with will, I believe, show that to Egypt, and not to Greece, must

* A paper read before the American Institute of Mining Engineers at the Philadelphia Meeting May 21st, 1872.

*Since the above was written, the author has noticed that Mr. SNELLUS has patented a furnace lining of iron ore and lime.

our attention be addressed for the solution of the problems relating to ancient metallurgy.

"The paucity of researches on the knowledge and use of iron in pre-historic ages is the outcome of that dogma propounded by the Danish and Swedish antiquaries—NILLSON, STEENSTRUP, FORCHAMMER, WORSÄE, and others—which teaches that men began with tools of stone, next used bronze implements, and lastly iron.

"As to the beginnings of man, to do his work with stones, it is no business of ours just now to enter upon; but, concerning the further question, as to whether bronze and iron came to be *universally* employed in the order assigned to them by "progressive developists" amongst each of the sections of mankind now grouped into the Aryan, Semitic, and Furanian families, we have sufficient grounds to doubt.

"It is asserted that the appearance of iron on the scene is an index that a higher civilisation prevailed than when bronze is present. Sir CHARLES LYELL, quoting MORLOT, says :—"The next stage of improvement that is manifested by the substitution of iron for bronze indicates another stride in the progress of the art. Iron never presents itself except in meteorites in the native state, so that to recognize its ores, and then to separate the metal from the matrix, demands no small exercise of the power of observation and invention." To the metallurgist, however, the picture at once presents a different view, and the bronze and iron order of succession does not receive the assent of our leading living metallurgist, Dr. PERCY.

"The higher antiquity of bronze is relied on, because no specimens of iron as old by, perhaps, thousands of years, have been found. But it is scarcely possible that a specimen of metallic iron should be found belonging to nearly so early an age as that to which even tolerably late bronzes belong. Iron when exposed to the action of air or moisture, in a very few years becomes converted into an oxide so entirely that it is often not possible to recognise that it has ever been metallic.

"The proto-Egyptian remains in Lower Egypt are generally accepted as the oldest relics of the human race. Confronting these structures with the bronze and iron succession dogma, as educed more especially from Scandinavian philosophy—How does the dogma fit the facts before us? The supporters reply "Exactly," for bronze was compounded of such proportions of the two metals that the resulting alloy would cut stone as well as the steel chisels of to-day. This is rather a begging of the question, and specially illogical. Since bronze is slowly oxidisable, if it was really used in Lower Egypt, we should find specimens in or about the monuments. Yet, so far as I have been able to ascertain, not a single relic has been found throughout the whole Nile Valley which can be pronounced as old as the material and hieroglyphic testimony we possess regarding iron.

"Not only are iron instruments depicted in the tomb-pictures of the fourth dynasty at Memphis, but at Memphis itself, among the monuments, metallic iron has been found; and that in what is by universal accord the oldest building in the world. And in that particular building placed in such a way as could only have been done when the structure was in course of erection.

"It may perhaps appear startling, but it is the fact, that, though a lump of malleable iron was removed by blasting it out from the solid masonry of the great pyramid at Gizeh by Colonel HOWARD VYSE, thirty-five years ago, I have altogether failed to meet with any allusion to it by any writer in the history of metallurgy.

"Mr. HILL discovered a piece of iron in an inner joint near the mouth of the southern air-channel. It was extracted after removing by blasting the two outer tiers of the stones of the present surface of the pyramid. This specimen, with accompanying certificates, is in the British Museum. Its original thickness was probably ¼ inch. In some parts it is now ⅛, including the scale of rust, and in other parts it scales off to nothing. It has evidently been flexible, tough, wrought iron.

"It is frequently asserted that the use of iron indicates a greater acquaintance with metallurgy than that of bronze. This is an erroneous conclusion, and one to which no practical metallurgist would assent. It is scarcely possible to point out a simpler and more readily occurring result than the reduction of iron ores, than the process employed prior to the modern invention of cast iron. We must remember that there is no evidence that cast iron was known to the ancients although certain writers have described the reduction of iron ore as being performed by mixing the oxide of the metal with carbonaceous matter, and subjecting the mixture to a heat of sufficient intensity to fuse it.

"Now, it is the result of a very long experience that iron may be reduced without fusion; indeed, in the most perfect blast-furnace operations, the iron is reduced by carbonic oxide before the charge reaches that portion of the furnace where fusion takes place (the smelting zone of SCHEERER). When fusion does take place, we get from the furnace either cast iron or crude steel, the iron being combined with a portion of the carbon of the charge.

"From what we know of the most ancient methods of reduction, the fusion of the metal by them was impossible. I believe it was obtained simply by heating the oxides in contact with carbon for a sufficient time to allow the carbon to attack the oxygen in the innermost parts of the lump of ore, by a process analogous to that of cementation; the result being a mass of malleable iron, which at a welding heat was hammered into a solid block. Hence the attempts, in modern times, to extol the difficulty of iron making by supposing its fusion to have been necessary, are very misleading.

"Still farther light has been thrown on this subject by the observation of my learned friend the Scottish Astronomer Royal, that the iron of the limestone in Lower Egypt becomes washed out of the matrix, filters through, and accumulates in hollow spaces and fissures, just as it does in South Africa, on the eastern frontier of Cape Colony. But in the latter place the Kaffirs have been famous from time immemorial far taking some of the flaky ironstone thus formed, and, after heating it in little charcoal fires, beating it out into good malleable iron heads for their "assegais."

"I do not, of course, presume to assert that this is by any means a proof that the proto-Egyptians did likewise, but put it forward as a more probable theory than that sometimes advocated, viz., that they used meteoric iron for their tools.

"These native ironworkers do not act in accordance with the modernly assumed law of the universal succession of the stone, bronze and iron ages, for these savages, who have never worked copper or bronze, are, nevertheless, most excellent workers in iron.

"By another very ancient nation, the Chaldeans, we have substantial proof that iron was used. The relics of their iron manufacture are doubtless only those comparatively few specimens which have owed their preservation to the peculiar dryness of the place in which they were deposited. After the decay of the proto-Chaldean Kingdom, *i.e.*, about B. C. 1600 to B. C. 625, when the Assyrians flourished, we find them as workers and users of iron. LAYARD found at Calah a large quantity of iron, armour scales from two to three inches in length, rounded at one end and square at the other, iron helmets inlaid with copper, etc., corresponding precisely in shape with those depicted in the sculptures.

"It may be remarked that these specimens show that the Assyrians had acquired very considerable proficiency in the execution of complicated ironwork, requiring, too, very excellent iron to submit to the various strains inherent to shaping it as armor. Amongst the articles of tribute enumerated in the statistical table of Karnak, iron is mentioned as brought to the Egyptians by the inhabitants of Assyria, Persia, etc. It was occasionally exported in the ore.

"Frequently the Assyrians overlaid iron with bronze, either entirely or partially, by way of ornament. Amongst the other "finds" at Nimroud, LAYARD mentions many in iron. Iron instruments of various kinds; swords, daggers, shields, the heads of spears and arrows, which fell to pieces almost as soon as exposed to the air, so that only a few specimens were preserved. The bronze shields had iron handles. As the crowning point of discussions bearing on the ancient use of iron, he adds: "Amongst the iron instruments were the head of a pick, a double handled saw (3 feet 6 inches long), several objects resembling the heads of sledge hammers, and a large blunt spear head, such as we find from the sculptures were used during sieges to force stones from the walls.

"While we have not at present sufficient knowledge to link together the chain of testimony by which to prove the center at which iron smelting took its rise, but find it prominently referred to in most ancient literature, and in none more decidedly than the earliest parts of the Hebrew Scriptures, we shall probably not err in venturing to suggest that it was first practised in the Highlands of Central Asia, prior to the great breaking up of the human family once cradled there, and their march north, south, and west to inhabit the earth. It is not improbable that subsequently, perhaps from the non-existence of iron ore in some of the regions to which they travelled, that this, as well as others of the arts, fell into disuse among some sections of this divided people, until in their progress they met with the ore, and either from traditions of the past, or by being subjected to conditions requiring the use of metals, their attention was directed to it. At such times the practice of reducing the ores and working in the metals would be revived, perhaps rediscovered. These independent occasions thus corresponding to the alleged first discovery of iron smelting ascribed by different peoples to themselves, as we find it recorded in such of their traditions as have reached us."

MINING SUMMARY.

Utah.

BINGHAM CANYON MINES.

Correspondence of the Salt Lake *Herald* of July 12.

About two miles above Bingham, in the main canyon, is located the celebrated

SPANISH MINE.

This mine is incorporated, and partly owned, by an eastern company, although a large portion of the stock is owned in Bingham. E. EICHEL is superintendent. It is developed by a tunnel running in an easterly direction, 400 feet in length. The mine was tapped at a distance of seventy-five feet from the mouth of the tunnel; at this point, drifts were run about one hundred feet on each side, following the vein. An incline was also sunk, to the depth of fifty feet. Large bodies of carbonate ore were found, varying in width from twelve to sixteen feet. At a distance of two hundred feet from the mouth of the tunnel, the Black Hawk vein was struck. At this point, two inclines were run a distance of seventy-five feet each, on a solid body of Galena ore. There is also three hundred feet of drifts on the vein. The Queen shaft connects with the tunnel near the end. The company are shipping about thirty tons of Galena and carbonate ores daily.

About half a mile above the Spanish, up the main canyon, is located the Utah Silver-Lead Company's mine, W. H. RODDA, Superintendent. This property was sold in London, and is an English incorporation. The company have an elephant on their their hands in the shape of a fine and completely appointed smelter, situated just below their mines. It is not in use now, and was abandoned on account of the cost of materials that had to be freighted up the canyon. This company has the finest steam hoising works in the Territory. The mine on which

they are working is developed by a shaft 160 feet in depth. It has a body of Galena ore about four feet in width. The ore being shipped now is being taken from the 104-foot level. They are shipping fifteen tons daily.

To the left of these mines, on Jordan Hill, is located the

GALENA MINE,

more frequently called the Jordan mine, ALFRED GAUCHAT, Superintendent, covered by United States patent, one of the largest and most extensive mines in Bingham canyon. The mine is extensively developed by a number of tunnels, shafts, inclines, drifts, open-cuts, etc. The Gauchat tunnel is ninety-three feet in length, tapping the vein at a depth of sixty feet. The discovery shaft is 103 feet deep, running along the hanging wall and pitching at an angle of about twelve degrees, showing ore the width of the shaft the entire distance. Above the discovery shaft a tracing drift has been run across the vein connecting with the Galena shaft, showing a width of fifty-five feet. A drift runs on the vein from the Galena shaft 175 feet in length, showing carbonate and galena ores the entire distance. There is a short drift running parallel with this, and only eight feet west from it. From here we go to Galena shaft No. 2, sixty-five feet in depth, connecting with the lower or track level. This shaft is also sunk through ore the entire distance. A tunnel has been run across the vein at this point, called the Track tunnel. There is a south drift from this tunnel running 112 feet, following the vein the entire distance. The north drift from the Track tunnel runs a distance of 250 feet on the vein. The Fond du Lac Shaft, Located seventy-five feet north of the discovery shaft, is vertical forty-five feet in depth. North of this shaft is shaft No.6, sunk through a body of fine carbonate ore connecting with the track level. A shaft has been sunk below the track level twenty feet, passing through carbonate ore until within three feet of the bottom, when it changed to solid galena. There is a drift at the bottom of this shaft showing a width of sixteen feet. There is a tunnel on the backbone of the hill three hundred feet north of the discovery shaft sixty-five feet in length, running across the vein, and showing a width of thirty-three feet of ore. To the north of this tunnel is shaft No. 7, eighty feet in depth, connecting with the upper north tunnel.

An open cut has been run on the vein about sixty feet in width, revealing the largest body of ore that it has ever been our good fortune to see in Uthah, The ledge in this open cut is from twenty to thirty-five feet in width, showing large deposits of both galena and carbonate ores. From this point the vein is stripped a distance of 1,400 feet, tracing a number of other locations and and fully establishing the existence of one of the finest ledges in the country.

From the open cut we proceed to the upper north tunnel running in a southerly direction a distance of 155 feet, connecting with shaft No. 7. This tunnel runs through large bodies of ore. From here we go to the lower north tunnel running south about 300 feet. Sixty feet from the mouth of this tunnel a shaft has been sunk twenty-two feet below the track level, exposing a large and valuable body of carbonate ore. This tunnel connects with the ore shute. There is a drift running south from the ore shute eighty feet through a fine body of high grade ore. We were shown through this mine by ALFRED GAUCHAT, the superintendent, to whom we would tender thanks for his courtesy. The mine is owned by JOHN W. KERR, of Salt Lake City, and is not incorporated.

In connection with the mine is the Galena smelter, located on the Jordan river, opposite GARDNER'S mills. The narrow-gauge railroad will run within about thirty feet of the smelter. They have already graded for a broad-gauge road from the Bingham junction of the U. S. R. R. to the Galena smelter. The Galena mine is now shipping about thirty tons daily, and can increase to almost any reasonable amount. There is about one thousand tons of ore accumulated at different points on the mine. One of the most important mines of Bingham is

THE NEPTUNE,

Located above the Galena on Jordan Hill. This mine is developed by a shaft eighty feet deep, showing a large body of ore. They have about two hundred tons of ore on the dump, and are taking out about sixteen tons daily. They are shipping twelve tons per day. The mine is not incorporated. It is owned by ROGERS & Co.

THE KEMPTON MINE,

Located on Jordan Hill, is developed by two shafts. It is one of the brilliant prospects of the camp, and is shipping ten tons of ore per day. It is not incorporated and is owned by HUSSEY & Co., Salt Lake City. Another prominent mine in this vicinity is

THE ORPHAN BOY,

Owned by DAVIS, ROBINSON & Co. This mine is developed by a shaft fifty-five feet in depth. There is also a tunnel connecting with the shaft, one hundred and seventy-five feet in length. The company are now running a lower tunnel to tap the vein at a depth of one hundred and fifty feet. They have a splendid body of ore in sight, and have been shipping, but do not intend to resume until the mine is more fully developed. Just above the Orphan Boy is located

THE NORTHERN LIGHT,

Lately sold to GAY, HARDY & Co., of New York City. This mine is developed by a shaft one hundred and fifty feet in depth. The ledge in the bottom of the shaft is fifteen feet wide, the average width from the surface being ten feet. The ores are carbonate and galena of medium grade. There is another shaft, thirty feet in depth, showing a body of ore from seven to ten feet in width. A tunnel is completed to a distance of eighty feet, and will intersect the ledge at right angles, two hundred feet from the surface. They have an office, boarding house, etc., at the mine. The company are also erecting smelting works on the Jordan River. The work is under the immediate supervision of Mr. GAY, who has a temporary residence in Salt Lake City.

THE SILVER HILL.

This mine is located in the main Bingham canyon, about two miles above the town—JOSEPH BUZZO, superintendent. It is developed by an open cut, 400 feet long, and from twelve to twenty feet wide. There has been extracted from it about 4,000 tons of ore. A drain tunnel, being run to intersect the vein at right angles, is already completed to a distance of 100 feet. There are two shafts on the vein about 150 feet apart. Ore is twenty-five feet in width and one forty feet. The mine is shipping twelve tons of ore daily. The owners are about to commence the erection of smelting works on the Jordan River. The property is owned in Salt Lake City by CARSON & BUZZO.

THE AMERICAN FLAG.

Located on Jordan Hill, is developed by two shafts and a tunnel running on the vein, showing galena and carbonate ore from four to six feet in width. It is owned by Dr. HICKMAN & Co.

One of the promising mines of the camp is

THE ELLSWORTH,

Located in Car Fork. The location is a late one, having been made only about thirty days ago. The ore is of high grade, averaging $150 to the ton, in silver, and carrying a large percentage of lead. It is developed by a shaft seventy-five feet in depth. The shaft follows the ledge, showing an average width of three feet of carbonate ore. The mine is shipping seven tons per day, and is owned by W. H. RODDA & Co. Another flattering prospect is

THE TIGER AND MONTREAL,

Located in Bear Fork, near the falls. This ledge was found while ground sluicing for gold. They have stripped it for a distance of forty feet, showing a body of carbonate ores twenty feet in width. The mine is owned by KLOPENSTINE, MILLER & Co. one of the leading properties in the canyon, and one that has been shipping a larger amount of ore than any other mine in the district, is

THE LAST CHANCE.

G. CULLINS, Superintendent. It is an English corporation. It is developed by an incline, or shaft, 210 feet in depth, running at an angle of about fifteen degrees from a perpendicular. There is a tunnel cutting the vein at right angles, run to a distance of 335 feet, tapping the ledge at a depth of 200 feet from the surface and connecting with the incline. A west level, one hundred feet in length, is run from the incline on the vein. Another level is run west from the incline at a depth of 140 feet to a distance of 400 feet following ore all the way. There are three other levels running east from the incline, the whole aggregating about 180 feet. An incline is run from the end of the tunnel to a distance of 140 feet; 80 feet of this incline was run through a pinch, the Superintendent having nothing to follow but a narrow seam averaging not over one inch in width. When the ledge came in again it revealed a fine vein of ore carrying 25 per cent. in lead. The ledge at the bottom of this incline is three feet in width, encased between walls nearly vertical. The strike of the vein at this depth is nearly north and south. They have been shipping forty tons daily, but have now reduced their shipments to twenty-five tons. The company have a large and complete smelter at Sandy to which point their ores are shipped for reduction.

THE ONTARIO LODE

is located in Muddy Fork, a tributary of Car Fork. This ledge is developed by a shaft fifteen feet deep, showing a ledge of high grade carbonate ores five feet wide. A tunnel has been run to a distance of sixty feet, tapping the ledge fifty feet from the surface. Owned by J. W. WATSON, of Salt Lake City. It is not incorporated.

THE CROESUS MINE

is developed by an incline 220 feet in depth. A tunnel has also been run to a distance of five hundred and twenty feet; 260 feet from the mouth of the tunnel it connects with the incline. At a distance of one hundred feet from the mouth a level has been run west to a distance of 200 feet. Two air shafts run from this level to the surface. Two other levels were run from the tunnel to a distance of about four hundred feet. Two shafts are sunk from the upper level to connect with the tunnel below. There is 800 tons of ore on the dump. The mine will soon commence shipping. It is incorporated and owned by a Pittsburgh Co.

THE WASHINGTON LODE

is located at the head of Bingham Canyon near the summit. It is developed by a vertical shaft thirty feet deep, showing a body of carbonate ores about two feet wide. Work is being prosecuted on the shaft, which it is intended to sink 75 feet deeper. It is owned by DIXON & Co.

THE VULCAN MINE,

located on Muddy Fork, is developed by a tunnel running on the vein revealing a ledge eight feet wide, of carbonate and Galena ores, and another tunnel, running a distance of sixty feet. This is one of the best prospects in Bingham Canyon. It is owned by J. J. NOON and is not incorporated. There is fifty tons of ore on the dump and work is being prosecuted with vigor on the mine.

About one mile below Bingham on the left hand side of the main canyon is located the celebrated

WINNAMUCK MINE,

ELLSWORTH DAGGETT, Superintendent. This is the most extensively developed mine in Utah, the shafts, inclines, tunnels, drifts and levels, that have been run on the mine, amounting in the aggregate to over three thousand feet. The property was incorporated in London for two millions. Most of the stock is held in Holland. One of the largest smelters in the Territory is built at the mine. A tramway, about one hundred feet in length, runs from the mouth of the tunnel to the smelter below. The ores of this mine, owing to the facilities which they have for working them, can be reduced at a less expense than those of any other mine in the Territory. The works are now reducing about 500 tons per month.

THE BLUE JACKET

mine is located on the Winnamuck hill, about fifty feet from the Winnamuck a patent line, in a southerly direction. It was incorporated in Salt Lake City for $500,000. There is 150 tons of ore on the dump sacked ready for shipment.

Nevada.

EUREKA ITEMS.

[From the Sentinel of July 4th.]

A representative of the *Sentinel* visited the promising mines on the eastern slope of Prospect mountain, a few days since. They are owned by M. P. MURPHY, MAURICE HARTNETT, DUNCAN FRAZIER and others. There is an incline on the Industry which has reached a depth of fifty-five feet. At the top the vein was rather small, but it gradually widens out, and at the bottom measures something near twelve feet. Pulp assays from the ore average $85 per ton. A peculiarity of the ore is that it assays nearly as high in gold as it does in silver. There is to all appearances, at the bottom of the mine, an immense body of ore fully developed, which pitches into the mountain at an angle of about forty-five degrees. The croppings can be readily traced along the surface for a distance of about 350 feet, and all of the indications seem to warrant the conclusion that the incline alluded to is in the center of a huge deposit or chimney of ore. The Mountain Chief is located a short distance up the mountain from the Industry. A tunnel has been run eighty-nine feet, all the way in ore, which paid amply

[co]working. The average width of the ledge appears to be about six feet, though the owners think it will get much larger further in the hill. Here the ore is very soft, so much so, in fact, that it is dangerous to work in it, and to avoid caves, a tunnel is being run from another direction in harder ground. The ore is very similar to that found in the Industry, and assays about the same. Indeed, the theory is advanced that the two deposits will come together at no great distance, forming one mammoth ledge or deposit, second to no other in the district. Considerable quantities of the ore have been shipped to the Lemon mill, Richmond and Ruby Consolidated furnaces, from which very favorable returns have been obtained. The owners have a standing contract with the Ruby Consolidated to treat all the ore furnished from these mines. As they are very easily worked, a few men are sufficient to make it very lively for a good-sized pack train. Each miner can take out his ton of ore per day without difficulty.

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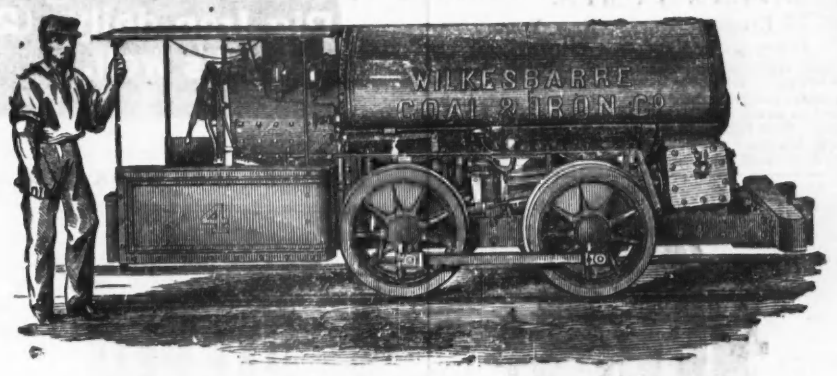

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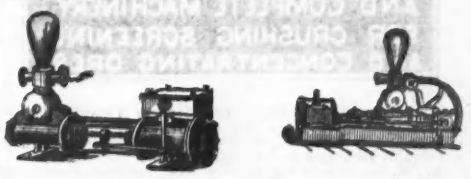

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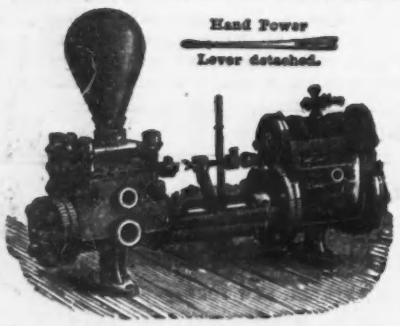

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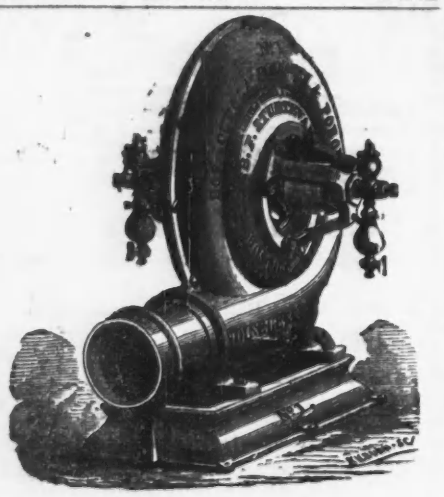

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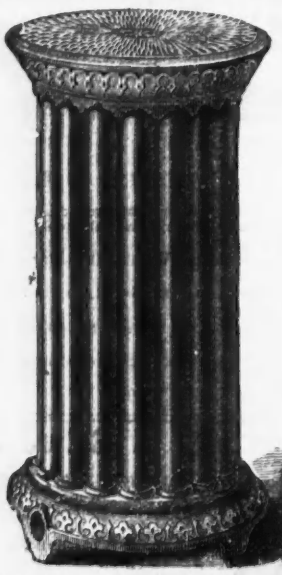

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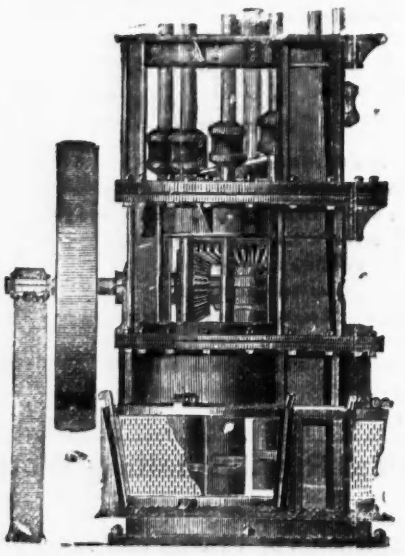

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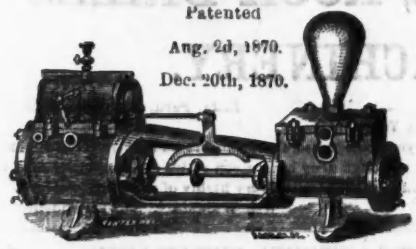

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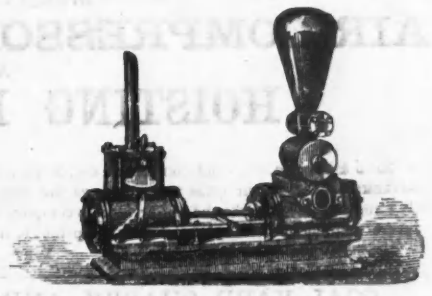

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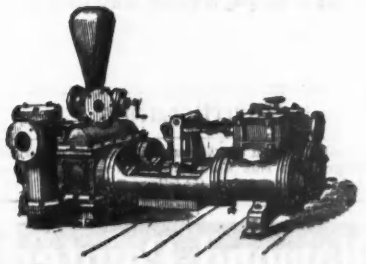

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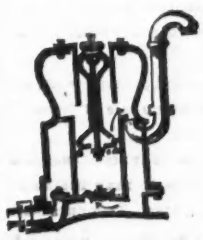

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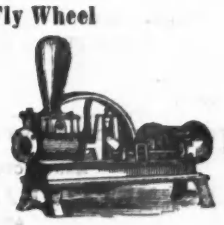

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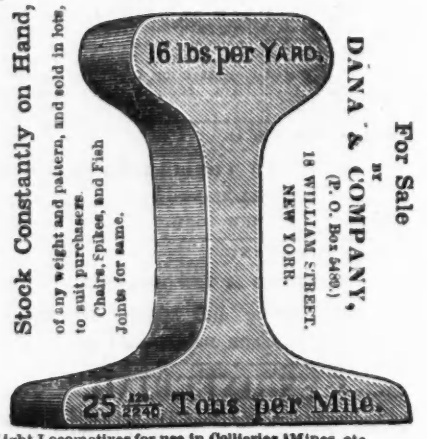

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