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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 34.)

THE Rachette furnace was for a long time the best that Clausthal possessed, but they seem to offer no advantages over the round furnaces, while they are not only more costly to build, but also are subject to a patent right. Their form is

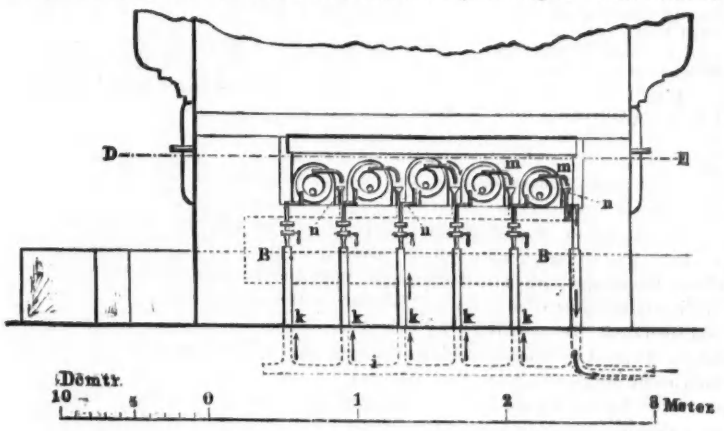

Fig. 15.

shown in figures 15 to 18. Figure 15 shows a vertical section of the furnace through the longer axis ; fig. 16 is a horizontal section, though the tuyeres, fig.

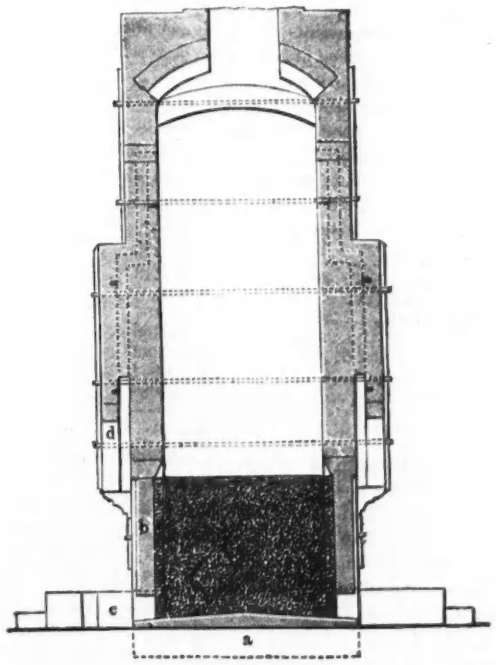

Fig. 16.

17, shows the tuyeres in place, and fig. 18 gives a horizontal section and end view of a tuyere, showing at the same time the relative size of the blast nozzle.

The Rachette furnace is a construction designed to obtain great capacity, without making the diameter greater than twice the throw of the blast. To that end it is made rectangular, and long and narrow. Tuyeres are placed on each of the long sides, and throw their air through the furnace in its narrowest direction ;

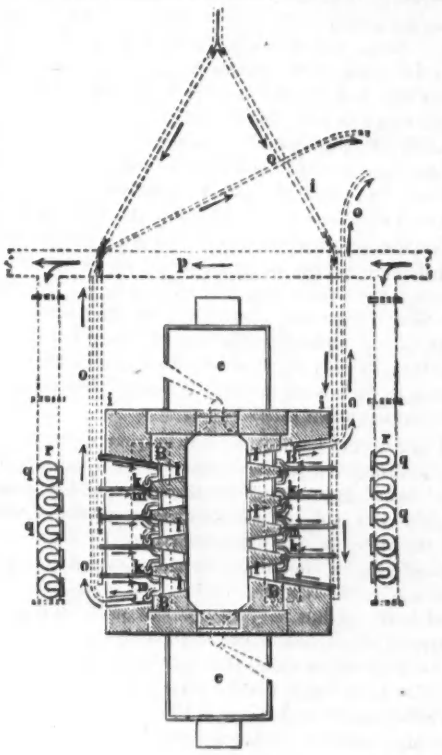

Fig. 17.

and the form of the furnace is such that any number of tuyeres can be used by merely lengthening the furnace. Usually five on a side is the number. Formerly the ends had no tuyeres, but it having been observed that scaffolds and accretions collected only on the ends, these have also been furnished with

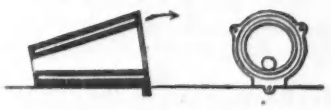

Fig. 18.

tuyeres, and with good effect. There is a tap at each end which requires a double set of men at the bottom. The main dimensions of the Altenau Rachette furnace, the first built in the Hartz, are given below ; they have not been materially changed in any of the newer ones :

Height	19	feet	6	inches.
Width at tuyeres	2	,,	11	,,
Width at top	4	,,	6	,,
Length	7	,,	4	,,
Distance between tuyeres	1	,,	4	,,

It is an excellent furnace and smelts 16,500 lb. of ore, or 44,000 lb. of charge in 24 hours with about 5,500 lb. coke. The increased width of the throat keeps the loss by dust down to a minimum, provided the pressure of blast does not exceed 10 or 12 lines of mercury.

THE WORKS OF LAUTENTHAL.

The lead is all desilvered at Lautenthal by the zinc and steam process, which, however, differs very greatly in its details from the system pursued at other works. The operations in the process are :

1. Fusion and treatment with zinc.
2. Treatment of poor lead with steam, under a hood, to remove the zinc.
3. Treatment of the poor lead with steam and admission of air, to remove the antimony.
4. Casting the purified lead.
5. Treatment of the rich crusts, or alloy, with steam, to remove the zinc.

6. Cupellation of the rich lead resulting from 5, with addition of the rich oxides to extract their silver.
7. Treatment of the poor oxides.

Treatment with Zinc.—The kettles used are old Pattinson kettles, of 5 feet 6½ inches diameter and 2 feet 10 inches depth. They hold 27,500 lb. of lead, and three are worked together, forming a battery. The two outer kettles are charged with 27½ tons (of 2,000 lb.) of lead, which is melted down in about six hours, when an *abzug*, or lead containing enough copper, iron, etc., to make its point of fusion higher than that of pure metal, is taken off and cast in moulds. Each of the end kettles then receives 49½ lb. zinc. The object of making this first charge so small is to concentrate the gold, of which the lead contains a very minute proportion, in a small quantity of silver. It is a peculiarity of the process that silver is not taken up except in small quantity, until the gold and copper have been removed. The result of this first charge is a crust which contains all the copper and gold, without being much richer in silver than the original work lead. In spite of this decided concentration, the silver made from this crust contains only 0.12 to 0.20 per cent. of gold. Still the latter metal pays for its separation.

When the zinc charge has melted, the bath is stirred by two men at each kettle for twenty-five minutes, the stirrer being a broad, flat and long-handled iron disc, pierced with holes. The metal is then cooled until a crust of about 1½ iches thickness forms on top. It is a matter of importance to so manage the cooling that it shall take place mainly from the surface, in order to prevent the formation of a thick crust on the bottom of the kettle, for this crust would contain zinc and silver. To avoid this the fire is merely covered with ashes. The top crust is lifted off by means of shallow ladles, the liquid lead drained off, and the crust thrown into the middle kettle, and when this is completed a new charge of 258½ lb. zinc is made to each outside vessel, and the fires are freshened. The stirring in, cooling down, and skimming are repeated, and the last charge of 77 lb. zinc is then made, and the same operation gone through with. The time consumed in completing a charge is about as follows: Drawing *abzug*, 30 minutes; melting in zinc, 2½—3 hours; stirring, 25 minutes; cooling, 1½—2 hours; skimming, 1—1½ hours; total, 6—7 hours. But the desilverization of 27½ tons of lead requires about thirty hours.

The middle kettle is now heated, the bath stirred, cooled and skimmed, the crust being a concentration of the three crusts taken from the other two kettles. This is cast in moulds. From 20 to 40 lb. of zinc are added to the bath, and the above operations are repeated. If necessary, a second charge of zinc is made.

According to the above the zinc charge amounts to ¼ per cent. of the lead. The crusts, however, do not contain all the zinc, but fully one-half is left in the poor lead. The removal of this zinc has been the most difficult problem in the whole process of desilverization, and though the poor lead can now be treated without difficulty, no direct and simple method of separating the zinc from the rich crusts has yet been found, unless the costly mode of distillization is excepted.

Dezincing the poor Lead.—The three kettles now contain poor lead, which is dezinced by blowing superheated steam at 15 lb. pressure through the bath, by means of a bent pipe, two feet in diameter, running to the bottom. A sheet iron hood communicating with a large pipe is bolted down on the kettle and the joint is luted. The lead is kept at a little below cherry red, and is steamed for four hours to remove the zinc, and for two hours more to remove the antimony, air being admitted by opening the door of the hood. Inasmuch as the antimony is not carried over with the rich crust, the middle kettle is steamed to remove the zinc alone. In this operation the temperature is a point of great importance. If too low, a longer time is required, and the amount of oxides formed is increased. If too high, the kettles are rapidly destroyed. At the right temperature 0·7 per cent. of zinc and 1 per cent. of antimony can be removed in the time given.

The object of passing the steam through the bath is to oxidize the zinc, but a good deal of lead is also oxidized, and the oxide first formed is fluid, but it gradually becomes powdery and "dry." The oxides from the end kettles are yellow, but those formed in the middle kettle are greenish, showing a preponderance of zinc. Perfect dryness of the oxides is a sign that all the zinc has been removed. Other tests are to cast a small assay in a scarifier from time to time, until no star forms in the center upon cooling. The star would indicate the presence of antimony. The kettle is also left exposed to the air a while, without steam, after the oxides have been removed. If a clear red litharge forms, the lead is pure. Another test for zinc is to take a ladle-full, scrape the surface, while hot, with a piece of wood, and if the silky appearance is gone the zinc has been removed. When the tests show the lead to be free from both zinc and antimony, the lead is ladled into moulds, and forms the "Refined Hartz lead." It is so nearly pure as to contain from 99·983 to 99·987 per cent. lead.

The dezincing of the rich crust presents more difficulties. The withdrawal of oxygen from the steam by the zinc leaves a gas so highly charged with hydrogen as to be violently explosive when the hot gas comes in contact with the air. In dezincing the poor lead, the deoxydation of the steam is quite imperfect, and the resulting gas never gives alarming explosions. But the rich crusts contain 5 or 6 per cent. of zinc, and severe explosions of the gas have occurred. These are, however, now completely prevented by turning steam direct into the hood before allowing air to enter it.

The products now consist of: (1) refined lead ready for market; (2) rich lead containing about 1·3 per cent. silver which is cupelled in a German hearth. (3) Poor oxides free from antimony, and others containing antimony. The former are washed on a sleeping table which separates them into two qualities. Of these one consists of metallic lead and lead oxide, containing about 85 per cent. of the metal; it is reduced to second quality metal. The remainder, containing much zinc, is of a yellow color and is sold as a paint. The oxides containing antimony are melted with other similar products to hard lead. (4) Rich oxides. These are placed upon the bath in the cupel furnace, the heat being raised to the highest limit. The silver passes into the lead, some lead being oxidized in the exchange. A slag, consisting of zinc oxide, lead oxide and metallic lead, remains and is drawn off. It contains about 50 ounces silver to the ton and is reduced with rich litharge to metal which passes a second time through the desilverization process. To have a successful imbibition, or absorption of silver by the lead in the cupel hearth, it is necessary to keep the rich oxides from being too dry. With lead, such as is produced in the Hartz—containing 38 ounces to the ton—the oxides are in the right proportion when they form 8 to 10 per cent. of the desilvered lead.

WEDDING & BRÆUNNING give the following summary of the results obtained by this process in 1869. The German centner of 110 lb. English weight is here given as cwt.

MATERIAL AND PRODUCTS.

	Weight. Silver. lb.	Weight. Lead. cwt.	Percentage. Silver.	Percentage. Lead.
Charged: 22,053 cwt. work lead	3168½	22,021½		
Produced: 3525½ lb. crude silver, containing fine silver	3243½		102·372	
Refined Hartz lead		18,803¾		85·389
Second quality lead		1907⅞		8·662
Hard lead		489½		2·223
Oxides containing no silver		55¼		0·250
Merchantable litharge 64 cwt.		58⅞		0·267
Total	3243½	21,1315	102·372	96·791
Various products not worked up: 452 cwt.		392¼		1·781
Total			102·372	98·572

It is certainly remarkable that the intermediate products still in treatment, consisting of hearth, scraps, litharge, abstrich, and impure lead obtained in liquatting the hard lead, should amount to only 22½ tons or 1·781 per cent. of the lead treated. The second quality lead is made from the washed oxides mentioned above, the scraps formed in ladling the first quality metal from the kettle and other products free from silver. It is blown with steam to remove the antimony and then cast. Its only impurity is a small proportion of copper. The hard lead is obtained by smelting the oxides containing antimony, and this also is blown with steam to remove the zinc and copper. Thus the steam process is now used for the refining of all kinds, and by its use the numerous operations which made up the old process of cupellation and refining by air has been entirely superseded.

In ladling out the refined lead, an assay weighing about ½ lb. is cast for every 8 pigs of lead. When 5000 pigs have been cast, these assays are melted together, and some pounds are cast and sent to the laboratory for analysis. The first of the following analyses is from the lead produced at Lautenthal in 1870 up to the month of August, and represents 20,465 pigs or about 1575 tons. The other is from 1193 tons of lead refined at Altenau, where refining was still in operation in that year. Each analysis is the mean of 4 made upon 1400 grammes in one case, and 1500 grammes in the other. It is noteworthy that although refined at different and widely separated establishments, and made from work lead of very different composition in regard to impurity, the refined lead shows a difference of only 4-1000ths of a per cent., that from Altenau, where the copper ores and matte are worked, showing a small excess of impurity. This similarity of composition is a proof of the method with which the operations are carried out.

Lead	99·983139	99·987560
Copper	0·001413	0·002022
Antimony	0·005698	0·003335
Bismuth	0·005487	0·003650
Silver	0·000460	0·000721
Iron	0·002289	0·001229
Zinc	0·000834	0·000776
Nickel	0·000680	0·000707
	100.	100.

In regard to the bismuth in the above metal, it is worthy of remark that steam has no effect upon this metal, which remains with the lead. This circumstance, which has been developed only within a few years, is a matter of great importance to works which, like Freiberg, make considerable quantities of Bismuth from intermediate products, which would be lost were it not concentrated in those products. Pattinson's process effects this concentration, and this is another reason why that system of concentration, now so generally rejected, should be retained at Freiberg.

The purity which now distinguishes the Harz lead has not been obtained without much trouble and study. Compared with the lead obtained from cupellation, the Pattinson, salt-and-poling and steam processes have yielded a product which has shown an advancing purity.

THE COPPER PROCESS AT ALTENAU.

When the matte is withdrawn from the ore-fusion it contains about eight per cent. copper and 7 per cent. lead. It is roasted in a square kiln, twenty feet high, four feet square at the bottom, and 5×4 feet at the top. The matte is broken into pieces, 1 or 1½ inches square. Only the upper part of

the kiln is hot, the fire not sinking below 3 feet from the mouth, while the remaining 9 feet serve as a regenerator to heat the ascending air, a process which of course cools the matte. Two doors at the mouth are used for charging; two others are placed two feet under them for the purpose of loosening the charge, and finally there are two more on a level with the sole, to allow for discharging. With good management of the draft the kiln burns for weeks. If too much air enters, the combustion may be sufficiently strong to sinter the charge together, or, allowed to increase still further, enough cold air to put the fire out may enter. The matte, which contains about 22 per cent. of sulphur, is reduced to 12 per cent. by two roastings in the kiln. The kilns are connected with sulphuric acid chambers, and no difficulty has occurred in utilizing the sulphur of the matte in this way. After the second kiln roasting, the matte is piled in a low heap and roasted with the addition of brush fuel to 6 per cent. sulphur. It is then smelted in low, square furnaces, about 9 feet in height, 1 foot 8 inches × 3 feet 4 inches square at the bottom, and 2 × 3 feet 10 inches at the top. The introduction of sloping sides has been found advantageous. Three water tuyeres are placed in the back wall, the piers between which the furnaces stand, preventing their introduction at the sides.

The charge consists of 100 roasted matte and about 93 slag, partly siliceous slag from the ore fusion, and partly matte slag repassed.

The products are (1) Lead containing 0·19 per cent. silver and more copper, iron, zinc, antimony, etc., than the metal from the ore; (2) Copper matte, the composition of which is about:

Sulphur	21·6	per cent.
Iron	39·2	"
Copper	13·7	"
Lead	15·0	"
Silver	0·057	"

Slag containing 2 per cent. lead, and 0·002 per cent. silver. When copper slag was used as a precipitating material, the mattes from this fusion contained only 11 per cent. of copper, and required another roasting and fusion before entering the copper process. Now this is unnecessary.

The treatment of the copper matte consists in enriching it by repeated roasting and fusion with siliceous material, to black copper containing 95 per cent. of that metal. This is granulated, treated with hot sulphuric acid, the copper sulphate crystallized out, and the rich residues smelted to obtain their silver and gold.

TO BE CONTINUED.

CORRESPONDENCE.

Colorado Mining Matters.

Central City, Colorado, July 7th, 1873.

TO THE EDITOR: SIR—Colorado is evidently destined to enjoy another season of prosperity, and *this time*, doubtless, a permanent one. Relieved from the disastrous effects of visionary and extravagant speculation, returning confidence, local energy and industry are steadily demonstrating the legitimate merits of our mines. Every mail brings letters of inquiry, each train the returning old settler or "disgusted capitalist," while every day dawns upon the resumption of work upon some long deserted and idle mine. The completion of the Colorado Central Railroad (narrow gauge) to Black Hawk, its connection with the Julesburg branch Union Pacific, Kansas Pacific, Denver Pacific, Rio Grande and Boulder Valley railways, together with the already large and steadily increasing competition in the purchase and treatment of ore, is having a marked effect upon the future of Colorado. During the past four months we have been very much surprised by the presence of officers and stockholders, representing some of the Eastern Companies, "victims of 1864 and 1865." We had settled down to the firm conviction that Colorado was beneath the notice of a sensible capitalist, but strange to say, we have been laboring under a misapprehension, else expressions of confidence and appreciation are entirely out of order.

You will find our visitors return much better informed and satisfied as to the permanency and capability of our mines, and, where the equity of redemption has not expired, the result of a personal inspection will doubtless transfer, from the profit and loss account, the entry, "Colorado investment," to an open page, and restore it to its more deserving position among the available assets of the investor. Out here, such remarks are quite common as, "There is no question as to the permanency and contents of these veins," and, "I had abandoned my Colorado investment, thought it worthless—a foolish speculation, but now, well, I think differently, consider it about as good as my eastern investments; all that seems to be necessary is a litte time, patience and proper management. I think I now understand the real cause of our failure, etc." Such expressions seem to argue that the prevailing opinion in the east has been as much in error, as former anticipations were extravagant and inconsistent.

Full paid stock, hence a limited working fund, estimated on a basis of $2.50 per day for labor, followed by *immediate* and *unprecedented* high prices, at a time when the mines were *non-productive* in consequence of *needed* development and improvement, surrounded and seriously affected by a whirlpool of extravagance and visionary ideas at both ends of the line, should have sufficient consideration to modify, if not remove, the prejudice, which in fact has its origin in a national calamity. To us, "a disreputable lot of swindlers," it is gratifying to notice the beneficial results from personal investigation, and the daily increasing product of the mines. Leasing and consolidation is now all the rage, and under the influence of such measures, the bullion product of the Territory is steadily approaching the standard of 1867 and 1868.

The Bobtail tunnel, 1300 feet in length, a very creditable enterprise, accomplished under the very efficient management of A. N. ROGERS Esq., has recently been completed and in consequence of same, quite a number of long deserted mines have been stimulated to action. The mine is opened to a depth of 675 feet and the shaft, below the line of tunnel, is now cutting a fine vein of mineral and yielding 6 ozs. per cord in stamp mill, and $100 per ton at the smelting works.

GEO. MALEY, Esq., has leased the Fisk Gold Mining Company's property on the Fisk Lode, and is now taking out 7 oz. stamp mill ore and $126 per ton smelting ore. The Briggs Mine, at a depth of over 550 feet, has a crevice of from 10 to 12 feet in width, which yields in stamp mill 7 ozs. per cord, and at the smelting works $130 to $160 per ton. MESSRS. SMITH and SULLIVAN have recently leased the Narragansett Company's property on the Gregory, and are now actively engaged making preparation for immediate and extensive operation. The Smith and Parmelee Company have also aroused from the lethargy of the past three years, and are now preparing their valuable mine for another campaign.

The Consolidated Gregory and Black Hawk Gold Mining Companies are busily engaged negotiating, estimating, interchanging propositions, &c., &c., significant of contemplated action in that quarter. The long deserted Running Lode, now the property of Mr. L. FRENCH, is paying a net profit of $7 00 per week; also, the New Boston, owned by LAWYER HALSON, only wanted a little confidence and muscle to place it in its present prosperous condition. BELA S. BUELL, Esq., who had confidence in what the Kip & Buell Gold Mining Company abandoned, after realizing within the past six months a profit of over $50,000, is now developing and erecting hoisting and reduction machinery with which to meet the requirements of an eight foot vein.

GEO. BARRETT, Esq., has leased the Barrett Gold Mining Company property on the Winnebago, and is now raising a large quantity of 6 oz. ore The Gunnell Lode, Church Bros. lessees, is also yielding a satisfactory compensation for the risk and perseverence of the past year. The Kansas Gold Mining Company (English) on the famous Kansas Lode, Nevada mining district, have a fine crevice of ore and have abandoned stamping entirely. They select the solid or lump ore, concentrate the fine, and sell the entire product to the smelters, at from $50 to $65 per ton, or from $500 to $650 per cord. MR. JAMES C. FAGAN of your city, formerly a resident of Colorado, has leased the valuable property on the Kansas and Camp Grove, belonging to Mr. WATERMAN, and is now engaged in developing and otherwise organising the mine for practical operation. His property also has a very large crevice in consequence of the intersection of two main veins, and is noted for its capacity and the usual richness of the ore. A thirty-two stamp mill with hoisting machinery attached and tramways from the shafts to the stamps reduces the cost of hoisting, training and reduction combined to less than $3 per ton. For the last 64 feet the shaft has been cutting a poor bar of ground, but as in other instances, the result of development indicates an approaching restoration of their mine to its customary activity and standing. A recent proposition from parties in London relative to the organisation of a company and the immediate departure of the lessee conveys the impression that this property will shortly pass into the hands of English capital.

Mr. STURRELL, also of your city, recently returned to Colorado, and after devoting several days to a general investigation, quietly started up the Missouri Lode of Nevada mining district.

In the Kent County, Geo. Estabrooks, Esq. finds himself amply compensated for the energy and perseverance of the last year; 9 to 15 oz. ore has changed the aspect of his countenance as well as his bank account. Geo. R. Sabin, Esq., is also among the fortunate ones. The Forks is beginning to yield up its tribute of precious metals to the unrelenting perseverance of one of Colorado's Pre-Adamites. The Burroughs Lode, formerly owned by the "Ophir Gold Mining Company," and now being worked by the Roberts Bros. (Cornish), has a fine vein of ore in the bottom of the 600 foot shaft, and is yielding from 7 to 11 ozs. in stamp mill and $200 per ton at the smelting works. The American Flag, another of Colorado's humbugs, is now yielding to Mr. James M. Clayton and others, a fortune.

The Malaga, Messrs. Sanger & Paul lessees, is yielding exclusively smelting ore, which is disposed of to the Boston and Colorado smelting works, at from $50 to $350 per ton. The Argus Mill and Mining Company's property on Keystone and Topeka, Vipond, Swancut and others, lessees, is now yielding 8 ounces per cord in stamp mill and the lump ore from $80 to $110 per ton. This also is the result of confidence and industry. Eighty feet of dead ground is no small obstacle to be overcome by muscle alone.

The Missouri Lode, of Russell mining district, idle since 1863, is now being worked by Shinneman & Stratten, and Baker & Harkin. Same is yielding 7 ozs. in stamp mill and the smelting ore $140 per ton.

The Clifton Lode, a very large and promising silver mine, the property of an English company, but for the present somewhat "in chancery" in consequence of conflicting management, is yielding from $40 to $60 per ton. The Veto silver mine, the result of years of prospecting, is now a source of permanent income to Joel A. Kinney, Esq., its fortunate discoverer and owner. The Seaton and other mines in the immediate vicinity are also paying, but to what extent I am not informed.

At Georgetown, in Clear Creek County, the Colorado Central, Saco, John Bull, Terrible (English company), Pelican and Cold Stream, are all yielding satisfactory returns. The Baltimore Tunnel, George Bassett, Esq., manager, is also

paying largely. In Sugar Loaf district, Boulder County, the Forest and Los Animas are yielding 30 per cent. bismuth and from 500 to 900 ozs. silver.

In Gold Hill district, the Red Cloud, Cold Spring, Seven-thirty, and others, containing tellurides of gold and silver in greater abundance than ever discovered elsewhere, are yielding very large and profitable returns to their owners.

The Caribou, of Baldwin County, the Gould and Curry of Colorado, now the property of the Nedderland company of Amsterdam, is sustaining its uninterrupted reputation to the entire satisfaction of the purchasers. Some of the stockholders are at the present time visiting the mine and express themselves well pleased with their investment.

The South Park Silver Mines, in Park County, limestone formation, and above timber line, are reported very rich. The Park Association have declared a dividend of over $30,000, as the result of four months' operation. Many other instances of success and evidence of prosperity in all the various localities named might be mentioned, but the above is considered more than sufficient to prove the energy and perseverance of our miners and our confidence in the future of this, the El Dorado of America.

Very respectfully, GEO. R. MITCHELL.

Ore Dressing.

NEW YORK, July 1, 1873.

TO THE EDITOR:

SIR—In the issues of June 17th and 24th the readers of the MINING AND ENGINEERING JOURNAL had the pleasure of perusing an ably-written paper under the heading: "The Utsch Automatic Jig," by HENRY ENGELMANN. The purpose of this paper was plainly an eulogium on the above-named contrivance, accompanied with some statements of results which, endorsed by such high authority, prove a very much-needed progress in the dressing of ores, using water as the medium. Several centuries have now passed since ores were first dressed by means of water and water devices, and it is certainly gratifying to have not only a final perfection in a device at last, but also a very decided expression of disapproval as to all "mediums" excepting water. It is to this point that just criticism will be directed, since, as will appear by the following extract, Mr. ENGELMANN not only eulogizes this machine, but in connection therewith undertakes to put down all machines or contrivances not using water, and the inventors thereof, as well as the believers therein, as the followers of an *ignis fatui*.

WATER THE BEST MEDIUM.

Water as the agent for dressing ores is not likely to be ever superseded. A fluid of greater specific gravity would afford an easier separation. If, for example, we take a fluid whose specific gravity is intermediate between that of quartz and that of blende, every particle of quartz will float on it, while every particle of blende and of the still heavier galena will sink in it Their separation will be perfect. If, then, we had a fluid intermediate in specific weight between blende and galena, these could be separated equally well without the use of any machinery. The difficulty of obtaining such fluids, and their consequent cost, precludes the adoption of such a method for dressing ores. On the other hand, in a vacuum a feather falls as rapidly as a piece of lead. The substitution of the thin and specifically light air for the heavier water, which has lately been advocated with much persistency, is therefore a step in the wrong direction—an attempt to produce a novelty which renders an easy matter difficult. Moreover, air can only move light, that is, small grains, and air-jigs would, therefore, necessitate an otherwise unnecessary fine crushing of the ore, which in itself would increase the losses of the concentration very materially, as we have demonstrated above. Air-jigs will remain an ingenious expedient, advantageous only under the most abnormal and exceptional circumstances.

Upon this sweeping condemnation of the air-school of ore dressers it is sufficient to remark that the separating of mineral from gangue has not been found "an easy matter." If all the grains of mineral and gangue, when comminuted, were of the same form, after a perfect sizing, the specific gravity of each particle of the same kind would be the same; and the separation would then become an easy matter with machinery (not without it), whatever the medium used. The correct theory is evidently the employment of the lightest medium, *and the application of force*, properly regulated and pulsating, or intermittent. In this way, the *force* is substituted for that "specific gravity intermediate;" and when mechanically applied and perfectly controlled, produces results the most perfect, because the flow of the "medium," the *robber of mineral*, carries off the least when that "medium" has the least specific gravity and is the easiest of perfect control. It is this intermittent *force*, when applied to "water, the best medium," which produces the separation, by causing the lighter material to float, pushing it up, impulse by impulse, whilst that force is not intended to be sufficient to overcome the specific gravity of the heavier. The effect, in other words, is that the lighter pulsates upwards, whilst the heavier pulsates downwards, and hence, under the same perfect conditions, that medium which has the least specific gravity will involve the least loss of mineral in the flow. Rightly understood, MR. ENGELMANN'S argument reverses his conclusions. A fluid of intermediate specific gravity, working without machinery, being utopian in practice, that "intermediate gravity" is to be artificially produced with the medium which is of the lightest gravity—lighter than water—in order that when discharged the least amount of valuable matter may be borne away with it.

The use of air as the medium is a step in the right direction theoretically, as it has been completely demonstrated to be right in practice. That the "Utsch Automatic Jig" may be an admirable contrivance to give new hope to the "water-dressing" school, is not here questioned, but it is questioned whether its claims are really so well founded that henceforth no reliance must be placed in the demonstration of a closer and more convenient separation of minerals by the use of air as the best medium. G. W. BAKER.

Brief History of a Placer Claim.

WASHINGTON GULCH, MONTANA, June, 1873.

TO THE EDITOR:

SIR—On the 1st April, 1872, I went up on the side of a bar, put down a prospect-hole to bed rock, and washed out sixty cents. Then, without further trial, I claimed the surplus water of the Gulch, constructed the necessary ditches, dams and gates, and proceeded to ground-sluice on the bed-rock, using a space about three feet wide, formed by the bank on the one side, and by the rocks picked out of the ground-sluice on the other, as a race to carry off the tailings as I advanced.

In this way, in about a month, the length of time the water lasted, I run off an area of 200 feet long and forty feet wide, and in depth from two to eight feet. So far, it had been nearly all work and no money; at long intervals I picked up pieces worth two or three dollars, and, two or three times, ten to fifteen dollar nuggets. Now comes the time to clean up the bed-rock. This was a hard slate, which had to be taken up and washed for a depth of from two inches to two and even three feet; also any loose gravel that remained on the surface. How this was done, I will now endeavor to show, and in doing so I think I can prove that it requires the exercise of a little brains, as well as a great deal of muscle, to succeed at mining. The ground where I was at work had been, three or four years previously, taken up by a party, and proved to pay sufficiently well, while they had water to work it, during the summer; but, so soon as the water lowered every season—some time in the latter part of June—the water of the gulch was conveyed in a small ditch into an adjacent reservoir, which left but one inch available for them. After they had given up, and I had taken hold, the same state of things continued. By an "inch" I mean 2 1-3 cubic feet per minute. This, I believe, is engineers' measurement; and, to some extent, that used in California, though not in Montana.

The first thing I did was to erect a structure, after the fashion of a log cabin, 5 feet high, 16 feet long, and about 5 feet wide. On this I placed a "dump-box," 12 feet long, 32 inches wide, and 15 inches high, and a "mouth-piece" 4 feet long, and in width so shaped as to connect the dump-box with a string of three or more flume-boxes, 16 inches wide. All these boxes, to be used for sluicing, I set *down* the Gulch, giving them a grade of 9 inches in 12 feet; six more boxes, of the usual length, 12 feet, I set *up* along the Gulch, to be used as a reservoir. The grade these got, was as follows: first box, ¼ in.; second, ½ in.; third, ¾ in.; fourth, 1 in.; fifth, 1¼ in.; and sixth, 2 inches.

The size of the boards used in this reservoir flume was: sides, 18 x 1 inch; bottoms, 16 x 1¼ inch. So you see, when full, it contained an hour's water; and, by reason of the curve-like grade, when the gate at the lower end was raised to a sufficient height, a *steady* stream flowed through the dump-box, washing from five to eight barrowfuls at a time. This amount of water, so used, was sufficient to keep one man steady at work; and, if reservoired during the night, would of course be sufficient for two. Nor did the contrivance cause any more trouble than if the water was running steadily, as, when a man dumped his las barrow, he could raise the gate, and shut it again from where he stood. In addition, I will say that the washing-boxes were placed on two long poles (36 ft.), so fixed in a simple way at the upper end that the lower end could be swung around in a few moments as the place became filled up with tailings.

As any one of ordinary ingenuity can supply the details of this story for himself, I will end by saying I got one thousand dollars that season for my trouble—one-eighth of which I took out in a single day—a sort of day that seldom smiles on the Montana mines. J. B.

Idaho.

The Owyhee *Avalanche*, of July 5, has the following local mining record:

Our mines are all looking more promising than ever, and every available stamp in camp is busily pounding ore. If the productiveness of the mines continue, which we are confident will be the case, the present facilities for crushing will be greatly insufficient for the demand. During the week ending yesterday, WELLS, FARGO & Co. shipped from here 30 bars of bullion, valued at $77,246.88, which is a handsome showing, indeed.

MINNESOTA.—This mine is looking well in all the levels. The 4th and 5th levels are sending up about 30 tons of ore per day. The 6th level is showing a fine quality of ore, and stoping will be commenced therein in a few days. The engine and reels will be running by the 15th inst., when the daily yield of ore will be increased to 50 tons. Superintendent COFFIN shipped to San Francisco, on the June account, Minnesota bullion, amounting to $77,995.99, which speaks for itself.

GOLDEN CHARIOT.—This mine continues to open up splendidly. Thirty-five drillers are now at work in the mine and 20 stamps are constantly running on the ore, which pays from $90 to $100 per ton.

IDA ELLMORE.—The new steam pump—the first one in camp—was started up this week and works in the most satisfactory manner. The Ellmore can now be worked at much greater advantage than heretofore.

WAR EAGLE.—The contractors of the War Eagle Company's creditors have just had 311 tons of ore crushed, which paid $13,982.25—nearly $45 per ton. This ore was taken from the mine by 10 men in 48 days, although they were considerably troubled with water. After paying all expenses, the net proceeds amounted to $8,634.02, of which the creditors and contractors each got one-half—the contractors making nearly $9 per day each, while the creditors realized a good dividend. This demonstrates the productiveness of the War Eagle, if properly worked.

OTHER MINES.—The Red Jacket continues to "pan out" splendidly, and the Mahogany is developing into a richer, more extensive and more permanent mine, the farther it is worked south. The Illinois Central and Belle Peck are as rich as ever, and the South Chariot looks very promising.

THE COAL TRADE.

NEW YORK, July 19, 1873.

Anthracite.

The trade this week is remarkably quiet, but little activity seems to exist among the various branches of the Anthracite trade. The usual 4th of July interruption seems to have extended over a longer period than usual, and at present we do not learn that much coal is being brought to tide-water. The prices for the month of August will be fixed on or about the 20th inst., when it is expected the usual monthly advance will be adhered to. There are rumors of trouble among the men in the various regions, and it is known that in some of the regions at least, the men are very much dissatisfied. In the Lehigh trade, the demand for the best brand is beyond the supply, and we learn that orders have been refused, by the leading dealers, during almost the entire month. Vessels are moderately plenty, and orders are very scarce. Freights are unchanged.

Bituminous.

The trade in bituminous coals is also quiet, and there are no changes to report.

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 12, 1873, compared with the week ending July 13, 1872.

COMPANIES.	1872. WEEK.	1872. TOTAL.	1873. WEEK.	1873. TOTAL.
Phila & Reading R.Rt..	100,989	2,437,858	81,523	2,653,782
Schuylkill Canal	24'765	394,107	25,738	321,276
Lehigh Valley R. R. ..	67,348	1,845,429	66,993	1,872,114
Lehigh & Sus. R. R.....	32,893	962,449	22,412	1,012,469
" " Canal	20,795	311,517	25,911	283,778
Scranton North.....	16,216	355,355	22,818	418,299
" South	38,213	1,140,625	24,350	1,158,799
Penn. Coal Co., rail.....	22,903	669,570	22.195	610,768
" " " canal....	239	2,273	370	3,711
Del. & Hud C.Co. Canal	42,952	591.730	46.360	600,432
" " East...	11,322	321,831	5,071	206,735
" " West..	10,883	193,862	14,139	250,119
" " South.	8,310	192,975	831	126,984
Shamokin.....	22,674	271,004	16,374	302,140
Trevorton.....	....	....	....	....
Lykens Valley Coal Co....	....	....	....	....
Wyoming North.....	....	....	....	....
Wyoming South.....	....	....	....	....
P. N. Y. C. & R. R. Co..	14,195	344,657	14,624	396,386
Williamstown Col'y.....	....	.....	....	....
Big Lick Col...	....	.....	....	....
Total..	424 697	9,875,242	389,609	10,237,772
1872.....	389,609			9,875,242
Increase.				362,530
Decrease.....	35,088			

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

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

Bituminous Coal Trade, 1873 and 1873.

The following table exhibits the quantity of Bituminous Coal passing over the following routes of Transportation for the week ending July 12, 1873, compared with week ending July 13, 1872.

COMPANIES.	1872. Week.	1872. Year.	1873 Week.	1873 Year.
C. & O. Canal.....	19,478	804,862	21,127	802,278
B. & O. R. R.....	28,103	652,566	30,562	732,482
Penn. S. Line.....	....	.....	1,230	44,562
H. & B. T. R. R.....	3,356	152,200	6,865	235,375
*Harrisburg & D.....	6,591	269,553	4,262	189,551
*L. V. R. R....	674	16,862	683	17,831
P. & N.Y.C. & R. Co.....	7,788	205,417	5,127	174,315
Cumberl'd Branch Canal	6,252	98,496	5,241	52,545
" Railroad....	468	9,740	398	56,403
Total.....	72,710	1,709,696	75,495	1,804,842
			72,710	1,709,696
Decrease.....	....			95,156
Increase	....		2,785	

Delaware and Hudson Canal Company.

Coal mined and forwarded by the Delaware and Hudson Canal Company for the week ending Saturday, July 12, 1873.

	WEEK.	SEASON
North.....	49,138 14	1,386,831 14
South.....	831 07	126,984 03
Total 1873.....	49,970 01	1,513,815 17
Corresponding time in 1872 :		
North.....	49,250 12	1,361,725 10
South.....	8,310 08	192,974 14
Total, 1872.....	57,561 00	1,554,700 04
Increase North.....	111 18	25,106 04
Decrease North.....		
Increase South.....		
Decrease South.....	7,479 01	65,990 11
Increase	.....	.....
Decrease.....	7,590 19	40,884 07

Pennsylvania Coal Company.

Shipments of Pittston Coal for the week ending July 12, 1873.

	1873. WEEK.	1873. YEAR.	1872. WEEK.	1872. YEAR.
By Railway.....	22,195 08	610,768 05	22,903 04	609,569 16
" Canal.....	369 10	3,710 15	238 17	2,273 07
... .	22,564 18	614,479 00	23,142 01	611,843 03
Increase, 1873..	2,635 17			

Philadelphia & Reading Railroad and Branches.

COAL TONNAGE

For the Week ending Saturday, July 12, 1873.

BY RAILROAD.—ANTHRACITE.

PASSING OVER MAIN LINE AND LEB. VAL. BRANCH.

	Tons. Cwt.
From St. Clair.	15,877 04
" Port Carbon.	3,117 02
" Pottsville.	1,683 06
" Schuylkill Haven.	18,017 07
" Pine Grove.	4,498 09
" Tamaqua.	8,617 05
" Harrisburg.	....
" Dauphin.	6,595 18
Total	58,306 11

FOR SHIPMENT BY CANAL.

Passing Frackville Scales	11,824 08
" Mill Creek "	1,749 14
" Schuylkill Valley Scales	172 01
" Mt. Carbon "	1,544 09
" Oressona "	8,982 02
" Pine Grove "	1,056 05
" Tamaqua "	2,193 13
Total	27,522 12

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

Via Catawissa & Williamsport Br.	56 01
" N. C. R. R. passing Locust Gap.	2,280 10
" " " Shamokin.	5,494 09
" " " Herndon.	....
Total	7,831 00

SHIPPED WEST OR SOUTH FROM PINE GROVE.

Via Schuylkill & Susquehanna R. R.	1,785 13
" Lebanon & Pine Grove Branch	1,646 00
Total	3,431 13

CONSUMED ON LATERALS.

From Frackville Scales.	495 05
" Mill Creek "	371 06
" Schuylkill Valley Scales.	1,128 11
" Mt. Carbon "	910 02
" Oressona "	230 13
" Pine Grove "	17 15
" Tamaqua "	331 17
Total	3,488 07

LEHIGH AND WYOMING COAL.

Received via Silverbrook Junction, Sent East	7,375 01
Cat. & Wpt. Br. Sent West	....
" " Rupert, Cat. & Wpt. Br.	....
" " Allentown, E. Penn'a Br.	65 08
" " Alburtis, " "	....
" " Oreland, G. & N. Br.	606 16
" " Willow Street R. R.	420 15
Total	8,466 00

BITUMINOUS.

From Harrisburg.	4,262 02
" Connecting R. R., G. & N. Br.	....
" Junction R. R.	....
Total	4,262 02

COAL FOR COMPANY'S USE.

Anthracite	2,631 07
Bituminous	136 11
Total	2,767 18

RECAPITULATION.

	Total for Week.	Corres-p'g week last year.	Increase and Decrease.
Passing over Main Line and Leh. Val. Branch	58,306 11	88,341 07	d 30,036 16
For Shipment by Canal	27,522 12	26,598 12	i 924 00
Shipped Westward via Northern Central R. R.	7,831 00	6,400 13	i 1,430 07
Shipped West or South from Pine Grove	3,431 13	2,249 03	i 1,182 10
Consumed on Laterals	3,485 07	2,851 05	i 634 02
Lehigh and Wyoming Coal	8,466 00	1,123 13	i 7,344 07
Total Anthracite paying freig't	109,045 03	127,686 13	d 18,641 10
Bituminous	4,262 02	6,599 15	d 2,338 13
Total of all kinds paying freig't	113,307 05	134,277 08	d 20,970 03
Coal for Company's use	2,767 18	5,382 12	d 2,614 14
Total Tonnage for Week	116,075 03	139,660 00	d 23,584 17
Previously this year	3320060 17	3224443 04	i 95,616 13
Total to date	3436165 00	3364103 04	i 72,061 16

SHIPPED BY CANAL.

From Schuylkill Haven	21,681 00	25,277 10	d 3,596 10
" Port Clinton	4,057 00	2,086 00	i 1,971 00
Total Tonnage per Week	25,738 00	27,363 10	d 1,625 10
Previously this year	295,538 00	372,519 19	d 76,981 19
Total to date	321,276 00	399,883 09	d 78,607 09

Delaware and Hudson Canal Company.

Coal mined and forwarded by the Delaware and Hudson Canal Company for the week ending Saturday, July 12, 1873.

	WEEK.	SEASON.
By Delaware and Hudson Canal	46,360	600,432
By Railroad, East	5,071	206,735
" West	14,139	250,119
" South	831	126,984
Total 1873	66,401	1,184,270
Corresponding time in 1872 :		
By Delaware and Hudson Canal	42,952	591,730
By Railroad, East	11,322	321,831
" West	10,883	193,862
" South	8,310	192,975
Total	73,467	1,300,398
Decrease	116,128	

Delaware Lackawanna & Western Rail Road Company.

Coal transported on the Delaware, Lackawanna, & Western Railroad for the week ending Saturday, July 12, 1873.

	WEEK. Tons. Cwt.	YEAR. Tons. Cwt.
Shipped North	22,817 15	418,299 05
Shipped South	24,350 03	1,188,799 09
Total	47,168 01	1,607,098 14
For the Corresponding time last Year :		
Shipped North	16,215 14	355,354 18
Shipped South	38,212 19	1,140,624 15
Total	54,428 13	1,495,979 13
Increase	.....	111,119 01
Decrease	7,260 12	

Report of Coal Transported over the Lehigh Canal

For the week ending July 11, 1873.

REGIONS SHIPPED FROM.	TIDE. tons. ct.	LOCAL. tons. ct.	TL. WEEK tons cwt.	TL. DATE tons, cwt.
Mauch Chunk Region	4,279 07	3,393 14	7,673 01	87,833 01
Mauch Chunk Region Hazardville	684 05	594 15	1,279 00	5,444 00
Beaver Meadow Region	1,373 02	3,637 11	5,010 13	45,795 00
Mahanoy Region	478 10	906 12	1,385 02	8,066 17
Hazleton Region	1,937 09	5,527 14	7,465 03	97,863 00
Upper Lehigh Region		1,050 18	1,050 18	11,619 12
Wyoming Region	830 05	1,137 05	1,976 10	41,976 18
Wyoming Region, Hazardville	92 15	78 00	170 15	262 11
Total.	9,584 13	16,326 09	25,911 02	305,776 09
Previously reported	96,229 00	161638 06	257,867 06	
Total to date	105813 13	177964 15	283,778 08	
Corresponding week last year	120749 07	190770 12	311,516 19	
Increase.				
Decrease	14,935 14	12,805 17	27,738 11	

DISTRIBUTION.	WEEK 1873.	WEEK 1872.	YEAR. 1873.	YEAR. 1872.
Consumed on line of Lehigh Canal	2,276 00	1,405 05	27,225 08	23,185 06
Passed into Morris Canal to Tidal Points	68 05	159 04	916 18	2,134 17
Passed into Morris Canal to Local Points	759 12	733 00	11,008 05	8,748 02
Passed into Del. & Rar. Canal to Tidal Points.	9,513 08	8,379 03	104,893 15	118,621 10
Passed into Del & Rar. Canal to Local Points	765 01	574 12	5,593 09	7,256 15
Consumed on line Delaware Div. Canal	1,636 06	1,260 05	14,049 17	19,016 13
Passed through to Bristol	10,789 11	8,244 00	126,087 19	123,249 16
	25,911 02	20,795 09	293,778 08	311,516 19

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

Week ending July 12—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	12812 16	8196 16	1147 04	21864 16	930033 18
Upper Lehigh		2218 06	708 04	2926 10	104580 17
Beaver Meadow	1515 00	1672 13	4665 04	7852 17	129075 06
Hazleton		304 17	7369 07	7674 04	89965 10
Mauch Chunk	1028 13	2594 15	11575 06	15198 14	261156 12
Total	15156 09	14987 07	26644 01	55787 17	1,521614 12
Prev'ly reported	712272 14	538648 05	229907 16	1470828 15	
Total to date	727429 03	553635 12	256551 17	1521614 12	
Same time .1872	617079 12	421258 01	193716 13	1232000 06	
Increase	110349 11	132377 11	62835 04	289614 06	
Decrease					

DISTRIBUTION.	WEEK 1873.	WEEK 1872.	YEAR 1873	YEAR 1872.
Forwarded East by Rail to Tidal points	15156 09	20648 00	727429 03	617079 12
Forwarded East by Rail to Local points	5417 17	10635 08	253584 03	199918 14
Forwarded East by Rail use Central Division	1657 06	1432 17	47872 15	40818 08
Forwarded East by Rail use L. & S.	180 06	178 14	6583 18	4631 06
Delivered at and above Mauch Chunk	1293 10	833 09	41546 08	28408 07
Delivered at Coalport & Hazard for Canal	31164 08	14817 06	281805 10	210569 07
Delivered to L. V. R. R. at Packerton	61 12	145 14	14732 19	9992 16
Delivered to L. V. R. Rd. at Sugar Notch	2761 14		58385 06	
Delivered to L. & B. R. R.at Plymouth Bridge	4094 15	4956 14	118522 01	113481 02
Total	50787 17	53646 06	1521614 12	1232000 06

Report of Coal Transported over Lehigh Valley Railroad

Report of coal tonnage for the week ending July 12, 1873, with Totals to date, compared with same time last year.

WHERE SHIPPED FROM.	WEEK. Tons. Cwt.	TOTAL Tons. Cwt.
Total Wyoming	28,942 16	495,788 06
" Hazleton	46,902 17	1,324,522 04
" Upper Lehigh	25 19	2,074 02
" Beaver Meadow	11,539 17	384,747 10
" Mahanoy	14,621 17	267,033 13
" Mauch Chunk	25 18	2,315 02
Total.	100,856 04	2,376,511 02
Same time last year	87,556 05	2,230,707 17
Increase	13,303 19	65,803 05
Decrease	.....	.....
Forwarded East from Mauch Chunk by rail	66,892 13	1,972,114 03
Same time last year	67,347 16	1,845,428 16
Increase		26,685 07
Decrease	455 03	

DISTRIBUTED AS FOLLOWS.

Local East of Mauch Chunk	821 05	46,092 07
Forwarded East for use L. V. R.	722 11	22,280 09
Delivered to Furnaces and Manufacturing Companies	12,100 16	422,883 03
Delivered to Cat & Fog. R. R.	114 06	5,975 00
" " East Penn R. R.	40 15	4,246 09
" " North Pennsylvania Railroad	5,108 15	190,962 15
" " Port Del	4,315 09	92,217 13
" " East Amboy Railroad		
" " Morris and Essex Railroad	5,797 03	174,887 04
" " Bel. Del. Railroad	27,155 16	864,998 04
" " Central Railroad	10,710 15	287,996 09
Delivered at and above Mauch Chunk for use of L. V. R.R.	1,199 14	42,199 15
To P. & N. Y. R. R.	10,454 17	349,413 14
To Northern Central R. R.	534 15	9,977 16
To D. H. & W. R. R.	223 16	20,276 12
To L. & S. R. R. at Packerton for rail	417 17	7,771 11
To Individuals at Mauch Chunk	10 17	1,732 14
To Individuals above Mauch Chunk	69 10	9,137 11
To L. &S. R. R., at Penn Hav., for railroad		1,541 19
Do. for canal	7,463 08	82,893 08
To Lehigh Canal Mauch Chunk	2,232 09	20,830 14
To Catawissa Railroad		50 00
To L. & B. R.R. at Lock. June	10,144 14	49,940 08
Total	100,856 04	2,376,511 02

Penn. and E. Y. R. R.—Coxton, Pa.

Coal tonnage for week ending July 12, 1873.

	Week. Tons.	Cwt.	Total. Tons.	Cwt.
Anthracite received:				
From Lehigh Valley R. R.	10,454	17	249,413	15
" Lack. & B. R. R.	352	06	16,664	18
" Pleasant Valley R. R.	3,315	09	99,718	02
" Sul. & Erie R. R.	501	09	20,588	17
Total	14,624	01	386,385	12
Same time last year	14,194	19	344,656	13
Increase	429	02	41,728	19
Decrease				
Distributed:				
To Lehigh Valley R. R.	1,282	19	23,306	14
To Lack. & B. R. R.	52	13	770	13
To S. Central R. R.	1,917	17	88,821	16
To Ithaca & A. R. R.	6,105	01	68,967	06
To Erie R. W. Pockets for shipm't.	3,220	12	134,132	08
To Erie Railway, Watkins direct.	782	03	2,222	02
To individuals on line of road	119	06	17,684	15
To points at & above Coxton for use of Co.	535	08	16,094	16
To points between Waverley and Elmira	898	02	34,382	02
Total	14,624	01	386,385	12
Bituminous received from BARCLAY R. R.				
Shipped north from Towanda	5,127	08	173,028	19
Shipped south from Towanda			1,193	19
Northern Central R. R.			91	14
Total	5,127	08	174,314	12
Same time last year	7,788	23	205,417	10
Increase	2,670	15		
Decrease			31,102	18
Distributed:				
To Erie Railway	5,127	08	153,367	06
To So. Central R. R.	....		19,407	17
To Ithaca Valley R. R.	....		213	17
Lehigh Valley, R. R.	....		586	16
To individuals on line of Railroad.	....		620	10
To points on line of road for use of Company	....		118	04
Total	5,127	08	174,314	12
Grand totals transported				
Anthracite	14,624	01	386,385	12
Bituminous	5,127	08	174,314	12
Total	19,751	09	560,699	04
Same time last year	21,983	02	550,074	09
Increase			10,625	01
Decrease	2,231	13		

Statement of Coal Transported over Cumberland and Pennsylvania Railroad

During the week ending Saturday July 12, 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	21,126	14	30,512	07	1,229	15	52,918	16
1872	19,477	11	28,103	03	....		47,580	14
Increase	1,649	03	2,459	04	1,229	15	5,338	02
Decrease	....		....		....		....	

YEAR.

1873	302,277	19	732,482	09	44,562	08	1,079,322	16
1872	301,861	16	652,566	01	....		957,437	17
Increase			79,916	08	44,562	08	121,894	19
Decrease	2,583	17	....		....		....	

Cumberland Branch R. R.

WEEK.

	To C. & O. Canal. Tons.	Cwt.	To B. & O. R. R. Co. Tons.	Cwt.	Total. Tons.	Cwt.
1873	5,240	17	388	03	5,630	00
1872	5,251	11	468	03	5,719	14
Increase					1,080	14
Decrease	1,010	14	70	00		

YEAR.

1873	52,545	02	55,403	19	108,949	01
1872	97,496	04	9,739	16	108,236	00
Increase			46,664	03	713	01
Dec ease	45,951	02				

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 11, 1873.

	Tons.	Cwt.
East	1,598	16
West	14,665	10
	16,264	06
Same time last year	12,674	08
Increase	3,589	18
Decrease		
Total amount shipped to date	302,139	12
Same time last year	271,004	07
Increase	31,135	05
Decrease		

Prices of Coal by the Cargo.

(CORRECTED WEEKLY.)

	AT NEW YORK. July 3. R. A.	W. A	AT PHILADELPHIA. July 3. 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	3 85	3 60
Pea	— —	— —	— —	— —
LEHIGH.				
Freight to New York 50 cents.				
Lump, (on board)	— —	— —	— —	— —
Broken	— —	— —	— —	— —
Egg	— —	— —	— —	— —
Stove	— —	— —	— —	— —
Chestnut	— —	— —	— —	—
Pea	— —	— —	— —	— —
SPECIAL COALS.*				
Honey Brook, Le'h W. A.	4 85@5 55		— —	— —
Spring Mountain " "	5 60@— —		— —	— —
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@5 10		— —	— —
Broad Top " "	6 60@- 10		5 35	— —

Company Coals.

July, 1873.

	L.	Bst.	Grs.	Eg.	Sto.	Chest
*Scranton at E. Port	—	—	—	—	—	—
Pittston at Newburgh	4 70	4 70	4 80	4 90	5 20	4 70
*Lackawana at Weehawken	4 70	4 70	4 90	5 15	5 60	4 70
Wilk'b're at Hoboken	4 65	4 75	4 90	5 00	5 20	4 65
Old Co. Lehigh at Pt. John'n	5 70	—	5 85	5 45	5 60	4 90
New York Coal Exchange	5 55	—	5 20	5 40	5 55	4 85

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	
Tyrconnel 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	$1 75	$1 25
Gowrie	2 00	0 00

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

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

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

AMERICAN.	Nominal quo Currency.
Westmoreland f. o. b.	$6 00 @7 00
Fairmount Gas Coal Co. of N. Y	6 50 @7 00
Despard Coal Co	6 50 @7 00
Penn	6 50 @7 00
Newburg Orrel Gas	6 50 @7 00
West Fairmount Gas Coal	6 50 @7 00
Redbank Cannel, at Pa	12 00 @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.	1
Shipping Expenses	35
Total	$2 23

PENN HAVEN TO ELIZABETHPORT.

L. V. R R. Penn Haven to Phillipsburgh	84
C. RR. of N. J. Phillipsburgh to Elizabethport	1 06
Shipping expenses	15
Wharfage	20
Total	$2 25

Freights.—July, 1873

TO EASTERN PORTS.	Cumberland. From Georgetown.	From Baltimore	Anthracite. From Philada'a.	From Elizabethport, Port Johnston, Hoboken, and Jersey City.	From Newburgh.	From Rondout.
Amesbury	3 75	—		—	—	—
Bangor	3 25	—		—	—	—
Bath	3 20	3 00		2 10	—	—
Boston	3 00	3 00		2 00*	—	2 05
Bridgeport	2 50	3 00		1 00	1 20	1 25
Bristol	—	—		1 40	1 60	1 69
Conasset Nar'ows	3 25	—		—	—	—
Derby	3 00	—		1 25†	—	—
Dighton	2 70	—		1 45	—	—
East Cambridge	2 75	—		2 05	2 25	—
Fall River	2 55	2 75		1 40	1 60	1 65
Hackensack	—	—		—	—	—
Hartford	3 10	3 25		1 50	—	1 75
Hoboken	2 15	—		50	—	65
Jersey City	2 15	—		50	—	65
Lynn	—	—		—	—	—
Middletown	—	—		1 25	—	1 50
Mystic	—	—		1 25	—	1 50
New Bedford	2 60	2 85		1 50	—	1 75
Newburyport	3 25	3 25		2 05	—	2 35
New Haven	2 50	2 50		1 00	1 20	1 25
New London	2 50	2 65		1 25	1 40	1 45
Newport	2 60	—		1 40	1 60	1 65
New York	2 25	2 15		50	—	65
Norwalk	2 75	2 50		1 00	1 20	1 25
Norwich	2 75	2 75		1 30	1 50	1 65
Pawtucket	1 50	3 00		1 50‡	—	1 75
Portland	3 00	3 00		1 80	—	—
Portsmouth, N. H	3 25	3 25		2 10	—	—
Providence	2 50	2 75		1 40	1 60	1 65
Rockport	—	—		—	—	—
Saco	—	—		—	—	—
Sag Harbor	—	—		1 25	—	—
Salem	3 20	3 25		2 00	—	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
Catskill	—					50
Cocksackie	—					50
Coeyman's	—					45
Cold Spring	—					20
Fishkill	—					20
Haverstraw	—					40
Hudson	2 50					65
New York vessels	2 00					45
Nyack	—					30
Poughkeepsie	2 40					30
Rhinebeck	—					—
Rondout	—					40
Saugerties	—					50
Sing Sing	—					55
Stuyvesant	—					50
Tarrytown	—					60
Troy	—					20
West Point	—					50
Yonkers	—					

†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

TO BOSTON.

Sydney	4 00
Lingan	3 50
Cow Bay	3 50
Port Caledonia	3 50
Little Glace Bay	3 50

TO MONTREAL.

Caledonia	3 75 gold.

TO CUBA.

Caledonia	6 50 gold.

MARKET REVIEW.

NEW YORK, July 16, 1873.

IRON.—In Scotch Pig, we note further sales of about 200 tons Glengarnock at $43, and 300 do. on private terms, to close a steamer lot; the stock of this brand is now somewhat scarce on the spot, though likely to be increased by arrivals nearly due. Eglinton is in ample stock for all present demands. Of the late arrival of Gartsherrie, several jobbing parcels have changed hands at $47, at which price the holders are firm. The market on the whole, though without much life or animation, can be called pretty steady, holders being more disposed to ask an advance on present prices than to make any reduction however small. No active business may be looked for, however, for perhaps several weeks to come, but holders have the impression that no lower prices are now likely to rule. American Pig is about steady at our quotations; for some of the strictly No. 1 brands it is impossible to obtain supplies to fill orders standing for some time past; this applies particularly to Carbon, Thomas and Lehigh brands; other brands are in full supply and may be quoted all the way from $45 to $47, at which we note sales of 100 tons Hudson, and 100 do. Poughkeepsie; we also hear that a number of new brands of Iron are offering on the market at greatly reduced rates. No. 2 Pig is accumulating, and Gray Forge is in good stock. Rails of all kinds are very quiet;

the only sale is 4,000 tons American Steel at a private price. Scrap is quiet, but the stocks are light, and there is a disposition to hold what is on hand for better prices; a sale of 200 tons is reported, but we could not confirm it. Refined Bar from store continues dull at our quotations, which, though rather nominal, are far below the cost of importations of English, and the American mills have the market to themselves, at least for as much as is wanted. We note sales recently of several hundred packs Russian Sheet at 17@18½ cents, according to numbers. The stock is now light, Nos. 8, 9, 10 and 11 are nearly out of market.

LONDON, July 2.—At Wolverhampton, Messrs. J. BRADLEY & Co., Messrs. G. B. THORNEYCROFT & Co., Messrs. BAGNALL & SONS, and Messrs. PHILIP WILLIAMS & SONS, are reducing their prices of finished Iron. The reductions average from 20s. to 50s. per ton, but they are mostly 40s. Messrs. BAGNALL reduce lowest price Bars 20.—namely, from £15 to £14 per ton. The rest drop their Bars 40s., but still make the lowest price £14. Messrs. BRADLEY bring down their Coke and Charcoal Sheets 50s.—*Times.*

LEAD.—Pig, both Foreign and Domestic, has been very quiet; Foreign nominally 6¼ cents, and Domestic 6½ gold. Bar 9¼ cents, Sheet and Ppie 10½, and Tin-lined Pipe 16½, less 10 per cent. to the Trade.

Withdrawals from bond for consumption 11th, 12th, and 14th July—

Lead, England, &c.....pigs.1.100

COPPER.—New Sheathing is steady at 38 cents, and Bolts and Braziers 40. Bronze and Yellow Metal Sheathing 27, and Y. M. Bolts 32, net cash. Ingot remains excessively dull, and prices still recede; we have only to notice sales of 50,000 lb. Lake at 27 cents. There is a little English here, but it is virtually held out of the market.

Withdrawals from bond for consumption 11th, 12th, and 14th July—

Copper, Japan.....pkgs.5

SPELTER—Remains dull, and our quotations are nominal.

STEEL.—Beth English and American are steady at our quotations.

TIN—Pig has been in better request, and prices harden, though they are not quotably higher. Later Cables have been received from Singapore advising a heavy demand for China and the price up to $35.50 per picul. Sales have been made of 1000 slabs Straits and Malacca at 31⅛@32 cents, and 35 tons English, to arrive, part in all July and August, at 29¼@29¾. At the close, holders ask 32 cents for Straits, 35⅛ for Banca, and 30¼@30½ for English, on the spot, all gold. Plates are in fair demand, and prices are without change; the transactions embrace 1,000 bxs. assorted Charcoal Tin, Allaways, at $11.37½; 500 do. Coke Tin, $9.25; 750 do. Charcoal Terne, 15 by 20, $10.25; 500 do., $10,37½; and 100 do., 20 by 28, $22, all gold.

Withdrawals from bond for consumption 11th, 12th and 14th July—

Tin from England.....bxs.326

ZINC—Mosselman Sheet is quite at our quotations, for lots from store. American oxide say 8½@9; French 9@9½; Sheet 10½@11; Manganese 4@4½

METALS.

NEW YORK, July 16, 1873.

IRON.—Duty: Bars, 1 to 1½ cents ₩ lb; Railroad, 70 cents ₩ 100 lbs.; Boiler and Plate, 1½ cents ₩ lb; Sheet, Band, Hoop, and Scroll, 1¼ to 1¾ cents ₩ lb; Pig, $7 ₩ ton; Polished Sheet, 3 cts. ₩ lb; Galvanized 2½; Scrap Cast, $6; Scrap Wrought, $8 per ton. All less 10 per cent. No Bar Iron to pay a less duty than 35 per cent. ad val.

	Store Prices.
Pig, Scotch—Coltness ₩ ton	50 00@52 00
Gartsherrie	— —@47 00
Glengarnock	44 00@45 00
Eglinton	43 00@— —
Pig, American, No. 1	45 00@47 00
Pig, American, No. 2	41 00@44 00
Pig, American, Forge	37 00@38 00
Bar Refined, English and American	00 00@— —
Bar Swedes, assorted sizes (gold	— —@137 50
	Store Prices, Cash.
Bar, Swedes, 1¾ to 5 x ⅜ & ⅞ 2 sq. & 6 to 12 x ⅜ & ¾	175 00@185 00
Bar, Refined, ⅜ to 2 in. rd. & sq. 1 to 6 in. x ⅜ to 1 in.	92 50@ 95 00
Bar, Refined, 1¼ to 6 by ¼	97 50@100 00
Bar, Refined, 2¾ to 2¾ round 1 & 1¾ by ⅛ & 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@140 00
Hoop	120 00@170 00
Nailrod	9¾@ 9¾
Sheet, Russia, as to assortment (gold)	17 @ 18½
Sheet, Singles, D. and T. Common	—8¾@— 7¾
Sheet, D. and T. Charcoal	—7¾@— 8½
Sheet, Galv'd, list 10 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	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 75
German, do.	6 62½@7 00
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 2½ cents; over 7 cents and not above 11, 3 cents ₩ lb; over 11 cents, 3½ cents ₩ lb, and 10 ₩ cent ad val. (Store prices.

English Cast (2d and 1st quality) ₩ lb	— 18½@— 23
English Spring (2d and 1st quality)	— 9½@— 10½
English Blister (2d and 1st quality)	— 14 @— 18½
English Machinery	— 14½@— —
English German (2d an 1st quality)	— 12½@— 14½
American Blister "Black Diamond"	— — @— 11½
American, Cast, Tool do.	— — @— 17
American, Spring, do.	— — @— 11
American Machinery do.	— 11½@— 72
American German, do	— 9 @— —

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

	Gold ₩ lb.
Banca	35½@35¾
Straits	31¾@32
English	33 @30½

PLATES.

Fair to Good Brands.	*Gold.*	*Currency*
I. C. Charcoal, ₩ box	$11 25 @11 50	$13 25 @13 75
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 50 @12 00

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

Plates, Foreign (gold) p. 100 lb.	7 50 @— 7 75
Plates, Domestic p. lb.	8½@—11

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

Sheet per lb.	—10½@11

San Francisco Stock Market.

BY TELEGRAPH.

NEW YORK, July 17, 1873.

Our report from the San Francisco Stock Board is dated the 15th inst. Except a slight advance in Savage of $4 per share, the list has materially declined, Belcher being $14 lower than per last report, the list following in about the same proportion. A dividend of $4 per share has been declared by the Crown Point Mining Co., payable on the 12th ult. The report is as follows:

	July 17.		
Savage	164	—	—
Crown Point	96	—	—
Yellow Jacket	51	—	—
Kentuck, "New Issue"	8½	—	—
Chollar Potosi	41	—	—
Gould & Curry "New Issue"	10	—	—
Belcher "New Issue"	81	—	—
Imperial	5¼	—	—
Raymond & Ely	57	—	—
Meadow Valley	18½	—	—
Eureka G. V.	21	—¾	—
Ophir	—	—	—
Hale and Norcross	—	—	—

American Institute of Mining Engineers.

OFFICIAL BULLETIN.

Announcements to Members and Associates.

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

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

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

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

THOMAS M. DROWN, Secretary.

1123 Girard street, Philadelphia, Pa.

THE ENGINEERING AND MINING JOURNAL.

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

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

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

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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.

THE "Brief history of a placer claim," which we publish in another column, is worthy of the attention of practical miners. The party who gave up, for lack of water, the ground which our correspondent, by a slight expenditure of ingenuity, was able to work with profit, may read with advantage this account of how it was done, and bear the lesson in mind for future occasions.

THE Twenty-second Exhibition of the American Institute, which will be opened in this city on the 10th of September, promises to be more interesting and successful than any which have preceded it. Speciel effort is being made by those who have the management of the exhibition to have the leading industrial operations carried on upon the premises. If their efforts prove successful the affair willl prove far more instructive and useful than heretofore. We hope that the exhibition will be made what it should be, a fair exposition of the progress of American art and industry during the past year.

RATHER a startling case of carrying coals to Newcastle is furnished by the recent erection of a stone monument at Georgetown, Colorado, to mark an astronomical station of Lieutenant WHEELER'S survey. If there is anything abundant about Georgetown, one would say it is stone. Yet this monument was brought all the way from Maine, at great expense, to be set up, with an appropriate inscription, in the Rocky Mountains. We wonder how much it cost, after the precious exotic was on the ground, to blast away enough granite to make room for it! Perhaps the best part of the joke is the circumstance that the material of the monument is sandstone, and not nearly so durable as the native rocks around it. Lieutenant Wheeler has, or will have, a good many astronomical stations in the West. Is he going to haul sandstone from Maine to supply them all? We trust he will be induced to utilize rather the resources of the regions he is exploring. We could point out several boulders, here and there, in Colorado, Utah, New Mexico and Arizona, which can be warranted not to budge. And even if poor sandstone is imperatively required, there are a few hundred thousand square miles of that in the Territories mentioned.

WE have had little to say about the Stevens oxhydrogen, super-heated steam, petroleum-burning, gas-generating furnace, which has made a great deal of noise in the far West, and is of course expected to "revolutionize" metallurgy. When a man talks of decomposing steam in order to gain heat by burning its ingredients, or by any chemical juggle upon them, we can scarcely treat him seriously. There are in this Stevens furnace some other absurdities, of a mechanical character, or, as inventors are accustomed to say, "difficulties attendant upon the first operations of all apparatus, and to be removed as practice is acquired." One idea, namely, that of employing gas-generators, is good, but far from new. It has been recommended for the Rocky Mountain and Wasatch coals repeatedly in our columns. Mr. ENGELMANN, we believe, actually erected and used a generator in Utah, in connection with some experiments in coke-manufacture. The use of stair-grates for these coals would also be a good thing. But all these principles require skilled metallurgists, not inventors and patentees, to apply them. It is quite safe to predict the failure of the present STEVENS' furnace, its modification, and the failure of that also—after all which, the art of metallurgy, instead of having been revolutionized, will be found *in statu quo.*

THE advertisement of Mr. THEODORE M. DAVIS, Receiver of the Ocean National Bank, which will be found in another column, is worthy of special attention. It announces the sale, by order of the Comptroller of the Currency, of the well-known Irondale Coal and Iron property, of West Virginia. This forced sale gives an opportunity to acquire on easy terms (only one-third cash) a property of great and varied natural resources, already extensively developed, and provided with a complete plant of buildings, furnaces, dwellings, railway, etc., etc.

This property was formerly owned by the Franklin Iron and Coal Co., and, in 1866, was thoroughly examined by Dr. HERMANN CREDNER (now Professor at the University of Leipzig, and Director of the Royal Saxon Geological Survey), for Messrs. ADELBERG & RAYMOND, of this city. The report and map prepared by the latter gentlemen at that time, as well as Dr. CREDNER'S original notes, are in our possession, and more than confirm the statement made by Mr. DAVIS in the advertisement of sale. After a detailed description, the report recapitulates as follows:

"It is evident:

"1. That the property of the Franklin Iron and Coal Company possesses rich, almost inexhaustible, beds of iron ore, coal, limestone, fire-clay and sandstone.

"2. That excellent heavy timber, oak and hickory, suitable for charcoaling, covers the greatest part of the property.

"3. That water and opportunities for water-power are abundant.

"4. That the metallurgical works, shops, dwellings, and other buildings, are in good condition and arranged on a remarkably practical and rational plan, and that the machinery and apparatus are of the best kind.

"5. That a railway (the Iron Valley Railroad) specially built for the purpose, connects all parts of the extensive works with each other, affording, *via* the Baltimore and Ohio Railroad, cheap, quick and convenient transportation. Upon such a basis, under proper management, the profits of this enterprise should be immense."

We know of nothing that has occurred since the above report was written to break the force of its conclusions. The furnace then existing has probably been rebuilt and enlarged; we notice that Mr. DAVIS reports a capacity of ten to twelve tons daily, whereas the product seven years ago was but six to nine tons. The second blast-furnace recommended by ADELBERG & RAYMOND appears not to have been erected yet. The prices of labor and some materials may have advanced, but certainly not so much as the price of iron. On the whole, therefore, we can sincerely recommend to the attention of capitalists the unusual opportunity offered by the Receiver of the Ocean Bank.

Wet and Dry Concentration.

WE publish this week a communication from our old contributor, Judge BAKER, in reply to a passage in Mr. ENGELMANN'S paper on the UTSCH automatic jig, which appeared in our columns some weeks since, as it was read before the Philadelphia meeting of the Institute of Mining Engineers. It is to the broad statement that water is the best medium practically available for the separation of ores, that Judge BAKER takes exception; and since that statement was supported by Mr. ENGELMANN with a theoretical argument only, it is met with an argument equally theoretical. This is a matter, however, in which both sides can appeal to practice; and it cannot be denied that the bulk of foreign experience is in Mr. ENGELMANN'S favor. Thus GÆTZSCHMANN, in his *Aufbereitung*, published 1864, after summing up the history of experiment in this direction, concludes (vol. I., p. 131) that "under all the circumstances, and according to all the effective conditions, separation by means of air will remain but an imperfect substitute for wet concentration; although, in the lack of the necessary water, it will still be of use."

But Mr. KROM, whose dry concentration has been repeatedly described and alluded to in our columns, claims as the result of actual practice a very different verdict; and it is only fair for him to say two things; first, that the apparatus used in Europe, and criticized by Professor GÆTZSCHMANN, is not the same in principle or detail as the KROM machine; secondly, that even in Europe, there is a party in favor of what is there called "wind-separation;" and that Mr. KROM is not the only engineer who claims favorable results from its employment.

In the *second* volume of GÆTZSCHMANN'S *Aufbereitung*, published in 1872, eight years after the first, the subject is again alluded to in an appendix, (p. 630) and reference is made to the system of concentration by the use of moving air, employed for the last twenty years at the zinc and lead works of Engis, in Nouvelle Montagne. This is declared in an article in the *Bulletin de l'Industrie Minerale*, (vol. VI., p. 172) to be completely successful, and superior to wet concentration. It is even asserted that in the apparatus there employed the separation takes place more according to the specific gravity than according to the volume of the particles. This claim, Professor GÆTZSCHMANN says, "is not confirmed by experience elsewhere;" a circumstance which may have its source in the pecu-

liarity of the apparatus at Engis. The article in the *Bulletin* says that the evil reputation which this method of separation has acquired arose from the former refusal of the authorities at Engis to permit the works to be studied by experts, and from the representations of rival companies. The earliest accounts of the machinery and process will be found in RITTINGER's *Mitheilungen* of the Paris Exposition (1855), and in the *Annales des Mines* (5th series, vol. IV., p. 169) GÆTZSCHMANN gives a brief description and drawings from these sources. It is said that the process has been introduced and found successful at the lead mines of Cartagena in Spain. On the other hand, the wind-separation at Garmeha in Northern Spain, a dozen years ago, was pronounced a failure, and the attempted separation of anhydrite from rock salt, at Stassfurth in Prussia, by the use of moving air, was unsuccessful.

Assuming the truthfulness of all these reports, they certainly indicate that under some conditions, or with some mechanical appliances, the use of moving air as a medium for ore-dressing may be more advantageous than was generally concluded by mining engineers ten years ago. This is also indicated by the experiments of Mr. KNOM in this country. What we should like to see would be—first, a thorough discussion of the mechanical and economical conditions of the process now in use at Engis; secondly, more satisfactory and conclusive tests of KNOM's concentrator upon various classes of ores, and in direct competition with the best wet concentrators.

Frankly avowing our inclination to prefer the wet method, as a general rule, where water can be obtained, we must also confess that we have hopes for good results from KNOM's machine on certain classes of ores, which involve a ruinous loss under wet treatment—such as brittle silver ores, etc. At all events, we recognize the fact that there are two sides to the question still; and whatever may be our opinion, we shall try to give all parties fair play.

The Compression of Air.

By PROF. B. W. FRAZIER, Lehigh University.*

(Continued from page 44.)

The intrinsic energy of the air when it has attained a condition of equilibrium in the mine

$$I_3=\frac{p_4 v_5}{\gamma-1} \qquad I_3=\frac{p_0 v_0}{\gamma-1}\ \frac{\tau_5}{\tau_0}.$$

Finally the heat absorbed by the air after it has left the cylinder

$$H_1=I_3-I_2+W_2.$$

$$=\frac{p_0 v_0}{\gamma-1}\ \frac{\tau^5}{\tau^0}-\frac{p_0 v_0}{\gamma-1}\ \frac{\tau_4}{\tau_0}+p_0v_0\ \frac{\tau^4}{\tau^0}\ \left(\frac{\tau_5}{\tau^4}-1\right)$$

$$=\frac{p_0 v_0}{\tau_0}\left(\frac{\tau_5-\tau_4}{\gamma-1}+\left(\tau^5-\tau^4\right)\right)$$

$$=\frac{\gamma}{\gamma-1}\ \frac{p_0v_0}{\tau_0}\ \left(\tau^5-\tau^4\right)$$

$$H_1=\frac{\gamma}{\gamma-1}\ p^0v^0\ \frac{\tau_5}{\tau_0}\ \left(1-\frac{\tau_4}{\tau^5}\right).$$

We have then

$$I=\frac{p^0v_0}{\gamma-1}\ \frac{\tau_1}{\tau^0}.$$

$$W=2.3026\ p_0v_0\frac{\tau_1}{\tau_0}\log\frac{p_2}{p_1}$$

$$H=2.3026\ p_0v^0\frac{\tau^1}{\tau^0}\log\frac{p_2}{p_1}$$

$$W_1=\frac{p^0v^0}{\gamma-1}\ \frac{\tau^3}{\tau_0}.\ \left\{1-\left(\frac{p_4}{p_3}\right)^{\frac{\gamma-1}{\gamma}}\right\}$$

$$I_2=\frac{p_0v_0}{\gamma-1}\ \frac{\tau_4}{\tau_0}$$

$$W_2=p_0v_0\ \frac{\tau_4}{\tau_0}\left(\frac{\tau_5}{\tau^4}-1\right)$$

$$I_3=\frac{p_0v_0}{\gamma-1}\ \frac{\tau_5}{\tau_0}$$

$$H_1=\frac{\gamma}{\gamma-1}\ p_0v_0\ \frac{\tau^5}{\tau_0}\left(1-\frac{\tau_4}{\tau_5}\right).$$

As we are at present occupied with the theoretical action of compressed air, let us suppose, to simplify these formulæ, that the pressure and temperature of the air in the mine are the same as at the surface, and let us also neglect the changes of pressure, temperature and volume which the air undergoes between the compressor and the working cylinder. Let us also assume that the pressure and temperature both at the surface and in the mine=p_0v_0.

None of these suppositions are exactly in accordance with the facts, but the errors they introduce into the calculations are entirely of secondary importance.

We shall then have

$$I=I_2=\tau_1=\tau_3=\tau_5=\tau_0 \quad p_4=p_0=p_1 \quad p_3=p_2 \quad v_1=v_5=v_0 \quad v_5=v^2$$

and the above formulæ reduce to

$$I=\frac{p_0v^0}{\gamma-1}$$

*Read at the Philadelphia Meeting of the American Institute of Mining Engineers, May 21, 1873.

$$W=2.3026\ p_0v_0\log\frac{p_2}{p_0}$$

$$H=2.3026\ p_0v_0\log\frac{p_2}{p_0}$$

$$W1=\frac{p_0v_0}{\gamma-1}\left\{1-\left(\frac{p^0}{p_2}\right)^{\frac{\gamma-1}{\gamma}}\right\}$$

$$I_2=\frac{p_0v_0}{\gamma-1}\ \frac{\tau^4}{\tau^0}.$$

$$W_2=p_0v_0\ \left(1-\frac{\tau_4}{\tau_0}\right)=p_0v_0\left\{1-\left(\frac{p_0}{p_2}\right)^{\frac{\gamma-1}{\gamma}}\right\}$$

$$H_1=\frac{\gamma}{\gamma-1}p_0v_0\left(1-\frac{\tau_4}{\tau_0}\right)=\frac{\gamma}{\gamma-1}p_0v_0\left\{1-\left(\frac{p_0}{p_2}\right)^{\frac{\gamma-1}{\gamma}}\right\}$$

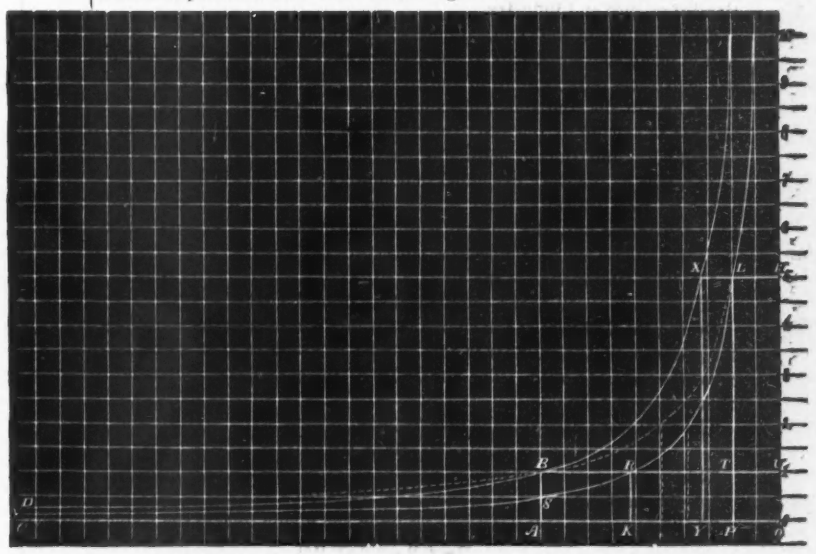
The following table gives the numerical values of I, W, H, W_1, H_1, W_2 and I_2 for different pressures. I, W, W_1 and I_2 are expressed in foot pounds. H and H_1 are expressed in thermal units.

$\frac{p_2}{p_0}$	I.	W.	H.	W_1	H_1	I_2	W_2
2	64,250	18,170	23.6	11,700	21.4	52.550	4,774
3	64,250	28,788	37.3	17,527	32.	46,723	7,151
4	64,250	36,340	47.1	21,267	38.3	42,983	8,677
5	64,250	42,189	54.7	23,965	43.7	40,285	9,777
6	64,250	46,970	60.8	26,034	47.4	38,216	10,622
7	64,250	51,010	66.1	27,705	50.5	36,545	11,304
8	64,250	54,510	70.6	29,092	53.1	35,158	11,870
9	64,250	57,597	74.6	30,275	55.2	83,975	12,352
10	64,250	60,360	78.2	31,296	57.0	32,954	12,769

These quantities can be represented graphically. Let us take the volumes for abscissas and the pressures for ordinates. Through a point whose coördinates are p_0 and v_0—we can construct an adiabatic curve—or that curve which represents the law of variation of the pressure and volume when the changes are made without accession or loss of heat. The equation of the curve is

$$p_0\ v_0^{\ \gamma}=pv^{\gamma}.$$

The area representing the intrinsic energy of 1 lb. of air at p_0 and v_0, or I, will be included between the axis of abscissas, the ordinate A B=p_0 (at distance from origin O A=v_0) and the portion of the adiabatic curve extending indefinitely from B until it becomes tangent to the axis of abscissas, when $x=\infty$.



The algebraic expression for this area may be found by integrating—pdv—between the limits ∞ and v^0, the relation between p and v being given by the equation of the curve $p_0v_0^{\gamma}=pv^{\gamma}$.

$$I=\int_{\infty}^{v_0}-pdv\equiv p_0v_0^{\gamma}\int_{\infty}^{v_0}-\frac{dv}{v^{\gamma}}.$$

$$=\frac{p_0v_0}{\gamma-1}\left(\frac{1}{v_0{}^{\gamma-1}}-\frac{1}{\infty^{\gamma-1}}\right)$$

$$\frac{p_0v^0}{\gamma-1}.$$

This is the expression we have before assumed for I.

Through the point B let us construct an isothermal curve, or one representing the law of variation of the pressure and volume at constant temperature. The equation of this curve is p_0v pv. This curve would be traced by the pencil of an indicator placed on the compressor. At a point (as L) chosen ar-

bitrarily upon this curve to correspond to a desired pressure we can construct another adiabatic curve L R N. The portion L R of this curve would be traced by the pencil of an indicator placed on the working cylinder during the expansion of the air.

Then

I=area A B D C prolonged indefinitely
W=area A B L P A.
H=area D B L R N prolonged indefinitely
=area A B L P A.
Consequently B S N D prolonged indefinitely
= A S L P A.
I_2=area C K R N prolonged indefinitely
W_1=area K R L P K.
W_2=area A B R K A.
H_1=area D B R S N prolonged indefinitely
=area A B R L P A.

$W=(W_1+W_2)$=area B L R B=$H-H_1$.

The area of B L R B represents then the excess of the work performed on the air above that performed by it, or the amount of work permanently transformed into heat. It is therefore not possible, even by preventing any rise of temperature during compression, and allowing the air to expand to its full extent, to obtain from the compressed air as much work as was expended in the compression.

We can obtain from compressed air all the work we expend upon it, only by causing it to reproduce exactly during its expansion the changes of condition it underwent during the compression. This may theoretically be accomplished in three ways:

1st. By allowing the compressed air to become heated by the compression, and preventing all transmission of heat until it leaves the working cylinder. It will be compressed and expand in this case, following the curve B X.

2d. By cooling the air during compression and heating it during its expansion, in such a manner that its temperature shall remain constant during both operations. The air will be compressed and expand in this case, following the line B L. The amount of heat abstracted during compression will be equal to that supplied during expansion.

3d. By cooling the air *before* its compression to such a degree that after it is compressed it will have the temperature of the media surrounding the working cylinder. The air will be compressed and expand in this case, following the curve R. L. This would necessitate the use of a freezing mixture, as the temperature of the air would have to be considerably below zero for any but the lowest pressures.

All these methods are accompanied with such physical or economical difficulties, that they may be considered practically impossible in the present conditions of science and industry.

Engineers might well congratulate themselves if they were able to reduce the loss in using compressed air to the amount above indicated. In practice, owing to the extreme refrigeration* of the air during its expansion in the working cylinder, and to the consequent obstruction of the ports by ice, the air cannot be allowed to expand to the full extent; indeed, usually expansion is entirely dispensed with, and the air maintains its full pressure during the whole stroke. In this case *all* the work expended in compressing the air is lost.

Let us now determine what is the amount of work thus lost. Hitherto we have considered only the work of compressing the air. The work performed in the compressing cylinder, however, consists of two parts.

1st. The compression of the air.

2d. The expulsion of the compressed air from the cylinder.

During the first part of the course the piston compresses the air before it, until the pressure in the cylinder is just enough in excess of that in the reservoir to cause the valves to open. The remainder of the course is employed in the work of expelling the air.

The total work performed is then W_c+W_e.

$$W_t=W_c+W^e.$$

This work is performed by

1st. The motor.

2d. The pressure of the atmosphere upon the piston during the whole course.

$$W_m+W_a=W_c+W_e.$$

The work required of the motor, or W_m, is then $W_c+W^e-W_a$.

We have already determined

$$W_c=W=2.3026\ p_o v_o \log\frac{p^2}{p^o}$$

$$W_e=p^2v^2$$

$$W_a=p^ov^o$$

$$W_m=2.3026\ p_o v_o \log\frac{p_2}{p_o}+p_2v_2-p_ov_o$$

But as the temperature is supposed to remain constant during the compression

$$p_ov_o=p_2v_2$$

$$W_m=2.3026\ p_ov_o \log\frac{p_2}{p_o}$$

When no expansion is used, the work performed by the air in the working cylinder is simply p_2v_2.

* When $\frac{p^2}{p^o}=5$, that is, when the pressure in the working cylinder is four effective atmospheres, neglecting the transmission of heat to the air through the cylinder, its temperature would sink from 32° F. to—152° F upon being fully expanded.

Of this, however, only a portion can be utilized, as a portion is employed to overcome the resistance of the atmosphere. The amount of work thus neutralized is p_ov_2.

The useful work performed by the air or

$$W_u=(p_2-p_o)\ v_2=p_ov_o\left(1-\frac{p_o}{p^2}\right).$$

Upon the diagram

W_t=area A B L H O A
W_c= " A B L P A
W_e= " P L H O P
W_a= " A B U O A
W_m= " U B L H U=A B L P A
W_u= " U T L H U
W_m-W_u= " T L B T=amount of work lost.

The following table gives the values of W_m-W_u and $\frac{W_m-W_u}{W_m}$ or the fraction of the total power required of the motor which is lost, per pound of air compressed:

$\frac{p_2}{p_o}$	Effective pressure in pounds, per square inch.	W_m	W_u	$\frac{W_m-W_u}{W_m}$
2	14.7	18,170	13,107	0.28
3	29.4	28,788	17,485	0.39
4	44.1	36,340	19,660	0.46
5	58.8	42,188	20,971	0.50
6	73.5	46,970	21,845	0.53
7	88.2	51,010	22.465	0.56
8	102.9	54,510	22,937	0.58
9	117.6	57,597	23,304	0.60
10	132.3	60,360	23,593	0.61

The proportion of the work lost increases with the pressure, so that, as far as regards economy of power, it is of advantage to work with low pressures.

The *rate of variation* of the loss, however, decreases as the pressure increases. As great a proportion of work is lost by increasing the pressure from two to three atmospheres as by increasing it from five to ten atmospheres.

Let us now determine what will be the loss of work, if the air is not cooled during the compression, but after it leaves the compressor.

In this case W'c will be the work of compression of the air from p_o to p_2 without transmission of heat.

$$W'_c=\frac{p_o\ v_o}{\gamma-1}\left\{\left(\frac{p_2}{p_o}\right)^{\frac{\gamma-1}{\gamma}}-1\right\}$$

$$W'_e=p_2\ v'_2$$

$$W'_a=p_o\ v_o$$

$$W'_m=\frac{p_o\ v_o}{\gamma-1}\left\{\left(\frac{p_2}{p_o}\right)^{\frac{\gamma-1}{\gamma}}-1\right\}+p_2\ v'_2-p_o\ v_o-p_2\ v'^{\gamma}_2=p_o\ v_o^{\gamma}$$

$$p_2\ v'^{\gamma-1}_2=p_o\ v_o\left(\frac{v_o}{v'_2}\right)^{\gamma-1}=p_o\ v_o\left(\frac{p_2}{p_o}\right)^{\frac{\gamma-1}{\gamma}}$$

$$W'_m=\frac{p_o\ v_o}{\gamma-1}\left\{\left(\frac{p_2}{p_o}\right)^{\frac{\gamma-1}{\gamma}}-1\right\}+p_o\ v_o\left\{\left(\frac{p_2}{p_o}\right)^{\frac{\gamma-1}{\gamma}}-1\right\}=\frac{\gamma}{\gamma-1}$$

$$p_o\ v_o\left\{\left(\frac{p_2}{p_o}\right)^{\frac{\gamma-1}{\gamma}}\ 1\right\}$$

$$W'_m=3.451\ p_ov_o\left\{\left(\frac{p_2}{p_o}\right)^{0.29}-1\right\}$$

The useful work performed by the air will be the same as in the former case,

$$W'^u=(p^2-p_o)v_2=p_ov_o\left(1-\frac{p_o}{p^2}\right).$$

In the diagram

W'_c=area ABXYA.
W'_e= " γXHOγ.
W'_a= " ABUOA.
W'_m= " BXHUB.
W'_u= " TLHUT.
$W'_m-W'^u$= " BXLTB=amount of work lost.

$\frac{p_2}{p_o}$	W'_m	W'_u	$\frac{W'_m-W'_u}{W'_m}$	$\frac{W_m-W_u}{W_m}$
2	20,132	13,107	0.35	0.28
3	33,947	17.485	0.48	0.39
4	44,774	19,660	0.56	0.46
5	53,791	20,971	0.61	0.50
6	61,629	21,845	0.65	0.53
7	68,602	22,465	0.67	0.56
8	74,867	22,937	0.69	0.58
9	80,608	23,304	0.71	0.60
10	85,930	23,593	0.73	0.61

In the above table a comparison of the two last columns representing respectively the proportion of work lost, when the air is not cooled in the compressing cylinder, and that lost when it is completely cooled, will make manifest the ad

vantage there is in cooling the air in the compressing cylinder. The real loss of work in practice will lie somewhere between the limiting values given by the two columns, approaching more nearly the lower limit, as the cooling action in the compressing cylinder is more energetic.

To show the advantage in economy of work of allowing the air to expand fully (if it were practicable), I have calculated the amount of useful work that would be performed by the air if allowed to expand to its original pressure p_o.

I have obtained the expression for this work by subtracting from W_1 the total work of expansion, found before, the work required to overcome the resistance of the atmosphere.

$$W_{ue} = \frac{p_o v_o}{\gamma - 1} \left\{ 1 - \left(\frac{p_o}{p_2}\right)^{\frac{\gamma-1}{\gamma}} \right\} - p_o \left(v_4 - v_2\right)$$

$$W_{ue} = \frac{p_o v_o}{\gamma - 1} \left\{ 1 - \left(\frac{p_o}{p_2}\right)^{\frac{\gamma-1}{\gamma}} \right\} - p_o v_o \left\{ \left(\frac{p_o}{p_2}\right)^{\frac{\gamma-1}{\gamma}} \frac{p_o}{p_2} \right\}$$

$\frac{p}{p_o}$	W_{ue}	$W_u + W_{ue}$	$\frac{W'_m - (W_u + W_{ue})}{W'_m}$	$\frac{W_m - (W_u + W_{ue})}{W_m}$
2	3,367	16,474	0.18	0.09
3	7,202	24,679	0.27	0.14
4	10,283	29,943	0.33	0.18
5	12,772	33,743	0.37	0.20
6	14,812	36,657	0.40	0.22
7	16,541	39,006	0.43	0.24
8	18,025	40,962	0.45	0.25
9	19,320	42,624	0.47	0.26
10	20,472	44,065	0.49	0.27

In the diagram

W_{ue} =area R T L R

$W_u + W_{ue}$ = " U H L R U

$W'_m - (W_u + W_{ue})$ = " B X L R B=amount of work lost when air is cooled after leaving the compressor.

$W_m - (W_u + W_{ue})$ = " B L R B =amount of work lost when air is cooled completely in compressor.

Table showing proportion of work performed by motor lost :

$\frac{p_2}{p_o}$	1 With full expansion.		With no expansion.	
	Air completely cooled in compressor.	Air not cooled in compressor.	Air completely cooled in compressor.	Air not cooled in compressor.
2	0·09	0·18	0·28	0·35
3	0·14	0·27	0·39	0·48
4	0·18	0·33	0·46	0·56
5	0·20	0·37	0·50	0·61
6	0·22	0·40	0·53	0·65
7	0·24	0·43	0·56	0·67
8	0·25	0·45	0·58	0·69
9	0·26	0·47	0·60	0·71
10	0·27	0·49	0·61	0·73

The table shows us that under the most favorable conditions, conditions not as yet attained in practice, there is a loss in the use of compressed air as a motor, which becomes considerable at high pressure. Under ordinary circumstances, viz., without the employment of expansion, with incomplete cooling in the compressor, and with high pressures, the loss exceeds 50 per cent. of the work performed by the motor.

It must be remembered that this is only that portion of the actual loss of work, which is due to the transformation of work into heat in compressing, and the non-employance of expansion. We have taken no account of the mechanical imperfections of the compressing and the working engines ; of the losses of air through the valves, by leakage &c. ; of the loss of pressure due to the friction of the air in the pipes &c. According to Professor RANKINE, as quoted in the ENGINEERING AND MINING JOURNAL, the actual loss rarely is less than from 65 to 75 per cent. of the work performed by the motor, and in some cases can be shown to exceed 90 per cent. of that work.

The foregoing calculations have been based upon the action of dry air. The disturbances introduced by the small quantity of moisture that the air contains cannot be very great.

To deduce from the above formulæ the amount of theoretical work in horse power performed by the compressing engine, multiply values of W_m or W'_m by the following co-efficient :

$$n\, n_1 \frac{\pi d^2}{4}.\, s. \times \frac{1}{12.387} \times \frac{1}{33.000} = 0.00000192\, n\, n_1\, d^2 s.$$

In which :

n = No. of single strokes of compressor per minute.

n_1 = No. of cylinders.

d = Diameter of " } in feet.

s = stroke }

12.387 = No. of cubic feet of air at p_o and τ_o in one pound avoirdupois.

33,000 = No. of foot pounds per minute in one H. P.

MINING SUMMARY.

Nevada.

GOLD HILL DISTRICT.

From the Gold Hill *News* of June 28.

[CONTINUED FROM PAGE 45.]

BALTIC CONSOLIDATED.

This is one of the oldest locations on American Flat, but for various reasons has been lying idle for years. Work was, however, resumed about four weeks ago, running a tunnel, which is now in over fifty feet, and is following the ledge. Good assays are obtained, and the general prospects are good for opening a valuable mine.

CROWN POINT.

Owing to the bad luck with the machinery, the ore production for the last week or two has not been up to the average, and what was taken out came from the 1000 and 1200-foot levels, where the ore is of a lower grade than at the 1300-foot level. This difficulty is now obviated, however, the machinery being all right once more and in good running condition. The cross-cut east of the 1300-foot level, after passing through a rich streak of ore fourteen feet wide, sixty-six feet from the drift, has gone on some twenty-three feet beyond in porphyry and quartz that gives low assays. The cross-cut east at the lower or 1400-foot level is in sixty-five feet, with the face still in solid white quartz giving low assays. A little water is coming in and the drill is kept driven ahead as a prospective and precautionary measure. The drift is not far enough in to tap the vein yet, but the indications are that it is not far off.

DAYTON.

The rock in the face of the main west tunnel at the 225-foot level is much softer than at last report, and admits of much better speed in the progress of the work. The same heavy and extensive quartz ledge which was opened and developed at the upper level of this mine in 1864—5 is found to extend to the lower level now being worked. It is much more concentrated, however, and contains more good ore. It is over 100 feet in width. The Dayton is one of the most valuable mines along the great main lode.

CONSOLIDATED VIRGINIA.

Sinking the shaft is making steady progress, the rock in the bottom working well. It is now down 1,066 feet. Excavating for the pump bob for the new pump is progressing rapidly. But little headway has been made in the main north drift on the 1167-foot level from the Gould & Curry shaft during the week, owing to the striking of a heavy flow of water in the face of the drift of so hot a temperature as to make it almost impossible for the men to prosecute the work.

FRANKLIN.

The clearing out and repairing of the main drift is still being vigorously driven ahead. Two shifts of men are employed, and they progress at the rate of two sets of timbers in three days. New ground and the ledge itself will be reached in the course of a week or ten days. Detached pieces of loose ore are frequently met with in the progress of the work, which give good assays. One piece last Wednesday assayed $124 26 to the ton, twenty-five per cent. of which was gold.

IMPERIAL.

There is no particular change to note in the appearance or prospects of this mine. Work goes on as usual, and everything operates well. The company held their regular annual meeting at San Francisco last Monday, when the old officers were re-elected as follows: A. K. P. HARMON, J. D. FRY, H. C. KIBBE, J. H. ROBINSON, WILLIAM NORRIS, ALPHEUS BULL and THOS. BELL, Trustees ; W. E. DEAN, Secretary ; C. C. BATTERMAN, Superintendent.

GOULD & CURRY.

The new pumps were all completed in good running order, and started up at six o'clock last evening. The main northeast prospecting drift on the 1500-foot level is still driven ahead, the face in quartz and porphyry. The connection of the south drift on the 1600-foot level with the Savage gives thorough ventilation, and affords the opportunity to cross-cut and develop that portion of the mine.

WOODVILLE.

This excellent mine continues to yield well, keeping the mills steadily running. The suit brought against the Woodville by the Justice Company is drawing towards a close. It is not a suit for title as many have supposed, but merely for trespass, the Justice Company alleging that the Woodville Company have been gouging in upon them and taking ore from the Justice ground.

HALE & NORCROSS.

Daily yield fifty tons of ore. Sinking the north winze from the 1700-foot level downward is making good progress. The engine used on the 1500-foot level to do the hoisting in the winze from the 1700 to the 1500-foot levels, will be used to do the hoisting from this new winze. Nothing new to report of the prospecting in the other portions of the mine.

SILVER HILL.

Daily yield sixty tons of ore. The ore in the face of the north drift at the first station shows quite an improvement in quality during the week. No change in the south drift at the first station. The main northwest prospecting drift at the second station is making good progress, with no change of interest to report.

SIERRA NEVADA.

Daily yield sixty tons of ore. The ore breasts in the upper and middle portions of the mine are being gradually extended back further into the mountain, and continue to show an improvement in both the quantity and quality of the ore extracted. The mill is kept steadily running on ore from the mine.

Colorado.

THE CARIBOU MINE.

From the Georgetown *Miner* of July 10 :

The recent sale of the Caribou mine and the large price obtained have naturally attracted attention to that district. A number of persons have been to visit the mine, and those who are properly presented are always courteously received by Mr. CUTTER, the superintendent, Mr. DAWLEY, who has charge of the mill, or Mr. ALLEN, the foreman in the mine. Since the sale there has been no apparent change. The same officers remain in charge. The first move has been to double the capacity of the mill, and Mr. CUTTER has just left for California to send on necessary machinery.

Prior to the sale, Messrs. BREED & CUTTER were only in possession of the west end. They had a bond, payable on the sale of the mine on the east end, and the original

owners remained in the possession on a lease until the money was paid. Now both ends 1,400 feet in all, are being worked for the Dutch company. A steam engine on the west end keeps the water down and hoists the rock, while a horse whim is still used on the east end. This will be dispensed with as soon as the workings are properly connected with the main shaft.

The principal workings now are on the 270-foot level. The crevice here varies from three feet six inches to five feet six inches in width. Both walls are well defined and pitch nearly perpendicularly. The gangue carries from ten ounces mineral up to 1,200 ounces and over, but the latter instances are not frequent. Much of the rock seems to carry about sixty ounces. As the rock is uncommonly hard, and overhand stoping is difficult, the whole mine is worked by the underhand stoping, and all the rock necessarily raised. In places, where the grade is evidently too low to mill it is left standing, and drifts are run until good pay is struck again. There are no pinches to be seen in the Caribou. The vein is always well defined and strong. There are places, however, which are very lean.

Situated as the Caribou is, at the edge of the timber line, with a long stretch of morass below it, drainage is necessarily difficult. The tunnel being run will strike the lode at a depth of 360 feet. Below that level all the water will have to be hoisted. As a steady and well defined stream is even now pouring in, this will require constant work from the steam engine. At the worst seasons of the year the present engine would hardly gain on the water.

Everything taken into consideration, richess of mineral, cost of mining, facility of drainage and means of access all the year round, it may safely be said that there are several mines near Georgetown quite as good as the Caribou.

What sold the Caribou was not the mine but its mill. This is situated at the foot of the mountain, four miles off, and is connected with the mine by a good wagon road. It consists of four Bruckner cylinders and their appurtenances, and is under the charge of Mr. J. M. Dawley. It is quite safe to say that the ores around Caribou can be treated profitably at this mill at a charge of twenty-five ounces for treatment, the miner receiving $125 gold per ounce for the balance of the assay.

The following will give an idea of the scale of prices recently established:

For 60 oz. ore, $1.20 for all over 30 oz.

For 80 oz. ore, $1.21 for all over 59 oz.

For 100 oz. ore, $1.23 for all over 25 oz.

In other words the price paid for 100 ounce ore is $92 per ton. Here, for the most docile ore we should not get more than $75—a difference of $17, or over 22 per cent. in favor of Caribou prices, and even at this figrue the Caribou mill makes a profit of $15 a ton.

It can readily be understood that if a mine can, with a good mill, save $18 a ton on twenty tons per day, it will make, by this saving, $90,000 a year, while without it the mine might barely pay expenses. The proof of this is to be seen in the fact that mines immediately adjacent to the Caribou, with large, strong seams, pay nothing. Indeed few of them are worked. In the Sherman they are pumping out water, but nowhere else are there any signs of marked activity.

The advantage the Caribou district has over Clear Creek is that its ores are more readily treated. Here the ores are unusually refractory, some of them carrying from 15 to 35 per cent. zink. These mines require much longer time to roast and entail an extra loss of silver. The Caribou saves about 94 per cent. With refractory ores the loss would be greater, although Mr. DAWLEY, who has had large experience in silver reduction works, insists that he can treat ores containing not over 15 per cent. of zink, readily in the Bruckner cylinder. Indeed this he contends is the proper method of reducing our ores. Heavier ores would have to be mixed with leaner ores or with ores free from base metals, so as to reduce the percentage of zink. Of course the capacity of the cylinders would not be as great with refractory ores, but Mr. DAWLEY is satisfied that on account of the superior economy and efficacy of the Bruckner cylinder, this method will in the end be found the most satisfactory one of those now in use, for the reduction of our zink ores. There are mines here which could supply a mill. When mine owners do as Messrs. BEED & CUTTER did and are as successful we shall learn what the value of our mines really are.

California.

CALAVERAS COUNTY.

MOSCOW DISTRICT.—Calaveras *Chronicle*, June 28: The main shaft in the Good Hope is now down 130 feet. Sinking now. Vein of good size; contains excellent ore. WILLET & Co. bought a portion of the Woodcock mine. Running tunnel on the vein. The Dolly Varden has pretty fair ore on the dump. The vein averages over five feet in thickness and presents better features than any other mine in the district. Shaft 100 feet deep. San Bruno is driving tunnel.

WEST POINT DISTRICT.—The Pancho will probably change hands in a short time. Developments on the Harris progress slowly. The ore yields considerable over expenses. Lone Star working five or six hands. The mine rates No. 1. Ohio Consolidated hauling and crushing ore. Running levels and transverse drift to tap the vein. The mine promises to exceed the most favorable expectations. S. HASTINGS is opening a handsome vein near Skull Flat. The new saw mill of WICKHAM & Co. is completed. Lumber can now be had at very reasonable rates. Business brisk.

FRESNO COUNTY.

COPPER MINING.—Fresno *Expositor*, June: In the vicinity of Buchanan Hollow, in this county, copper mining seems to be increasing in prosperity. Three mines are now in operation near Green Mountain, from all of which excellent ores are being extracted. The names of the mines are the Green Mine, Green Mountain and Lone Tree. The last of these is being operated by J. M. AULT, Esq. We learn that he is taking out a considerable quantity of ore, much of which assays 35 per cent. copper. The ores from the mine are being smelted at the furnace erected by Mr. HARRY DEGROOT, on Green Mountain, and the regulus shipped to San Francisco, where it sells for $525 per ton. The Green Mountain mine, worked by HARRY DEGROOT, is yielding splendid ore. A number of tons shipped last month brought $100 per ton in San Francisco. The old Buchanan Copper Mine, which was started up about a year ago by JAMES MCMECHAM, Esq., is yielding more and better ore than ever before. It ranges from 16 to 35 per cent. About fifty tons of ore are shipped per month. Ten white men and fifteen Chinamen are now engaged about the mine, but the working force is to be doubled, and then shipments of ore will be proportionately increased.

EL DORADO COUNTY.

OFFER FOR A PLACERVILLE MINE.—Mountain *Democrat*, June 28: Edward Keegan, one of our pioneers, has a quartz ledge in the heart of this city. He has stripped the croppings of one enormous ledge and tunnelled on another near by. A few days ago he was offered $10,000 cash down, by responsible San Francisco capitalists, for his claim, but refused to take less than $17,000 for it.

NEVADA COUNTY.

Nevada *Transcript*, June 26: The Little York Gold Washing Company is the name adopted by the purchasers of the property of the Little York Water and Gravel Mining Company. The new company is composed of English capitalists, and the property is a very excellent one. In addition to extensive gravel ranges, they have first water right for two ditches from Bear river, and the second right on Steep Hollow, giving them first-rate water privileges. They are now running two sets of diggings by day, and supplying Dr. ALPIN, who is running his claims night and day, and they have about 700 inches of water. We understand the prospects of the company are very encouraging.

RUSS LEDGE.—Grass Valley *Union*, July 29: KENNEDY & Co. have been working for some time on a ledge a short distance from the North Star mine. It was formerly known as the Buss Ledge, having been worked for a time, about the year 1859, by Col. Russ, who left Grass Valley and finally located in the gold mines of Nova Scotia, where he died. Two satisfactory crushings have been made from the rock taken out. They are down on the ledge about 150 feet, and the rock is looking better as the sink upon it.

STRIKE.—It is rumored about the streets that a new and very rich strike in quartz has been made in this district within a few days. The parties in interest are not yet ready to give public information, but they inform us that it is but a few minutes' work at any time to scratch out $10 or $15 worth of gold with the fingers.

THE ENTERPRISE MINE.—Nevada *Transcript*, June 28: The Enterprise Gravel mine is located in Buena Vista Slide, and the works are very complete. They have a 10-stamp battery, pumping, and hoisting works, all in the most complete order. The incline is in three compartments, and is down 1400 feet. All the way above the bottom of the incline they have gravel which prospects well, but they have not yet struck the main channel for which they are running. We understand, however, that the Enterprise has paid expenses all along, and the yield will, no doubt, be largely increased when they reach the main channel, which is known to run along under the ridge which they are washing.

PLUMAS COUNTY.

MINING NOTES.—Plumas "National," June 28: METCALF and HAYCOCK on Gopher Hill have nearly finished their seasons' run of water. They have moved a large quantity of ground this season, and will be well remunerated for their toil. MORRIS, SMITH & Co., whose drifting claims are also on Gopher Hill, are doing well, and have been for some time. The Blackhawk Co. are cleaning up, and report says will make a good season's run. The Devil's Elbow Co. are working several men, with fair results. Low water is unfavorable, as it allows tailings to accumulate. The Hungarian Co. are not piping at present, the Mill Creek water having been turned down the creek for the benefit of the farmers. The Superintendent, Mr. GOODWIN, is working a few men, however, and as usual, taking out lots of "kalesced." The O'NEIL Bros., have recently got some very favorable prospects in their drifting claims at Newtown. JUDKINS & KINGSBURY, of Newtown, have nearly completed their preparations, and will soon be taking out "pay grit." BELL still continues to get some fine prospects from his quartz claim near Elizabethtown. LEAVITT is working a claim in Betsy Gulch, near Elizabethtown, and is making good wages. HEATH & Co., of Argentine are still piping and the indications are that they will make a huge clean up. This claim we consider one of the best in the country. DEAN & TEFFT are doing a large amount of work at the mouth of Squirrel Creek, and have good prospects. SWAN, WEBSTER & Co., are also at work on Squirrel Creek, but we are not posted as to the results. The water has been remarkably short, and numerous claims have been idle. One or two good water seasons would develop a large number of claims, and make Plumas one of the foremost mining counties in the State.

SAN DIEGO COUNTY.

Weekly *World*, June 21, says: About one week ago the Messrs. YOUNG, WORTH & SHEARD struck an extension of the Golden Chariot, 6 miles south of that mine. The specimens from this ledge are of a very favorable character, and promise to equal the Golden Chariot in richness. The developments of the Tom Scott are good, and promise to exceed anything before discovered, perhaps with the exception of the Golden Chariot. A joint shaft with the Eureka, which it adjoins, is being sunk and is already down 100 feet. As soon as water is struck they will put on an engine. The Owen mine has let a contract to sink 25 ft. at $30 per ft., and the work is being pushed vigoreusly. Good rock has been struck in the Far West and the outlook is all that the owners could wish. In the Helvetia mine three shafts are being worked daily and a great deal of rock is being taken out. The San Nicholas mine, in the San Rafael District, cleaned up after a crushing of 180 tons of rock, netting $1,200. Owing to the failure of water supply, crushing has been suspended on this rock as also that of the Pueblo, Zapata and other mines.

TUOLUMNE COUNTY.

T. M. BLUE GRAVEL CO.—*Independent*, June 28: Are turning out from 22 to 24 ounces of gold per day, and better prospects ahead.

A GOOD CLAIM.—On Thursday of last week HAYNES & Co., who own a claim in Parsons' Ranch, Columbia, cleaned up after a 100 days' run, and obtained thirty-four pounds of gold—about $7,550.

GOLDEN GATE.—A few tons of rock from this lode was run through an arastra at Brown's Flat, recently, and under most discouraging circumstances, the machinery being out of order and mud water being used. The yield was over $10 per ton, even at that; 609 pounds of the same rock shipped below last week, and run through a mill, turned out $28.11 to the ton, the average assay of pulp being $7.18. Sulphurets sent down at the same time, assayed $516.64 per ton. Mr. LONG, the Superintendent, wishing to thoroughly test the vein, picked out parcels of the sulphurets—one in the slate, near the hanging wall, and one on foot wall, from neither of which anything was expected. The first, in the slate horse, where the lead is from 12 to 15 ft. in width, assayed $202.18 to the ton, and the highest assay had was on the foot wall in the breast of the tunnel, which went $5,461.35 to the ton, and getting richer as the miners work in. The shaft is now down to the tunnel, which is in on the vein some 200 ft. below the surface. The prospect ahead looks first-rate, better than ever.

PROSPECTORS.—Union *Democrat* June 28: Quite a number of persons during this month, have made trips into the mountains east of this place, for the purpose of finding silver-bearing leads. Large bodies of snow have prevented them from making anything like satisfactory explorations. The fact that silver-bearing ore was found last year in our county, makes many of the prospecting class uneasy, taxing their patience until such time as the snow will permit of a thorough search. The parties that commenced opening a lead last fall, have made preparations to resume work, with sanguine expectations that it will develop into a paying mine. A number of assays made returned a handsome per cent. of silver.—*Mining and Scientific Press.*

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The special advantages of the ENGINEERING AND MINING JOURNAL, *as a medium for advertisers, are so great and so widely known that it may seem almost needless to call attention to them. It is extensively circulated among the engineers of the country and takes a position in this respect before any other publication of the kind. It has a large and constantly increasing circulation among miners and mine owners, and men connected with mining operations generally. As it is the only paper in the country that makes this subject a specialty it has this field entirely to itself, and is the only direct and reliable means of reaching this class of persons. Being kept on file by almost every subscriber, it is doubly valuable as a permanent means of keeping an advertisement before the public. It is the Organ of the* AMERICAN INSTITUTE OF MINING ENGINEERS, *and is regularly received and read* BY ALL THE MEMBERS AND ASSOCIATES *of that large and powerful society,* THE ONLY ONE OF THE KIND IN THIS COUNTRY. *It is therefore the best medium for advertising all kinds of machinery, tools and materials used by engineers or their employees. It is the recognized organ of the coal trade, and is taken extensively by the trade throughout the country, and presents the very best means of reaching that very important class of men.*

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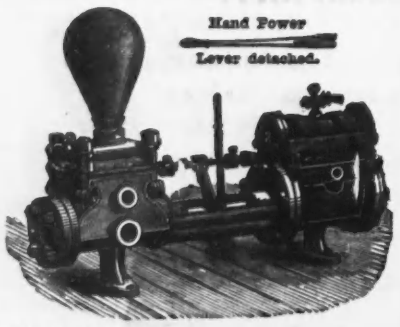

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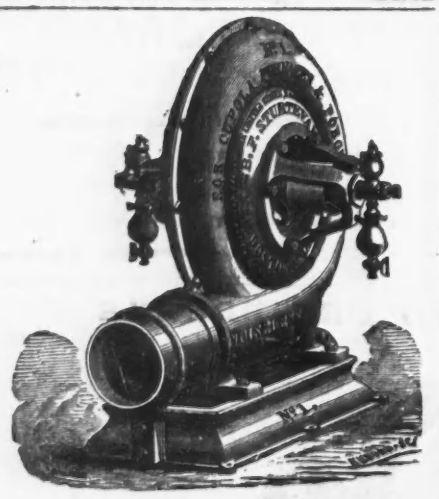

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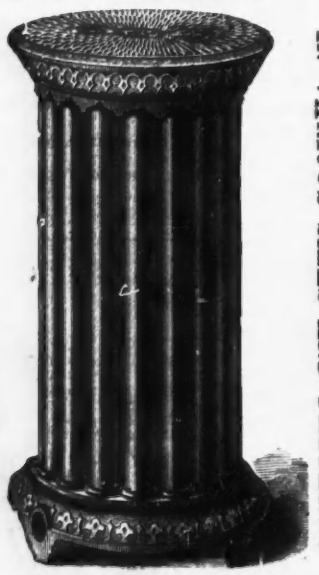

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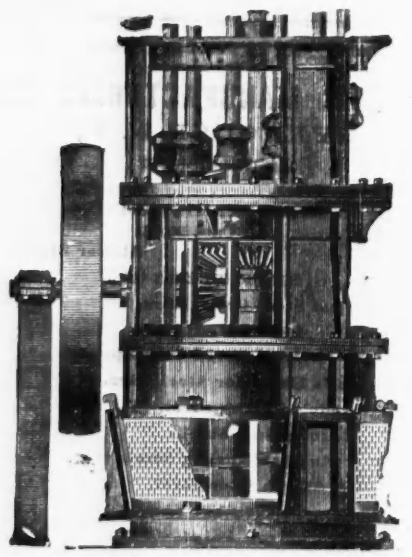

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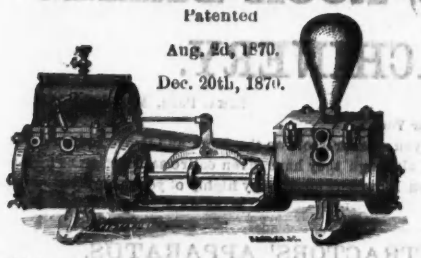

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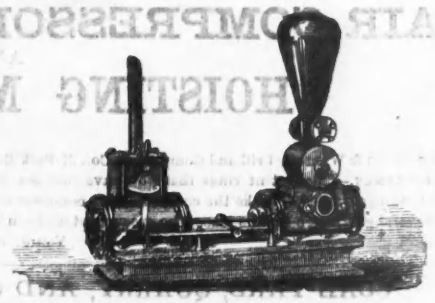

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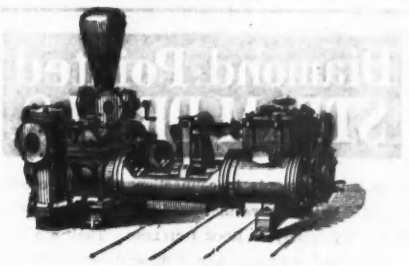

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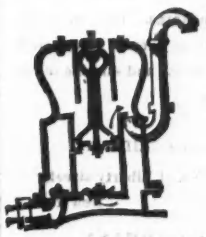

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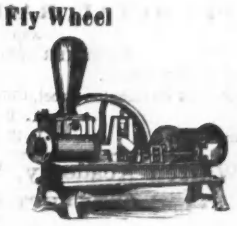

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