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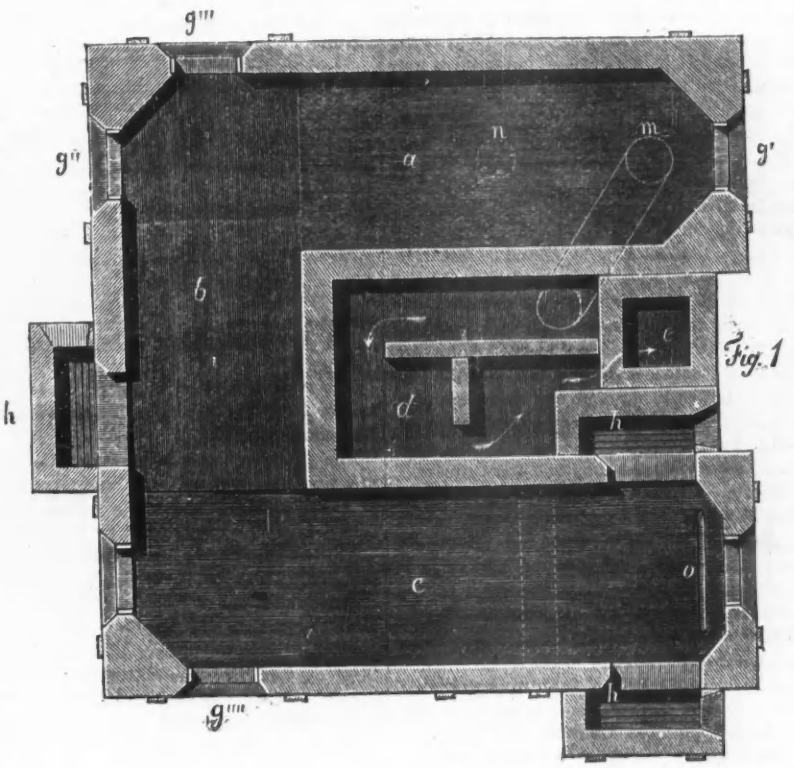
Küstel's Improved Roasting Furnace for Copper, Silver and Gold Ores.

WHOEVER has been engaged in roasting ores will admit, that different classes of ore, for instance gold sulphurets (iron pyrites), decomposed silver ores, silver sulphurets, blendic ores, etc., cannot be treated exactly in the same way, if the best roasting results are to be obtained. In this respect the old reverberatory was the proper furnace. The roaster had it in his power to modify the heat, the time of roasting, the amount of salt, lime or sulphate of iron, the proper time of adding these ingredients and so forth, till oxidation or expulsion of volatile base metals and chlorination of the silver was accomplished. But the expense was too high and the time of roasting too long. The introduction of the long reverberatory roasting furnace diminished the expense and shortened the time of roasting, but the moving of ore from one end to the other through side doors was very tedious, and the roasting time still too long, and the amount of labor required large.

All the disadvantages, above mentioned, are obviated by KÜSTEL'S improved furnace, of which Figs. 1 and 2 give a clear illustration; they are drawn to a scale of six feet to one inch. Fig. 1 is the horizontal and Fig 2 the vertical section. There are in this furnace two very important improvements. The first consists in breaking the straight line of the long furnace. The working doors *g g* are placed so that no lateral work is performed; only drawing and pushing on an inclined hearth is required. The ore is introduced through the hopper *n*, on the upper hearth *a*, spread equally, and after an hours' time drawn at *g''* and pushed from *g'* upon the second inclined hearth *b*, and from this upon the third, *c*, in the same way. No stirring is required unless very difficult ore is under treatment. The moving of the ore from one end of the furnace to the other is generally sufficient. The necessary heat is kept up by two or three fire-places *h h*. The gases pass through the flue *m* above the roof into the dust chamber *d*, and escape through the chimney *e*. The arrangement



KÜSTEL'S IMPROVED REVERBERATORY ROASTING FURNACE.

of having the working doors at the end of the long sides, enables the roaster to do a great deal more work than if tired out in the old way of moving the ore towards the fire bridge.

The other improvement refers to the chloridizing chamber K, Fig. 2. The purpose of this chamber is to shorten the time of roasting. It has been ascertained that the ore at rest in a red-hot condition continues to be chloridized when drawn out of the furnace. The ore falls through the opening, o, into the chamber and remains there red hot for two or four hours, as may be required. Chlorine and volatile chlorid metals, that are evolved, pass into the furnace and continue to chloridize the ore all along the furnace. In case there is no sulphur in the ore, sulphurous acid gas can be introduced through the pipe l, simply by burning sulphur. The sulphurous gas is transformed into sulphuric acid and liberates the chlorine from the salt.

The inventor states that a furnace of this kind, by the aid of the chamber K, can put through from 15 to 20 tons of ore in 24 hours, employing two shifts of three men each, consuming less than one-fifth of a cord of wood per ton of ore. The roasting being perfectly under control, the highest percentage of chloride of silver is obtained.

Without interfering in the least with the advantages alluded to, these furnaces can be worked just as well by an approved mechanical arrangement, so that a continuous feeding direct from the battery is effected. Local circumstances will decide whether hand work or machinery is preferred. The discharge of the ore from the chamber can be made at intervals or continuously by giving to the bottom a funnel shape and applying an endless chain arrangement. A few small holes through the brick work funnel may serve for the use of an iron rod in case choking occurs. The patent refers not

only to the shape as represented by Figs. 1 and 2, but to any breaking of the straight line of a long furnace by which the lateral work is avoided.

The Wyandotte Silver Smelting and Refining Works.*

BY W. M. COURTIS, M. E., OF WYANDOTTE, MICHIGAN.

Since many accounts of Silver Islet Mine, in Lake Superior, have already been published, it is supposed that the members of the Institute are familiar with the location and character of the mine. To many, however, a more detailed account of the ore, and manner of treatment will, perhaps, not be without interest.

The extraordinary richness of Silver Islet ores, and the difficulty of obtaining correct assays, induced the company to erect smelting works of its own. Accordingly, ground was broken at Wyandotte, Mich., early in the spring of 1871, and the work was pressed on with indomitable energy by Capt. E. B. WARD of Detroit, as president, and Mr. THOMAS MACFARLANE, the discoverer of Silver Islet, as superintendent of the works, so that by July 1st the works were so far completed that smelting could be commenced.

The intention was to work western ores with those from Lake Superior, since the latter contain but a small amount of lead. Hence the capacity of the works is much larger than is needed for the present yield of the mine. The planned process for treatment was smelting with lead ores, desilverizing the lead by BALBACH'S process with zinc, cupelling the rich lead, and refining the crude silver.

Since the supply of western ores was uncertain, and prices and freights were high, a sufficient supply could not be obtained; and hitherto the works have been in operation but a few months each year. Yet they have produced a very large amount of silver—931,203 ounces in fine silver up to Sept. 1st, 1873.

The process has been smelting for rich lead at once, and cupelling and refining the bullion. In addition has come: treatment of the matte to save the nickel; refining the nickel matte; extracting the silver from the marketable nickel speiss; and treatment of the refuse, too poor for smelting.

The works occupy three stone buildings, 150 feet long by 47 and 50 feet wide. The first building contains the offices, laboratories, engine and boiler, No. 8 ROOT'S blower, No. 8 BLAKE'S pump, crushing room, with BLAKE'S crusher, and two 30-inch mills, DODGE'S pan-amalgamator and settler (used for experiments at present). The second building has the refining-room, with 7 wind refining-furnaces; the cupelling-room, with two large English cupelling-furnaces; the bottom-room, where the tests are prepared; the smelting-room and charging-floors, with a block of four low blast furnaces (Krummöfen) and two reverberatories; and a blacksmith's and carpenter's shop at the end of the building. In connection with the blast-furnaces is a flue chamber about 150 feet long and 4 feet square.

The third building contains two cupelling-furnaces, and the plant for the zinc-process, with the furnaces for refining 25 tons of bullion daily.

The low blast-furnaces, though perhaps not the most economical for general application, answer their purpose very satisfactorily, and have the advantage of being easily regulated in case a charge should not work well, besides involving but small costs for repairs. The former is a very important item in working ore of about 1,000 ounces. Water-backs have been used, and lately water-blocks at the sides seem to show increased economy in the working of the furnace. These furnaces measure about 4 ft. from tuyere to top, 3 ft. 3 in. from front to back, 1 ft. 9 in. wide at tuyere, and a few inches wider at the mouth; from tuyere to sole, about 15 in. The sole inclines to the tapping-hole. One tuyere is generally used. At one time, the height of the furnace was changed to 14 ft., and two tuyeres were used, but owing to want of ore and other circumstances it was changed back, though the running was quite successful. A campaign in the usual furnace lasts four or five weeks, after which it is best to blow out and put in a new bottom. When brick sides are used, they are by that time cut out so much that the furnace requires greatly increased care in working. The bottom is made of brasque, composed of 3-5 coke and 2-5 fire clay by measure. A little more fire clay is usually added in preparing it. The mixture is ground together in the mill until it is as fine as flour. This makes a better bottom than coarser material, as it does not take up the lead, and, if moistened just enough, will not crack.

At first, the ore was separated into four classes: A I., containing between between 2 and 4,000 ounces silver per ton, or 7 to 14 per cent; II., 600 to 2,000 ounces, or 2 to 7 per cent.; III., above 100 ounces, or 0.3428 per cent.; and IIII., the waste of the mine, averaging 40 ounces, or 0.14 per cent. The latter forms the larger part of the ore and hereafter will be either concentrated or amalgamated as may prove most economical. At present, only two classes are made, smelting ore, which averages between 900 and 1,000 ounces, and No. 4, or waste for the present.

The minerals observed in the ore or gangue are:

Native silver, filiform and massive.	Dolomite.
Cerargyrite, where the rock has been decomposed.	Rhodochrosite.
	Chalcopyrite (rare) crystallized.
Argentite crystallized.	Pyrite. "
Antimonial silver (not determined).	Marcasite. "
Niccolite.	Calcite. "
Annabergite.	Graphite.
Galenite crystallized.	Quartz.
Sphalerite. "	

The presence of the following substances has been proved by tests: cobalt, in the niccolite; gypsum, probably resulting from the decomposition of some sulphure's. As the vein runs under the water of the lake, ore is obtained that has been exposed to its action, both from the vein and as boulders. The gangue has become quite soft and is usually stained green from the presence of nickel. The niccolite is so intimately mixed with native silver and sulphurets that it is impossible to say whether the pure niccolite contains silver; but from the tests made it would seem that it does not.

The country rock is diorite in clay slate, pieces of the former being enclosed in the ore. The native silver is generally disseminated through the ore in more or less dendritic masses, the points of native silver forming nuclei for the deposit of niccolite and sulphurets. Sometimes masses are found weighing several pounds. An analysis of a piece of native silver covered with a white powder, gave the following results:

Treated with water it showed HCl, in solution; then treated with acetic acid, it showed CO_2, HCl, CaO, MgO, AgO, FeO; dissolved in conc. NO_3, it left a brown powder of Fe_2O_3, which, treated with HCl, left a black powder, from which NH_4O. dissolved AgCl. The balance was AgS. The mass therefore contained more AgS than appears in the following analysis, which shows the composition of the part insoluble in water and acetic acid.

AgCl	4.65	Pb	0.90
AgS	0 29	Ni and Co	0.02
Fe	0.26	Sb and As	0.
Cu	0.04		

6.16, the balance being fine silver.

The following are analyses of samples of ore prepared for smelting, and represent an average of about thirteen tons for each sample.

ANALYSES OF ORES.

	A I.	I May '72	I June '73	IV June '71	IV June '71
CaO	7.57	19.39	19.94	23.15	22.90
MgO	6.94	4.35	9.65	6.28	7.73
Al_2O_3					
Fe_2O_3	1 88			7.53	3.84
Pb	40.24				0.80
Cu					
Zn	2.27				
Ag	8.30	2.85		0.114	0.1445
S	3.36			1.03	0.64
Silicates	13.23	27.20	30.50	36.13	33.78

Sample A I contained Ni 2.53, Co 0.65, determined by blowpipe analysis, and As 6.85.

The average yield in fine silver of 389 tons, smelted in '71 was 969.8 oz. per ton, or 3.325 per cent.; in '72 the average of 350 tons was 911.6 oz., or 3.126 per cent.

The yield on the assay was for the two years 99.15 per cent., being for the first year about 97½ per cent., and for the second over 100. This was partly due to the difficulty of getting a correct assay; but mostly to the working up of material left as waste the first year.

As there are grains of metallic silver in the ore it is difficult to get correct samples. To approximate as closely as possible, four samples are now made of each lot of 13 tons; three assays are made from each sample, and the mean of the 12 assays is taken as correct for the lot.

The ores used for mixing have been pure galena, argentiferous galenas from Colorado, and ores from Little Cottonwood, Utah, the latter being the most satisfactory. Colorado ores generally contain too much zinc to be used in large quantities with rich ores. Only enough galena is used to furnish sufficient sulphur for a fluid matte.

The fluxes used are limestone and iron cinder from rolling-mills, or iron blast-furnace cinder, when a silicious slag is required.

ANALYSES OF THE FLUXES.

	Limestone.		Mill cinder.	Blast-furnace cinder.
CaO	48,47			28,25
MgO	5,03			1.18
Al_2O_3				9,04
Fe_2O_3	0,67		75,06	5,69
Silicates	1,72	SiO_2	25,49	55,25
CO_2 and H_2O	43,41			
	99,30.		100,55.	100,01

The iron cinder has at 8.°3C., the sp. gr. 4.293, hardness, 5½, fusibility 3, and formula $5FeO.2SiO_2$.

The blast furnace slag corresponds to the formula $7(RO.SiO_2)+Al_2O_3,3SiO_2$.

The fuel used in the low-blast furnaces has been Hammondville and Connellsville coke), and coke from the Detroit Gas Works, trials being made with each. To obtain the value of each, the amount of Silver Islet ore treated is alone taken into account, so that the amount of coke used includes smelting all ores and flux, roasting matte, refining, assaying, and loss in weight.

One ton Hammondville coke treated				0.83 tons ore.
" " Connellsville " "				1.27 " "
" " Gas Works " "				1.20 " "
	Hammondville.	Connellsville.	Gas.	Utah Coke.
Ashes	15.82	12.93	7.93	9.7
Carbon	74.6	81.1		68.7

Carbon is determined by docimpastic assay. The ashes contained by analysis:

	Connellsville (?)	Gas.	Utah Coke.
Fe_2O_3	22.73	24.14	59.26
Al_2O_3	25.12	19.69	
CaO	6.95	3.98	5.34
MgO	1.91	1.25	1.74
SiO_2	44.64	51.07	31.37

The first contained 2.23 sulphur and needs a correction for oxygen.

*A paper read before the American Institute of Mining Engineers at Easton, Pa., October 22, 1873.

The ore and flux are made up into charges of about six tons, each charge intended for twenty-four hours. Two and a half tons of Silver Islet ore is called a unit, and the proper amount of lead ore and fluxes are estimated on this basis. The amount of lead in each charge is so arranged that one pound of the silver-lead (*werk blei*) produced will contain one ounce of silver or between six and seven per cent. silver.

The fluxes are added in proper proportion to produce a basic slag, in which iron predominates; and when the ore is running silicious, enough lime is supplied to keep the specific gravity of the slag so low that the matte can separate perfectly. About ten per cent. of slag from the same furnace is added, partly to use up any rich slag, but especially to make the charge more fusible. Old tests, refining ashes, sweepings, etc., are added in small amounts, in proportion to the production, that there may be no accumulation of silver in unnecessary products. Roasted matte, as well as iron cinder, is used to make a fluid slag and throw down the lead from the galena. Experience shows that a mixture of both in a charge gives better results and a cleaner slag than either alone. The largest amount of Silver Islet ore put through in twenty-four hours is 2.7 tons to a furnace; the average is about two tons, on account of lead-ores being used instead of litharge.

PRODUCTS.

Silver-lead, containing six to eight per cent. of silver, which is cupelled.

Matte.—Enough sulphuret is given to each charge to keep the matte fluid, and prevent the formation of sows. As the ore has but little sulphur, western ores are used, and the matte is only partially roasted. To have the furnace work well, a cake of matte, at least two inches, should be produced with each tapping. If iron slag is used alone, the matte becomes thick and encloses shots of lead, which makes the assay very high, and consequently, the loss greater.

The matte is roasted in heaps and used over again until the resulting matte contains so much nickel that it can be worked for speiss in the reverberatory furnace. During the roasting, there is a partial sweating out of the speiss contained in the matte, so that the lumps that are melted together contain a larger percentage of nickel than that better roasted. These are therefore sorted out to be treated in the speiss process. The poorest matte, containing 0.28 per cent. silver, was produced when working Utah ores, which were also favorable to the concentration of the nickel. The following analyses of matte show the increase of nickel as it was worked. The copper and a trace of gold that is found in some of the products comes mostly from western ores.

ANALYSES OF MATTES.

Fe.	1. Balance.	2. Balance.	3. Balance.
Ni Co Zn	1.57	7.32	10.44
Pb	8.17	9.66	3.75
Cu	0	0	0.89
Ag	0.5954	0.5044	0.852
S	16.83	11.48	17.55
Sb	——	2.38	trace
Sp. Gr.	6.0672	6.1086	As 4.18
Temp.	17°8C	18°3C	slag 4.75

No. 3 was matte produced in a high furnace.

Flue-dust collects in the chambers to the amount of about ½ per cent. of the material smelted. The largest and richest part settles in the first chamber, that from the chimney containing less than one-third as much as the first chamber.

It is mixed with lime water to a paste, dried, broken up, and smelted on the charges. The following are analyses of dust:

	1.	2.
CaO	8.74	6.62
MgO	3.66	0
Al_2O_3	14.43	18.54
Fe_2O_3		
NiO	0.08	trace
CoO	0.09	
ZnO	6.23	
PbO	19.91	23.77
Ag	0.286	0.292
So_3	9.30	8.85
SiO_2	16.11	13.06
CO_2	1.28	3.76
H_2O		
Insol. coke, etc.,	19.13	22.14
	99.25	97.03

Slag.—This is thrown away, except what is wanted for flux, or what is too rich in silver to be rejected.

The assay is generally less than five ounces in silver, and sometimes less than one, while the lead contained is usually less than one per cent. If the charges are put up so that the slag will be very poor in silver, the loss in labor and fuel more than balances the saving in silver.

ANALYSES OF SLAGS.

	1	2	3	4	5
CaO	10.77	15.88	24.99	21.43	17.52
MgO	1.97	3.39	2.46	8.04	4.92
Al_2O_3	12.25	9.56	3.34	1.59	1.78
FeO	41.11	33.80	28.25	16.14	39.36
PbO	——	——	——	1.84	0.81
Ag	0.017	0.026	0.007	0.023	0.025
SiO_2	33.77	37.13	41.46	48.00	34.42
	99.89	99.79	100.51	97.06	98.84

Formula for (1) 13 RO, 5 SiO_2 + Al_2O_3 2SiO_2 Low furnace.
" " (2) 14 (2RO, SiO_2) + 3 (Al_2O_3 2 SiO_2) " "
" " (3) Sp. Gr. 3,205 at 17°8C.
" " (4) 7 (12RO 11SiO_2) + 2 (Al_2O_3 2SiO_3 High furnace.
" " (5) Ore smelting in Reverberatory, Sp. Gr. 3. 733 at 64° F.

No. 1 was very fluid; but the charge did not work as fast as No. 3, with not so fluid a slag.

Bricks.—These are divided into two classes, those rich enough to be smelted on the charges, and those that are too poor. When the furnaces are blown out, the brick linings are partly smelted and heavy with lead. Those away from contact with the inside of the furnace are more or less impregnated with lead and silver. The latter is often found filling little cavities, crystallized in octohedrons and nearly pure.

Dressing would be the best way of treating this material, but amalgamation has been used, although a large part of the lead is lost, which also causes the loss of quicksilver to be very heavy.

CUPELLATION OF SILVER LEAD.

The furnaces are English, with blast below the fire grate, and on lead bath; the fuel used is Briar Hill soft coal. The tests are made of ground lime-stone and fire-clay in the proportion of 3 to 1, stamped into the ring while moist. When full, the tests hold about 650 lb. of silver; but the cupellation ends when there is about 500 lb., lasting three days, in which 3 to 4 tons of silver lead have been cupelled, and consuming 1,350 lb. coal per ton. The work done by the cupellers has been improving steadily, the litharge being poorer and a larger amount of lead being put through per hour. As none of the workmen employed have had any previous experience in smelting, it has not been without a great deal of attention that they have attained their present skill. The old tests are broken up by hand to detach the buttons of silver; the part saturated with lead is smelted on the charges, and the balance is mixed with new material to make tests. One test will sometimes outlast two cupellations; but it is safer to use new ones. The greater heat required at the end of the process is apt to injure the bottom so that flakes come off, thus making the material too thin for a second cupellation.

ANALYSES OF CRUDE SILVER.

	1.	2.
Fe	0.090	0.031
Ni. Co	0.004	0.008
Cu	0.117	0.106
Bi	0.0058	....
Pb	1.090	0.260
Au	0.0023	0.0015
Sb	trace.	....
As	0	0
	1.309	0.407

The balance is silver.

ANALYSES OF LITHARGE.

	First part.	Average.	Last part.
Fe_2O_3	2.82	0.66	1.24
CuO	0.29	0.36	1.41
Ag	0.032	0.072	1.314
SbO_4	1.35	0.62	0.44
AsO_5	....	....	....
	4.49	1.71	4.40

The balance is oxide of lead.

The litharge is used in the charges to supply lead. The crude silver is refined in graphite crucibles and cast into bars, weighing 450 ounces. The slag from refining contains shots of silver, and is therefore melted down on the lead bath in the cupelling furnace, the skimmings going to the blast-furnace.

The fineness of the bars is 999, and generally 999.5 thousandths, by U. S. mint assay.

In the refining slag, which is mostly silicate of lead, (sand being used in refining,) the following metals have been found:

(Ni, Co)O	0.550
Cu O	0.203
Bi O	0.026
Ag	1.837
SbO_4	0.639
AsO_5	0.005
	3.260

NICKEL AND COBALT.

Nickel and cobalt are found in all the products, especially in a green coating that covers the tests, and part of which seems to be a compound of nickel, similar to the *Kupfer-glimmer* found in *Gaar-Kupfer* containing antimony.

From the analyses of the mattes, it will be seen that the nickel contained in the ore is collected in the matte, the percentage increasing each time the roasted matte goes through the low furnace. When it reaches about 14 per cent. the matte begins to take the appearance of speiss. It is then smelted in the reverberatory with screenings from the roasting piles, which contain a good deal of arsenic, sulphuret lead ores and silicious chimney-slag, or other material, to take up the oxidized iron. The slag, containing some nickel, goes to the blast-furnace; the silver lead is cupelled; the matte, poor in nickel, is roasted; and lastly the speiss, containing 25 per cent. of nickel and cobalt, is reserved for further treatment.

The process for treating the speiss has not yet been fully decided upon. At present it is melted on a lead bath, which takes up about two-thirds of the silver.

It is then ground fine, roasted with salt, and the silver extracted with a solution of $CaCl_2$. The residue will be either sold in this state, or, if it proves more profitable, the nickel and cobalt oxides will be extracted. At present, experiments are making to determine which is best. The speiss after leaching shows but a few ounces of silver per ton, and laboratory experiments show that when the proper roasting furnaces are in use, the loss of silver in residues will be very small. As there are several tons of nickel now on hand in the different products, its value will form a considerable item in the economical working of the ore.

H. C. HAHN, Ph. D., chemist at the works, to whom I am indebted for assistance in preparing this article, and who made all the analyses of the different products, instituted the following experiments to determine the solubility of AgCl in different chlorides used cold. From the table it will be seen that $CaCl_2$ is a much better solvent than NaCl, commonly used in the Augustine process.

At Tajowa, in Hungary, in 1868, a cold solution of salt was used, flowing continuously; and it was our purpose to imitate this process on a small scale, on account of its simplicity. A solution of hyposulphite of soda of the same strength that was used in the Patera process at Joachimsthal would dissolve about twice as much silver as concentrated $CaCl_2$ but the latter is to be recommended, as it dissolves six times more than salt, and can be used in the automatic process of Tajowa.

Table of Solubility of AgCl. in different Chlorides.

Name.	Salt. Percentage	Saturated at.	AgCl. Pre'tage.	Ag. Pre'tage.	Sp.Gr.	Temperature.	Grms. Ag. in 100 c. c.
KCl	24.95	19°.6	0.0776	0.0584	1.1774	19°.6	0.0688
NaCl	25.96 (a)	"	0.1053	0.0793	1.2053	"	0.0956
NH_4Cl	28.45	24°.5	0.3397	0.2551	1.0835	30°	0.2764
$CaCl_2$	41.26	"	0.5713	0.4300	1.4612	"	**0.6283**
$MgCl_2$	36.35	"	0.5313	0.3999	1.3350	"	0.5339
BaCl	27.32	"	0.0570	0.0429	1.3017	"	0.0558
$FeCl_2$	30.70	—	0.1686	0.1269	1.4199	20°	0.1802
Fe_2Cl_6	37.48 (b)	—	0.0058	0.0044	1.4472	21°.4	0.0064
$MnCl_2$	43.85	24°.5	0.1996	0.1499	1.4851	30°	0.2226
ZnCl	53.34 (b)	—	0.0134	0.0101	1.6005	"	0.0162
$CuCl_2$	44.48 (b)	21°.5	0.0532	0.0399	1.5726	"	0.0627
$PbCl_2$	0.99	"	0.0	0.0	1.0094	"	0.0
$Na_2O_2S_2O$	—	—	—	—	—	—	1.191(c)
Solution A	—	—	0.2160	—	1.2962	19°.6	—
" B	—	—	0.3555(d)	—	1.3416	19°.6	—
" C	—	—	0.5393	—	1.3826	"	—
" D	—	—	0.2167	—	1.3023	"	—
" E	—	—	0.2013	—	1.3249	"	—

(a) Saturated with $CaSO_4$. (b) Acid. (c) Of the same strength as that used in the Patera process at Joachimsthal. (d) Basic reaction—and, therefore, did not dissolve much silver.

Analyses of Solutions.	A.	B.	C.	D.	E.
$CaCl_2$	17.70	33.74	23.60	a	a
$MgCl_2$	12.55	3.46	11.42		
$FeCl_2$	0.22	—	—	—	—
Fe_2Cl_6	—	—	0.41	—	—
$PbCl_2$	—	—	—	—	2.0715
$MnCl_2$	—	—	0.77	—	—
$NiCl_2$	—	—	0.02	—	—

(a) Amounts not determined; made by dissolving the limestone, of which an analysis has been given. B is also a solution of limestone, and A and C are made from No. 4 ore. E is saturated with $PbCl_2$.

The object of trying the compound solutions was to determine the possibility of using some material that was at hand.

A concentrated solution of limestone answers the purpose very well.

Experiments have been made in amalgamating No. 4 ore, over 30 tons having been treated to get an average; and it is intended to continue the experiments to determine whether the large loss in quicksilver is due to the machinery and process used, or results from the character of the ore.

The ore cannot be chloridized, on account of the large amount of lime it contains. After roasting and chloridizing, only 43 per cent. of the silver was produced, while an average of 87 per cent. was obtained by raw amalgamation. The niccolite goes into the amalgam, and, on smelting, the sponge obtained is separated on top of the bullion as a speiss, which contains about 4 per cent. of silver, 8 per cent. of nickel, and 3 per cent. of cobalt.

The bullion is about 666 thousandths fine; or, if the black amalgam is separated and melted alone, two grades are produced—one over .800 fine, and the other .470. As the total amount of metals in this class of ore is about 3 per cent., it is doubtful whether dressing would save as high a percentage as can be got by amalgamation.

The successful working of the poor ores will give an impetus to mining on the North Shore, and many miners that are now under a cloud on account of not finding "that rich strike that would excel Silver Islet," will make their steady profits from the large deposits of low grade ores, and may not unlikely be surprised at some lucky moment by working into a rich pocket. It is not to be supposed that Silver Islet is something unique, where there are so many good indications.

Were it not for the duties on lead ores, the North Shore of Lake Superior could provide us with the proper mixture of ores containing gold, silver, lead, copper, and nickel, to make practicable the most economical treatment for the products of this rich, but poorly developed, region.

Undoubtedly a more complete preparation of the ore at the mine is desirable, thereby saving at least 50 per cent. of the cost of smelting, and 90 per cent. of waste. It takes time and skill to put in motion the complicated machinery of a perfected mining enterprise, such as Germany has only just completed, and that, too, with her centuries of experience and skilled rank and file, all well trained to their appointed tasks, from the little boys that roll tamping clay for three farthings a day, to the august *Berghauptmann* who directs the pens of a thousand assistants, collecting, collating, and condensing the figures and experiences of a large empire.

At no distant day, it is to be hoped, our people will open their eyes to the necessity and utility of a Government Mining Bureau, which, by faithful attention to its duties, may do as much for the future development of our mineral resources as has already been done for Germany.

New Puddling Furnaces.

A CORRESPONDENT furnishes the following description of an improved method of puddling recently patented by Messrs. RILEY and HENLEY, and now in operation at the Pontnewynydd Ironworks, near Pontypool:—"The object of this invention is to reduce the extreme manual labor attending the production of wrought iron in the ordinary puddling process, at the same time to improve the quality and increase the yield of iron so produced, to decrease the consumption of coal, and add to the quantity of puddled bars made per turn by diminishing the time occupied in the ordinary process. We are assured that these objects have been accomplished in the two furnaces now in operation, the one charged with the ordinary charge, and the other with a charge of 10 cwt. of pig iron, and that especially the hard work of the puddler is lessened to a very great degree. A description of the process will enable any ironmaster or forge manager to understand how this is effected. The body or hearth of the furnace on which the materials are heated consists of a circular pan, with slanting sides. The revolving pan is fixed on a vertical spindle, and worked by bevil gearing by a very small engine, the number of revolutions of the pan being under the direct control of the puddler. The pan is so fitted that air cannot enter the furnace except at the working hole of the door. This puddling furnace is, with the exception of the revolving bottom and its connections, built up and stayed by plates and bolts like the ordinary puddling furnace, only that the back and front plates at the middle of the furnace are cut off about the bottom of the hearth to admit cool air under the pan. The tools used are nearly like those of the ordinary process, but the rabble has a projecting pin, which is caused to rest against the inside of the rabble-hole, in order to obtain a hold against the revolving mass of iron melted in the pan. The other principal tool used may be called a 'plough,' because it is something in the shape of a ploughshare and causes the metal to be turned over, broken up, and cleared after beginning to 'form' or 'drop into nature.' This tool, also, has a pin which holds it as in the previous case.

"Having generally described the new furnace, we will give a short account of its manipulation. The furnace having had a small dressing of hammer slag and ground bull-dog after the previous heat is set slowly revolving, and the puddler throws in his half pigs in regular course, so that they are equally distributed over the floor of the pan. The melting process then goes on as usual, but the revolving pan sucks the flame after it, and gives a more uniform and intense heat throughout the whole body of the furnace, and therefore the melting is quicker. Before the melting is complete, the boy in attendance breaks up the unmelted pieces of pig iron, and mixes them as they pass the working hole, with the melted pigs, and in a few minutes the whole mass is in a beautiful state of fluidity, circling round in the pan, but travelling, from its density, at a slower pace than the bottom of the furnace, and consequently presenting fresh surfaces continuously to the flame. When melted, the puddler takes his rabble and fixes it in the hole in the door-plate, and inserts it in the fluid metal, directing it from the circumference to the center of the pan, and *vice versa;* thus stirring the metal by the end of the tool, with little or no exertion on his part, or he turns it in the opposite direction, and rakes it up from the bottom as it passes. There is here none of the pushing and dragging which is the exhausting work of a puddler in the ordinary process. When the metal is coming to nature he removes the rabble, and puts in, and fixes as before, the 'plough,' which he presses to the bottom against the stream, causing the plastic material to roll over the tool in the form of a small cascade. The metal being 'fit,' the balling up is set about. The revolving pan is stopped; the iron in front of the door is formed into a ball, the furnace is then turned round one-sixth or so; another ball made, and so on, till the whole of the iron is balled up. There is no dragging about, and no poking in four corners, as in the usual process, but the puddler's work is brought to his hand by the action of the furnace. The lifting of the balls out of the furnace is also lightened in the same way, and, therefore, the men who are working these furnaces are very well pleased with them, as one would naturally expect. We understand that all the puddling furnaces at Pontnewynydd Works wil be arranged on the patented plan. Those gentlemen who are interested in the improvement of puddling furnaces should inspect Messrs. E. RILEY & HENLEY'S furnaces at work, and we are authorized to state that they will be gladly received and fully informed on the subject by Mr. RILEY, the inventor of this very successful process. A model of this furnace will be exhibited and explained at the nex quarterly meeting of the iron trade at Birmingham on Tuesday, the 9th October.'—*Colliery Guardian.*

THE COAL TRADE

NEW YORK, Nov. 20, 1873.

Business remains about as last week, that is to say, it is not as bad as it has been, but is still far from being good. Prices are, with few exceptions, at the level of two months ago, the companies nearly all reporting no change for December.

Lehigh Coal Exchange.

Lump	$5 85
Broken	5 70
Egg	5 70
Stove	5 85
Chestnut	5 15

Wilkesbarre Coal and Iron Company.

Lump	$5 05
Steamer	5 15
Broken	5 25
Egg	5 40
Stove	5 70
Chestnut	5 05

The Pennsylvania Coal Company make a reduction of from 6 to 8 per cent., its prices to contractors being as follows:

Lump	$4.60 per ton.
Steamer	4.60 "
Grate	4.70 "
Egg	4.80 "
Stove	5.10 "
Chestnut	4.50 "

Delivery at Weehawken, freight to New York 40 cents.

The Scranton Company will sell 70,000 tons next Wednesday.

The slight threatenings of war which are current have of course, had no other effect than to give a faint steadiness—not to the market so much as to the general tone of dealers in conversation. Anything like imminent military operations would, of course, send coal upward, or at all events steady it perfectly, but the complications with Spain are still too new to afford a basis even for safe anticipations.

The line trade in Pennsylvania has suffered immensely, as the idleness of so many ironworks and other manufacturers necessarily indicates. The Mauch Chunk *Gazette* says the collieries in that region are mostly idle or working on half-time, and thinks that unless there is a change in the condition of business there will be a large decrease this year, and indeed the movements of coal show that in spite of the lateness of the season there is still time for a considerable further decrease in the year's production.

Bituminous coal resembles its harder neighbor in having nothing new to report. The Chesapeake and Ohio Canal will keep open until the ice closes it. There are no large stocks in the city, as the companies will probably have no difficulty this winter in obtaining the cars they need. Gas coals are rather a drug, the gas companies being all filled up, with stock drawn from both foreign and home sources.

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 Nov. 15, 1873, compared with the week ending Nov. 16, 1872.

COMPANIES.	1872. WEEK.	1872. TOTAL.	1873. WEEK.	1873. TOTAL.
Phila & Reading R.R†	85,730	4,155,661	89,620	4,849,335
†Schuylkill Canal	26,415	792,875	20,828	699,774
‡Lehigh Valley R. R.	63,048	2,915,678	60,915	3,036,062
Lehigh & Sus. R. R.	47,911	1,508,527	40,322	1,786,971
" " Canal	12,666	727,733	24,466	703,746
Scranton North	16,346	713,685	17,437	847,356
" South	40,754	1,850,131	38,886	1,901,762
Penn. Coal Co., rail	28,067	1,077,649	23,574	1,101,615
" " canal		5,997	241	7,927
Del. Hud C. Co. Canal	6,678	1,336,215	27,089	1,336,224
" " " East	9,071	471,848	3,802	269,835
" " West	11,711	378,583	15,940	520,170
" " South	8,287	346,314	702	166,750
Shamokin	14,987	511,551	12,504	576,434
Trevorton	...	...	...	...
Lykens Valley Coal Co.	....	....	....	....
Wyoming North	...	....	...	....
Wyoming South	...	....	...	....
P. N. Y. C. & R. R. Co.	13,567	465,147	11,963	661,862
Williamstown Col'y	....	.....	....	....
Big Lick Col	....	.....	....	....
Total	385,178	17,367,876	377,909	18,265,823
1872	377,909			17,367,876
Increase	7,269			897,947
Decrease				

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

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

Delaware Lackawanna & Western Rail Road Company.

Coal transported on the Delaware, Lackawanna, & Western Railroad for the week ending Saturday, Nov. 15, 1873

	WEEK. Tons. Cwt.	YEAR. Tons. Cwt.
Shipped North	17,037 03	847,355 17
Shipped South	38,886 10	1,901,761 18
Total	55,923 13	2,749,117 15
For the Corresponding time last Year:		
Shipped North	16,345 19	713,665 00
Shipped South	40,753 19	1,850,129 18
Total	57,099 18	2 563,794 18
Increase		185,322 17
Decrease	1,176 05	

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 Nov. 15, 1873, compared with week ending Nov. 16, 1872.

COMPANIES.	1872. Week.	1872. Year.	1873. Week.	1873. Year.
C. & O. Canal	12,996	600,977	18,568	606,991
B. & O. R. R.	30,358	1,114,355	32,702	1,328,052
Penn. S. Line	970	5,422	3,434	15,347
H. & B. T. R. R.	5,495	263,011	7,671	404,228
*Harrisburg & D.	8,769	428,514	6,527	299,469
*L. V. R. R.	375	26,210	454	27,651
P. & N.Y.C. & R. Co.	5,897	326,661	6,562	281,943
Cumberl'd Branch Canal.	3,709	196,868	4,909	128,692
" Railroad	884	21,160	1,393	78,464
Total	69,453	2,983,178	82,220	3,250,837
Decrease	....		69,453	2,983,178
Increase	....		12,747	267,659

Report of Coal Transported over the Lehigh Canal

For the week ending Nov. 14, 1873.

REGIONS SHIPPED FROM.	TIDE. tons. cwt.	LOCAL. tons. cwt.	TL. WEEK tons cwt.	TL. DATE tons. cwt.
Mauch Chunk Region	499 16	3,479 02	3,978 18	204,683 06
Mauch Chunk Region Hazardville	1,409 10	267 02	1,676 12	26,025 18
Beaver Meadow Region	590 03	3,673 05	4,263 08	126,122 02
Mahanoy Region		484 16	484 16	19,079 19
Hazleton Region	1,278 14	5,940 03	8,228 00	194,255 17
Upper Lehigh Region		1,427 01	1,427 01	27,877 06
Wyoming Region	3,913 14	493 05	4,406 19	105,4 9 07
Wyoming Region, Hazardville				4,282 09
Total,	7,691 17	16,273 17	24,465 14	703,746 04
Previously reported	242539 14	436740 16	679280 10	
Total to date	250231 11	453514 13	703746 04	
Corresponding week last year	279805 18	457926 15	737,732 13	
Increase				
Decrease	29,574 07	4,412 02	33,986 09	

DISTRIBUTION.	WEEK 1873.	WEEK 1872.	YEAR. 1873.	YEAR. 1872.
Consumed on line of Lehigh Canal	2,851 09	1,844 11	75,203 08	74,758 01
Passed into Morris Canal to Tidal Points	67 00		2,613 17	5,015 15
Passed into Morris Canal to Local Points	488 05	421 16	28,229 09	23,229 12
Passed into Del. & Rar. Canal to Tidal Points	7,674 17	4,154 11	247,717 14	274,793 03
Passed into Del & Rar. Canal to Local Points	456 08	386 16	12,783 08	14,220 09
Consumed on line Delaware Div. Canal	471 16	482 17	38,061 15	44,996 04
Passed through to Bristol	12,505 19	5,375 11	299,272 13	300,722 13
	24,465 14	12,666 02	703,746 04	737,732 13

Report of Coal Transported over Lehigh Valley Railroad

Report of coal tonnage for the week ending Nov. 15, 1873, with Totals to date, compared with same time last year.

WHERE SHIPPED FROM.	WEEK. Tons. Cwt.	TOTAL. Tons. Cwt.
Total Wyoming	25,516 10	811,374 00
" Hazleton	34,343 08	2,058,037 09
" Upper Lehigh	126 10	2,850 03
" Beaver Meadow	10,047 07	612,698 14
" Mahanoy	9,724 10	480,118 12
" Mauch Chunk	93 16	3,211 15
Total	79,872 01	3,998,900 13
Same time last year	78,617 16	3,734,014 13
Increase		264,886 00
Decrease	1,234 05	
Forwarded East from Mauch Chunk by rail	50,915 06	3,036,062 03
Same time last year	63,048 01	2,915,678 01
Increase		120,324 02
Decrease	12,132 15	

DISTRIBUTED AS FOLLOWS.

Local East of Mauch Chunk	2,240 03	75,853 09
Forwarded East for use L. V. R.	1,214 12	50,053 13
Delivered to Furnaces and Manufacturing Companies	8,503 10	639,695 18
Delivered to Cat. & Fog. R. R.	315 05	7,146 15
" " East Penn R. R.	82 00	8,578 19
" " North Pennsylvania Railroad	4,832 13	296,067 04
" " Port Del.	4,327 06	202,014 05
" " East' Amboy Railroad		
" " Morris and Essex Railroad	4,976 04	160,188 15
" " Bel. Del Railroad	18,901 18	997,072 09
" " Central Railroad	5,491 06	497,371 16
Delivered at and above Mauch Chunk for use of L. V. R.R.	1,273 05	64 996 01
To P. & N. Y. R. R.	10,492 00	463 940 02
To North-rn Central R. R.	21 10	22,719 12
To D. H. & W. R. R.	373 12	20.8 9 08
To L. & S. R. R. at Packerton for rail	238 16	13,684 15
To Individuals at Mauch Chunk	120 16	2,478 17
To Individuals above Mauch Chunk	478 06	15,745 07
To L. &S. R. R., at Penn Hav., for railroad Do. for canal	6,286 08	1 541 10 184,555 02
To Lehigh Canal Mauch Chunk	3,718 04	76,538 13
To Catawissa Railroad		95 00
To L. & B. R.R. at Lack. June	5,933 10	87,710 05
Total	79 872 01	3,998,900 13

Delaware and Hudson Canal Company.

Coal mined and forwarded by the Delaware and Hudson Canal Company for the week ending Saturday, Nov. 15, 1873.

	WEEK.	SEASON.
By Delaware and Hudson Canal	27,089	1,336,224
By Railroad, East	3,802	269,835
" West	15,949	520,170
" South	102	166,750
Total 1873	47,533	2,392,979
Corresponding time in 1872:		
By Delaware and Hudson Canal	6,678	1,336,215
By Railroad, East	9,071	471,848
" West	11,711	378,583
" South	8,287	346,314
Total	35,747	2,532,960
Decrease	139,987	

Philadelphia & Reading Railroad and Branches.

COAL TONNAGE

For the Week ending Saturday, Nov. 15, 1873.

BY RAILROAD.—ANTHRACITE.

PASSING OVER MAIN LINE AND LEB. VAL. BRANCH.

	Tons.	Cwt.
From St. Clair	36,162 07	
" Port Carbon	4,450 00	
" Pottsville	1,856 08	
" Schuylkill Haven	29,083 12	
" Pine Grove	6,959 01	
" Tamaqua	11,945 01	
" Harrisburg	....	
" Dauphin	3,363 13	
Total	89,620 04	

FOR SHIPMENT BY CANAL.

Passing Frackville Scales	8,746 05	
" Mill Creek "	496 05	
" Schuylkill Valley Scales	707 03	
" Mt. Carbon	1,437 13	
" Cressona "	7,370 05	
" Pine Grove "	....	
" Tamaqua "	1,718 00	
Total	20,874 11	

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

Via Catawissa & Williamsport Br.	378 00	
" N. C. R. R. passing Locust Gap	551 09	
" " " Shamokin	4,161 05	
" " Herndon	....	
Total	5,089 14	

SHIPPED WEST OR SOUTH FROM PINE GROVE

Via Schuylkill & Susquehanna R. R.	1,800 13	
" Lebanon & Pine Grove Branch	1,158 19	
Total	2,959 12	

CONSUMED ON LATERALS.

From Frackville Scales	1,370 00	
" Mill Creek "	411 01	
" Schuylkill Valley Scales	269 14	
" Mt. Carbon "	803 05	
" Cressona "	805 05	
" Pine Grove "	72 12	
" Tamaqua "	285 03	
Total	3,736 19	

LEHIGH AND WYOMING COAL.

Received via Silverbrook Junction, Sent East	7,685 09	
" " Cat. & Wpt. Br. Sent West	14 15	
" " Rupert, Cat. & Wpt. Br.	12 00	
" " Allentown E. Penn'a br.	....	
" " Alburtis, "	786 04	
" " Oreland, G. & N. Br.	640 00	
" " Willow Street R. R.	....	
Total	9,198 11	

BITUMINOUS.

From Harrisburg	6,527 00	
" Connecting R. R., G. & N. Br.	....	
" Junction R. R.	....	
Total	6,527 00	

COAL FOR COMPANY'S USE.

Anthracite	8,322 03	
Bituminous	370 18	
Total	8,693 01	

RECAPITULATION.

	Total for Week.	Corres-p'g week last year.	Increase and Decrease.
Passing over Main Line and Leb. Val. Branch	89,620 04	85 733 06	i 3,886 18
For Shipment by Canal	20,874 11	22,846 01	d 1,971 10
Shipped Westward via Northern Central R. R.	5,089 14	7,674 05	d 2,584 11
Shipped West or South from Pine Grove	2,959 12	1,826 03	i 1,133 09
Consumed on Laterals	3,786 19	4,578 14	d 791 15
Lehigh and Wyoming Coal	9,198 11	6,612 15	i 2,585 16
Total Anthracite paying freig't	131,529 12	129,268 04	i 2,261 07
Bituminous	6,527 00	8,768 19	d 2,241 19
Total of all kinds paying freig't	138,056 11	138,037 03	i 19 08
Coal for Company's use	8,693 01	6,324 15	i 2,368 06
Total Tonnage for Week	146,749 12	144,341 18	i 2,387 14
Previously this year	6077878 13	5789139 01	i 288,740 12
Total to date	52246.6 05	5933491 19	i 291,134 06

SHIPPED BY CANAL.

From Schuylkill Haven	18,388 00	22,222 00	d 2,834 00
" Port Clinton	1,450 00	1,084 00	d 634 00
Total Tonnage per Week	20,838 00	24,306 00	d 3,468 00
Previously this year	678,936 07	772,428 00	d 93,491 13
Total to date	699,774 07	796,734 03	d 96,959 13

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

Week ending Nov 15 —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	27577 17	7646 03	6362 08	41586 08	1336741 07
Upper Lehigh	....	2950 09	1376 01	4326 10	173875 18
Beaver Meadow	3338 03	1745 11	3265 16	8349 10	292373 11
Hazleton	....	152 10	6205 08	6357 18	196533 01
Mauch Chunk	....	1363 18	3625 14	4989 12	477935 17
Total	30916 00	13858 11	20735 07	65509 18	2736461 14
Prev'ly reported	1272505 15	821948 14	576497 07	2670931 16	
Total to date	1303421 15	835807 05	597232 14	2736461 14	
Same time 1872	1049319 10	771870 13	477427 16	2298617 19	
Increase	254102 05	63936 12	119804 18	437843 15	
Decrease					

DISTRIBUTION.	WEEK 1873.	WEEK 1872.	YEAR 1873	YEAR 1872.
Forwarded East by Rail to Tidal points	30916 00	27411 04	1303421 15	1049319 10
Forwarded East by Rail to Local points	7211 16	18570 18	393938 01	392020 09
Forwarded East by Rail use Central Division	1895 19	1737 19	79142 14	69499 14
Forwarded East by Rail use L. & S.	298 08	190 19	10563 15	7666 16
Delivered at and above Mauch Chunk	1449 08	1752 05	73677 03	53432 13
Delivered at Coalport & Hazard for Canal	20735 07	7800 00	631319 17	519999 15
Delivered to L. V. R. R. at Packerton	323 17	433 18	20709 16	13240 07
Delivered to L. V. R. Rd. at Sugar Notch	2327 03		97144 15	
Delivered to L. & B. R. R.at Plymouth Bridge	352 00	5217 17	130688 18	204117 13
Total	65509 18	63115 00	2736461 14	2298617 19

Penn. and F. Y. R. R.—Coxton, Pa.

Coal tonnage for week ending Nov. 15, 1873.

	Week. Tons. Cwt.	Total. Tons. Cwt.
Anthracite received:		
From Lehigh Valley R. R.	10,492 06	468 940 02
" Lack. & B. R. R.	291 06	36,434 15
" Pleasant Valley R. R.	507 15	127,604 05
" Sul. & Erie R. R.	671 04	33,883 04
Total	11,962 11	661,862 06
Same time last year	13,507 03	565,146 19
Increase		96,715 07
Decrease	1,544 12	
Distributed:		
To Lehigh Valley R. R.		24,004 13
To Lack. & B. R. R.		1,448 05
To S. Central R. R.	4,135 11	151,643 07
To Ithaca & A. R. R.	2,166 03	136,438 10
To Erie R. W. Pockets for shipm't.	2,728 02	237,101 01
To Erie Railway, Watkins direct.	558 19	12,118 11
To individuals on line of road	953 15	28,722 04
To points at & above Coxton for use of Co.	535 11	24,912 16
To points between Waverley and Elmira	881 10	45,477 19
Total	11,962 11	661,862 06
Bituminous received from BARCLAY R. R.		
Shipped north from Towanda	6,518 13	279,600 12
Shipped south from Towanda	43 12	1,958 10
Northern Central R. R.		384 09
Total	6,562 05	281,943 11
Same time last year	5,896 12	326,661 01
Increase	665 13	
Decrease		44,717 10
Distributed:		
To Erie Railway	6,097 09	257,222 02
To So. Central R. R	421 05	21,767 04
To Ithaca Valley R. R.		542 01
Lehigh Valley, R. R.	43 12	1,078 05
To individuals on line of Railroad.		1,215 15
To points on line of road for use of Company		118 04
Total	6,562 05	281,943 11
Grand totals transported		
Anthracite	11,962 11	661,862 06
Bituminous	6,562 05	281,943 11
Total	18,524 16	943,805 17
Same time last year	19,403 15	891,808 01
Increase		51,997 17
Decrease	878 19	

Statement of Coal Transported over Cumberland and Pennsylvania Railroad

During the week ending Saturday Nov. 15, 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	18,5 8 06	32,702 05	3,434 05	54,704 16
1872	12,995 18	31,3b7 15	970 09	44,324 02
Increase	5,572 08	2,344 10	2,463 16	10,380 14
Decrease	..	.....	....	

YEAR.

1873	606,901 18	1328 52 07	95,347 01	2,030,391 03
1872	600,977 00	1114 35 01	5,421 16	1,720,753 17
Increase	6,014 15	213,697 06	89,925 05	309,637 06
Decrease	....	....	....	....

Cumberland Branch R. R.

WEEK.

	To C. & O. Canal. Tons. Cwt.	To B. & O. R. R. Co. Tons. Cwt.	Total. Tons. Cwt.
1873	4,209 10	1,382 19	6,392 09
1872	3,709 07	884 02	4,593 09
Increase	1,200 03	508 17	1,799 00
Decrease	.....	.....	.....

YEAR.

1873	128,691 16	78 463 18	207,155 14
1872	186,808 03	21,119 11	218,027 14
Increase		57,344 07	
Decrease	68,176 07		10,872 00

Northern Central Railway, Shamokin Division

Below is the return of Coal sent over the Shamokin Division the N. C. R. W., for the 7 days ending Nov. 14, 1873.

	Tons. Cwt.	Tons. Cwt.
East	1,289 00	
West	11,214 15	12,503 15
Same time last year		14,987 04
Increase		
Decrease		2,483 09
Total amount shipped to date		576,434 00
Same time last year		511,550 13
Increase		64,883 07
Decrease		

Delaware and Hudson Canal Company.

Coal mined and forwarded by the Delaware and Hudson Canal Company for the week ending Saturday, Nov. 15, 1873.

	WEEK.	SEASON.
North	48,181 15	2,387,674 13
South	702 01	166,749 15
Total 1873	48,883 16	2,564,424 08
Corresponding time in 1872:		
North	26,746 14	2,267,705 02
South	8,287 08	346,314 02
Total, 1872	35,034 02	2,614,019 04
Increase North	21,435 01	119,969 11
Decrease North		
Increase South		
Decrease South	7,585 07	179,564 07
Increase	13,849 14	59,594 14
Decrease		

Prices of Coal by the Cargo.

(CORRECTED WEEKLY.)

Company Coals.

Nov. 1873.

	L.	Nut.	Gra.	Egg.	Sto.	Chest
*Pittston at Newburgh	4 60	4 60	4 70	4 80	5 10	4 50
*Lackawana at Rondout	5 05	5 15	5 25	5 40	5 70	5 05
Wilk'b're at Pt. John'n	5 05	5 15	5 25	5 40	5 70	5 05
Old Co. Lehigh at Pt. John'n	4 60	5 85	5 85	5 95	5 20	—
New York Coal Exchange	5 85	5 70	5 70	5 85	5 15	—
AT PHILADELPHIA						
Hard White Ash	4 60	4 60	4 70	4 70	5 00	3 95
Free B'rn'g White Ash Coal.	4 60	4 60	4 70	4 70	5 00	3 65
Schuylkill Red Ash	—	—	4 70	4 85	5 15	3 95
Alaska Red Ash	—	—	4 70	4 70	5 00	3 95
Shamokin White Ash	—	—	4 80	5 00	5 20	4 10
North Franklin	—	—	5 20	5 20	5 10	4 00
Lorberry	—	—	5 50	5 50	5 50	4 35
Lykens Valley	—	—	—	6 10	6 10	4 75
SHIPPED FROM ELIZABETHPORT, HOBOKEN AND TRENTON.						
L. C. and N. Co., Newport	—	—	5 35	5 50	5 70	5 10
" " Plymouth Red Ash	—	—	5 5	5 60	5 80	5 10
" " Room Run	5 85	—	5 70	5 70	5 95	5 15
Honeybrook Lehigh	5 90	—	5 80	5 85	5 90	5 20
Fulton, "	6 10	—	5 85	5 85	5 95	5 20
Scranton	4 15	5 19	5 20	5 55	5 65	5 00

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

Prices at Baltimore—Nov. 1873.

Wholesale Prices to Trade.

Wilkesbarre, by cargo or car load	$5 05@5 70
Pittston and Plymouth, do	5 75@6 00
Shamokin Red or White Ash, do	6 00@6 25
*Lykens Valley Red Ash, do	@6 80
By retail, all kinds per ton of 2,240 lbs	7 50@8 50
*George's Creek and Cumberland f. o. b. at Locust Point for cargoes	4 85@5 00
West Va. Gas Coal	6 50
Youghiogeny gas f. o. b. at L. Point, nominal	7 50
Kanawha Cannel, coarse	@12 50

* 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.

Nov. 1873.

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

Prices at Havre de Grace, Md.

Nov. 1873

Wilkesbarre and other White Ash for Cargoes	$ —@5 00
Lykens Valley	—@6 50
Shamokin Red or White Ash	—@5 25

Bituminous Coals (Cumberland).

Georgetown, F. o. b.	$4 60
Baltimore "	5 00
New York "	7 25@7 50
South Amboy "	6 50

Prices of Foreign Coals.

Nov. 1873.

Duty 75 c. per ton.

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

Liverpool Gas Caking	16 00@18 50
" " Cannel	13 00@18 00
" House	20 00@21 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.

Nov. 1873.

PROVINCIAL.

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

	Coarse	Slack
Block House, f. o. b. at Cow Bay	$2 75	$1 25
Gowrie	2 25	0 00

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

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

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

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

Rates of Transportation to Tide Water.

BY RAILROAD.

TO PORT RICHMOND, PHILADELPHIA.

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

MAUCH CHUNK TO ELIZABETHPORT.

L. V. Railroad from Mauch Chunk to Phillipsburgh	$2 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	$2 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	6
Shipping expenses	25
Wharfage	00
Total	$2 23

TO SOUTH AMBOY.

L. V. R. R.	
D. & R. R.	
Cam. & Am. R. R.	
Shipping Expenses	$5
Total	$2 29

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.—Nov. 1873.

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

+3 c. per bridge per ton in addition to freight.
† 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

Nov. 1873.

Foreign.

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

TO NEW YORK.

Provincial

Sydney	$5 00
Lingan	4 00
Cow Bay	4 00
Port Caledonia	4 00
Little Glace Bay	4 00

TO BOSTON.

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

TO MONTREAL.

Caledonia	3 75 gold

TO CUBA.

Caledonia	9 50 gold.

MARKET REVIEW.

NEW YORK, Nov. 20, 1873.

IRON—Scotch Pig is very dull, the trade being confined to the present needs of purchasers; the foundries are nearly all running on short time, and as the season is now nearly over, and the closing of the canals near at hand, the prospect ahead is dubious; as noted above the business is only in jobbing parcels, in which way about 100 tons Glengarnock have been sold at $38@$40. Eglinton is in very small stock, and held at $39; and we have been creditably informed that Coltness has been offered for sale at less than our quotations, and they are quite nominal. American Pig is depressed, and prices very irregular; the need of ready money in many cases influences the price of the various brands more than ever, while again, other furnaces with small stocks tenaciously hold for full figures; there is little or no change looked for in the situation until next February; some brands are offered at $26 for No. 2 X, and $30 for No. 1, at the works, without finding purchasers; we quote No. 1 $30@34, No. 2 $26@30, the latter prices for Lehigh

brands, and Gray Forge $25@26; the stock of No. 1 Irons is not large, while that of No. 2 is considerably in excess of any demand likely to spring up in the near future; the only sales are several hundred tons No. 2 X Lehigh at $27,50, laid down here. The Iron and Steel Association of Philadelphia is to hold a meeting at Philadelphia to-day, to discuss the causes of the general dulness of trade, the labor question, &c. In Rails, both old and new, there has been no business, and any quotation would be nominal. Scrap is quiet—Dealers are in want of orders, while consumers are almost out of market; from yard there is little or no business, the demand being principally confined to such lots from dock as the owners do not wish to store; in this way sales have been made of 250 tons, a mixed lot, on private terms; 110 do. Wrought, $30@34; while several hundred tons besides have been sold at $30 and $28, and under. In addition to the above, a lot of 244 tons Cast (Sugar Mill Machinery) was sold at about 1 cent per lb., cash, the parties desiring to realize, a time offer at higher price being refused. Manufactured continues dull, but prices are nominally steady, any advantage being on the side of the purchaser, Common sheets are very dull, and low, compared with old prices—we quote Singles, Doubles and Trebles 4½@5¼ cents currency, with a sale of 350 bdls on private terms.

LEAD—Pig remains quiet, but the market has rather more tone; 50 tons Ordinary Spanish sold at 7 cents gold; for Domestic, $6@$6,06¼ per 100 lb. gold is now asked. Bar 9¼ cents, Sheet and Pipe 10¼, and Tin-lined Pipe, 16½, all less 10 per cent, to the Trade.

COPPER—The manufacturers of Copper and Yellow Metal are very quiet. No change has been made in prices, but in some instances lower rates than those we quote have been accepted. Ingot is less active, but stocks are offered sparingly, and the advance in price has made further progress: sales have been made of 300,000 lb. Lake at 23@23¼ cents; and 100,000 lb. Baltimore, 22@22½, cash— for future delivery 25@25 cents is now asked.

SPELTER—Both Foreign and Domestic are dull, and we hear of none but small jobbing sales; Foreign is held at 7¼ gold, domestic 9 cts. currency.

REGULUS ANTIMONY—Last sales 12¼ cents gold.

TIN—Prices of Pig still weaken, and the market is depressed, buyers showing no disposition to operate, even at the now considerable reduction in values; the only sale we hear of is 150 slabs Straits at 27¼ cents—holders, however, generally ask 27½@28 for large parcels; the nominal quotations are for Banca 32@32½ cents, English L. & F. 26¼, and Refined English 27¼, all gold. Plates are quiet! we hear of rumors of lower prices ruling in England, but nothing authentic; prices in Liverpool are already below the cost of manufacture, and makers unwilling to book orders for delivery this year at present quotations; good Terne Plates are selling here at about cost of importation, but Charcoal and Coke Tin are selling at a loss; the transactions embrace 250 bxs. Charcoal Tin at $9,75; 150 do. Coke Terne, $7,50 gold; and 1,000 do. Coke Tin, on private terms.

ZINC—Mosselmann Sheet continues quiet, and nominally steady at 10 cents less 4 per cent. from agents hands, though selling at considerably less from store, by dealers, say, 8¼@8¾ cents net, gold. Manganese black oxide is quoted at 3½ cts., gray peroxide 7 cts. There is no high grade crystallized Pyrolusite Manganese in the market.

METALS.

NEW YORK, Nov. 20, 1873.

IRON.—Duty: Bars, 1 to 1¼ cents ℔ lb; Railroad, 70 cents ℔ 100 lbs.; Boiler and Plate, 1½ cents ℔ lb; Sheet, Band, Hoop, and Scroll, 1½ to 1¾ cents ℔ lb; Pig, $7 ℔ ton; Polished Sheet, 2 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	43 00@— —
Gartsherrie	— —@48 00
Glengarnock	38 00@39 00
Eglinton	38 00@39 00
Pig, American, No. 1	30 00@34 00
Pig, American, No. 2	26 00@30 00
Pig, American, Forge	25 00@26 00
Bar Refined, English and American	— —@— —
Bar Swedes, assorted sizes gold	— —@137 50

	Store Prices, Cash.
Bar, Swedes, 1¾ to 5 x ⅜ & ¾ 2 sq. & 6 to 12 x ¾ & ⅛	175 00@— —
Bar, Refined, ¾ to 2 in. rd. & sq. 1 to 6 in. x ¾ to 1 in.	80 00@— —
Bar, Refined, 1¼ to 6 by ¼	85 00@— —
Bar, Refined, 2½ to 2⅞ round 1 & 1¼ by ¼ & 5:16	87 50@— —
Large Rounds	96 00@105 00
Scroll	100 00@132 50
Ovals and half-round	107 00@127 50
Band	100 00@102 50
Horse Shoe	115 00@— —
Rods, ¾ to 3-16inch	90 00@132 50
Hoop	117 50@157 50
Railroad	¾@ 2
Sheet, Russia, as to assortment (gold)	17 @ 18
Sheet, Singles, D. and T. Common	—4¼@— 5¼
Sheet, D. and T. Charcoal	—6½@— 8
Sheet, Galv'd, list 10 per cent. discount	— —@— —
Rails, English (gold), ℔ ton	60 00@ 62 00
Rails, American, at Works in Pennsylvania, currency	65 00@ 70 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	34 @— 38
Copper Bolts	36 @— 40
Copper Braziers, 16oz. and over	36 @— 40
Copper Nails	41 @— 45
Copper, Old Sheathing, &c. mixed lots	18 @— —
Copper, Old, for chemical purposes, 14@16 oz.	— @— —
Copper, American Ingot, Cash	23 @— 23⅛
Copper English Pig	— @— —
Yellow Metal, New Sheathing & Bronze	27 @— 35
Yellow Metal Bolts	29 @— 32
Yellow Metal Nails, Sheathing and Slat'g	23 @— 26

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

Spanish (gold)	6 87½@7 00
German, do.	6 87½@7 00
English do.	6 87½@7 00
Foreign, Refined	7 25 @7 50
Domestic do	6 50 @ —
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	— 17½@— 22
English Spring (2d and 1st quality)	— 9½@— 10½
English Blister (2d and 1st quality)	— 14 @— 18½
English Machinery	— 14½@— —
English German (2d an 1st quality)	— 12½@— 14½
American Blister "Black Diamond"	— — @— 11½
American, Cast, Tool do.	— — @— 17
American, Spring, do.	— — @— 11
American Machinery do.	— 11½@— 12
American German, do	— 9 @— —

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

	Gold ℔ lb.
Banca	32 @32½
Straits	27½@27⅝
English	26½ @27
English Refined Gold	27⅛@28

PLATES.

Fair to Good Brands.	Gold.	Currency
I. C. Charcoal, ℔ box	$ 9 50 @10 00	$10 75 @11 25
I. C. Coke	7 50 @ 8 00	8 50 @ 9 00
Coke Terne	6 75 @ 7 75	7 75 @ 8 75
Charcoal Terne	9 50 @ 9 75	10 75 @11 00

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

Plates, Foreign	(gold) p. 100 lb.	7 37½@— 7 75
Plates, Domestic	p. lb.	7½@—11

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

Sheet	per lb.—8¾ @ 10

San Francisco Stock Market.

BY TELEGRAPH.

NEW YORK, Nov. 20, 1873.

Our report from the San Francisco Stock Board is dated the 18th inst. Excepting a decline of $1.00 in Yellow Jacket, the market is firmer. Chollar leads the list, having advanced $8.00 per share since our last; the report is as follows:

Savage	—	—	57
Crown Point	—	—	16
Yellow Jacket	—	—	45
Kentuck, "New Issue"	—	—	13
Chollar Potosi	—	—	55
Gould & Curry "New Issue"	—	—	12
Belcher "New Issue"	—	—	81
Imperial	—	—	6
Raymond & Ely	—	—	57½
Meadow Valley	—	—	14½
Eureka G. V.	—	—	19½
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.

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

THE ENGINEERING AND MINING JOURNAL.

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

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

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THE SCIENTIFIC PUBLISHING COMPANY.
WILLIAM VENTZ, SECRETARY.
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P. O. Box 4404. NEW YORK CITY.

CONTENTS FOR THIS WEEK.

MR. MORRELL'S letter, to which we alluded last week, was crowded out by the press of other matter, and will be found in our paper this week.

IN another column will be found an article from the *Gold Hill News*, of Nevada, describing the establishment of underground connection between the East and West drifts on the Sutro Tunnel. The difficulties attending the survey of this work were described in an article from the same paper, very recently published by us. The problem was to run a drift from the bottom of a shaft south, to the center line of the tunnel, and then East along that line to meet a drift coming west from the tunnel-mouth, 4,885 feet away. The accuracy of the surveyor's work is, of course, measured by the precision with which the two headings come together; and Mr. SCHUSSLER, the engineer, can receive no more emphatic praise than is implied in the circumstance that the variation in grade between his headings, upon establishing the connection, was but half an inch, while the horizontal variation in the center line was but seven-eighths of an inch. This splendid accuracy contrasts forcibly with the style of work in some of the leading mines of the Comstock lode. Even at this late day, we believe, there is an alleged error in the determination of the boundary between Crown Point and Belcher, involving the ownership of many thousand dollars' worth of ore.

It is understood that Mr. SUTRO is provided with capital to continue operations vigorously, and that a large supply of fuel, timber and stores has been laid in for winter. The immediate cause of the suspension of some of the work in March last was the horse disease, which stopped hauling. The main tunnel-header, however, has, we believe, been prosecuted without interruption.

PERHAPS the most amusing class of items to be found in the periodical literature of the day is that which refers to the large sums received by English colliers as wages, and the absurd uses they make of their wealth. We have on one hand the squibs of *Punch* and *Judy*, and on the other, stories which can be nothing more than "auld wives' tales," but between these there are others which are not necessarily unfounded, though they seem somewhat extravagant. For instance, a Wigan correspondent of the *Birmingham Morning News* writes:—"I have learnt to-day, from sources not to be regarded with much suspicion, that only last week a collier in Bryn, near Wigan, bought a dog for £37. Not many days since a Wigan jeweler, it is reported, sold to one of these modern terrors a gold watch for £32 and a guard at £18. You will know, of course, that in a few of the colliers' homes in this district the household goods comprise a *piano*. The colliers are evidently arriving at a proper appreciation of the beautiful in nature and art." We noticed some time ago that several English papers gave currency to an amusing story, which illustrates the danger of rousing an opponent's bravado. Some one addressing a meeting, on behalf of the masters in the late disputes about wages, said that the colliers were drinking champagne. The assertion does not appear to have been true at that time, at least it was not generally true. But the colliers were determined to show that they had as good a right to drink champagne as any one, and immediately the gin shops of the mining districts literally overflowed with the most famous champagnes. The colliers drank it by the quart, out of tin mugs, or pewter pots, or whatever was most convenient, and the quantities which were consumed by men who probably preferred beer, are reported to have been immense.

THE meeting of the American Iron and Steel Association, held in Philadelphia last Thursday, was attended by an influential, though not a very large, representation of the iron-masters of the country. The proceedings, which we have not room to publish this week, consisted of an address by Mr. SAMUEL J. REEVES, President, referring to the condition of the iron trade; a report by Mr JAMES M. SWANE, Secretary; the election of officers; the adoption of a series of resolutions; and the adjournment to meet in Philadelphia on the first Wednesday in February next, coupled with the arrangement of a joint convention on the first Thursday in February, in which other iron associations are to be requested to take part.

The address of the President seems to express satisfaction with the present tariff and a desire that it should remain as it now is; but the report of the Secretary seems to urge an increase of duty on pig-iron from $6.30 to $9 per ton, and proportionally on other classes—a view which finds indirect expression in the resolutions, also. These resolutions declare in favor of a protective tariff; "a financial system adequate to the largely increased and increasing business needs of the country," (which, we suppose, means a further expansion of the currency); the repeal of the reduction of duties made in June, 1872; a revision of the national banking system, so as to prohibit the payment of interest on demand deposits; other means for providing an "adequate" and "flexible" currency; the uniform construction, at all ports, of the Customs Laws; and an amendment of the Bankrupt Law, enabling three-fourths of the creditors to control the settlement of the affairs of the insolvent. They protest against changing the Registry Laws, and allowing foreign-built ships to be registered by the United States.

This series of resolutions covers a good many different subjects and constitutes a platform which cannot be discussed as a unit, or without considerable deliberation and study, however easy it may have been for a small meeting of eminent ironmasters to adopt it unanimously, after little or no debate. The last two resolutions, however, relate to subjects concerning which there is scarcely a possible difference of opinion, and we cordially rejoice that the American Iron and Steel Association has taken such action in the premises as befits its position and expresses the sentiments of all American ironmasters. The two resolutions referred to are the following:

Resolved, That this Association has learned with great satisfaction that the members of the Iron and Steel Institute of Great Britain propose to visit this country next year for the purpose of ascertaining the extent and progress of the iron and steel industries of the United States, and that the members of this Association will extend to them a hearty welcome, and will take pleasure in showing them their several works and in otherwise aiding them to accomplish the object of their visit.

Resolved, That the acceptance by the Executive Committee of the trust delegated to this Association by the Executive Committee of the United States Centennial Commission, of making an adequate representative collection of the iron ores of the United States, for display at the International Exhibition of 1876, is hereby approved; and recognizing the importance and difficulty of the work, the Association asks the active co-operation of all manufacturers of iron and steel, and producers of iron ores, and it further invites assistance in the collection of samples of all the fuels, fluxes, and refractory materials used in the iron trade, or likely to be of use to it.

An Interesting Question in Coinage.

WE find in the *Evening Bulletin*, of San Francisco, a long letter from Mr. LOUIS GARNETT to the Director of the U. S. Mint, containing an interesting and novel recommendation with regard to coinage. Mr. GARNETT'S letter occupies too much space to be reproduced at length in our columns; we must, therefore, attempt the difficult task of fairly representing the substance to our readers.

After an introduction, in which he expresses his belief that no measure yet proposed will successfully effect a return to specie currency, Mr. GARNETT proceeds to show that, since the discovery of silver in Nevada, we have increased the world's total annual supply of that metal from $30,000,000 to $45,000,000, while in the meantime the consumption of silver has not experienced a commensurate increase. The large addition to the gold coinage of the world, from California and Australia, has served to decrease the amount of silver money necessary as currency; the extension of commercial exchanges with Eastern countries has checked the disappearance of silver in that direction; and improvements in the arts, particularly the introduction of plated ware, have operated, if not to diminish the actual consumption, yet, at least, to diminish the rate of its increase. To these causes Mr. GARNETT adds the progressive demonetization of silver coins by leading commercial nations—that is to say, the abandonment of silver and the adoption of gold as a legal standard of value. All these causes have effected a rapid decline in the value of silver.

On the other hand, Mr. GARNETT asserts that there has been a rapid appreciation of gold, caused by increased demand and diminishing production. The aggregate production of the world, he thinks, will fall short of the following estimate for the present year: The United States, including gold contained in silver, $35,000,000; Australia and New Zealand, $30,000,000; other sources, $25,000,000; total production, $90,000,000. Twenty years ago, he says, the United States and Australia alone produced over $150,000,000; and in 1857 CHEVALIER estimated that the annual consumption of gold for the next ten years would be $88,000,000. This estimate, Mr. GARNETT thinks, was too low; but

even accepting it as correct for that time, there are new demands for gold which have arisen since, notably in Germany and Japan, where this metal has been adopted as a standard; and Mr. GARNETT concludes that within a few years "a glut of gold will be the least of our financial troubles, and we may be very glad to resort to silver again as our only relief."

As a remedy for this state of affairs, he proposes to remonetize silver in a way which will avoid the inherent principle of self-destruction, existing hitherto in all systems of coinage, involving a double standard of value. After enumerating the formidable obstacles which have so long beset this question, and which have driven every nation to abandon the double standard, Mr. GARNETT proposes to make silver coin of full weight a legal tender for all sums, concurrently with gold; introducing, however, a novel feature in the composition of the silver coin—namely, that it shall contain an appreciable amount of gold, which will act as a heavy seigniorage in preventing its export or its use in the arts. The proportions which seem to him best adapted to his purpose, and which should be stamped upon the coin, are as follows:

Weight of Coin.	Fineness.	Grains.	Value.
380 grains	.005 in gold, equal	1.9 fine gold	$0.081826
	.895 in silver, equal	340.1 fine silver	0.918174
	.100 in copper, equal	38.0 fine copper.	
380	1000	380	$1.000000

In these statements, the value of 340 1-10 grains silver is assumed to be 0.918174, whereas the value in the present London market for fine silver is 63¾ pence per ounce, or $1.292615. The relative value of metals assumed for this coin is, gold to silver, as 1 to 15.953, and in the London market as 1 to 15.988. The effect of issuing such a coin will be, Mr. GARNETT thinks, to immediately check any further decline in the value of silver, and to open a home market for our entire product, at a valuation above that of the price abroad, to say nothing of the expenses of laying it down in the foreign market. And as this product is nearly 50 per cent. of that of the world, its withdrawal from other markets must sooner or later produce a decided effect upon its market price, and at the same time nearly double our metallic circulation at home, thus materially contributing to a resumption of specie payments.

For purposes of the arts, either at home or abroad, no one can afford to give a dollar in gold to obtain ninety-two cents in silver. The gold in this silver would add no practical value to silverware, even if the silversmith could demonstrate its existence in his plate. Hence, Mr. GARNETT thinks, the new coin could be made to entirely supersede our fractional subsidiary silver coin with perfect safety, as it would not be melted on one hand, while, on the other hand, silver containing gold being at a discount abroad (to say nothing of shipping expenses) as compared with fine silver, will not be exported, unless its price advances very materially, which will be, he thinks, a great advantage to our silver mines.

In answering supposed objections, Mr. GARNETT says he thinks such a coin would not drive out gold, because the tendency of gold to appreciate will very nearly keep pace with any probable advance in the price of silver, and will thus preserve their relative values so nearly as to leave no inducement to ship either, except in the event of the necessity of the adjustment of the balance of trade, which we have to do anyhow in gold.

He believes, also, that it would not encourage counterfeiting. Like the present coin, it could be clumsily imitated in base metals. It is true that counterfeits consisting of standard silver, for instance, *i.e.*, of silver and copper without gold, would not be readily distinguished by specific gravity, or appearance, from the auriferous coin; but if such counterfeits were attempted to be circulated, it would require large capital to be invested in silver, yielding only a profit of nine per cent., the proportion of gold in the genuine coin.

He argues, moreover, that no injustice is done to creditors by issuing coin as legal tender concurrently with gold, in which a corresponding intrinsic value cannot be realized as a commodity, in consequence of the greater expense attending such conversion. In other words, the intrinsic value of the new auriferous silver dollar could not be realized by selling the coin as so much metal, because of the cost of separating the gold. But this, he says, is a matter which the sovereign authority is not bound to recognize.

The bulk of this coin might be urged as an objection, since it would render it inconvenient as a legal tender for all sums. Mr. GARNETT pertinently remarks on this point, however, that before the discovery of gold in California and Australia, the commerce of the world was carried on in silver. But the practical result would doubtless be to put the new coin into the bank and other reserves, and set free the gold now held for such purposes. After specie resumption the coinage, whatever it is, will chiefly serve as a basis for redeemable paper, and the business of the country will be conducted with a paper currency on a specie basis, and with the extended system of credits, inland exchange, and certified checks, which alone can carry the burden of the enormous transactions of modern industry and trade.

Mr. GARNETT's proposition is certainly a very ingenious one, and we shall express our dissent from it with due respect for the ability and experience of the author. We must confess that we do not feel at all sure that its adoption would successfully avoid the recognized evils of a "double standard." He argues, in substance, that silver is decreasing in value, as measured by gold, the almost universal standard. If we should make a silver dollar, as legal tender in all amounts, which should contain only 92-100 as much silver as a dollar in gold will buy, the gold dollar and the silver dollar could not continue to circulate interchangeably. Everybody knows that in this case debts would be paid in silver dollars, and gold would be melted or exported. The addition of eight cents worth of gold to such a silver coin will retard, but will not, we think, effectually prevent this tendency. The coin proposed is in reality, however disguised, one of diminished value; and the continued depreciation of silver would make it still more so. In fact, it seems to us, we are asked virtually to take as our standard of value a metal which is just now subject to a great change in price, and particularly to a rapid depreciation. Make this the standard, says Mr. GARNETT, that it may not continue to fall in price. A perilous experiment, we fear.

Our opinion that the proposed auriferous silver coin would be in reality of less value than the gold coin may be objected to on the ground that the two would contain an equivalent amounts of the precious metals. This reply contains a sophistry which cannot be imposed upon the keen and sensitive intelligence of commerce. No one considers a ton of ore to be worth a hundred dollars because it contains a hundred dollars' worth of gold. But we may waive the question in this form, and content ourselves with the proposition—equivalent in our eyes—that if the United States should coin two dollars, both legal tender in all amounts, but one capable of being used in the arts without loss, or with much less loss than would attend the use of the other, then the former would possess elements of desirability not possessed by the latter, and would inevitably disappear from circulation, or cease to be the standard of value (that is, be bought and sold in terms of the latter, as gold now is, in terms of greenbacks) whenever the difference between them should be sufficient to be felt in commerce. We think it would be so felt immediately, under present conditions; but it would certainly be so felt if the relative value of the two metals in question should continue to vary in the direction of the present tendency.

Mr. GARNETT, of course, admits that gold must be used in settlement of foreign balances, but thinks it would not disappear in other ways, because it would appreciate about as fast as silver. This is substantially the expression of a hope that we should be able artificially to force an equilibrium between the two metals, by consuming for purposes of coinage a good deal of the most abundant one. We think the attempt would fail; and hence we are not in favor of hanging upon it our whole system of coinage. Even he is apparently not free from all misgivings, but advances his proposition as the most feasible one, in the face of a troublesome problem.

We cannot help feeling that the case does not require such measures. The over-production of silver must take care of itself, like the over-production of any other commodity; and the scarcity of gold for coinage will bring its own remedy all over the world, in a gradual fall of prices.

The Law of Accidents.

THE arrest of Mr. DILLON, one of the firm of contractors who assumed the great task of sinking the Harlem Railroad tracks in Fourth Avenue, as one of the parties responsible for the boiler explosion which caused the loss of so many lives two weeks ago, reminds us that our law relating to accidents sadly needs revision. So far as we know, the only connection of Messrs. DILLON & CLYDE with that part of the work upon which the boiler was engaged is a financial connection. The fact is, our present law is faulty, and based upon a theory which has not been found effective in any country. The law takes no pains to secure safety by prescribing a well-considered mode of work, and then making sure by constant inspection that its provisions are carried out. It merely imposes penalties after a mishap, expecting possible culprits to avoid falling under condemnation by looking well to their mode of working.

This system has not been found to work. When the requirements of the law are not specific, it is exceedingly difficult to prove culpability; for then the question of whether the care exercised has been sufficient, or not, must be decided by personal opinion rather than by a comparison of the facts with a fixed standard, which the law recognizes as sufficient. It is undoubtedly due to this difficulty that so many feeble verdicts are rendered by Coroners' juries in cases which plainly fall under the class of preventable accidents. Another reason for the failure of this mode of enforcing care is, that no supervision is exercised over the acts of responsible agents until the day of disaster has passed. An efficient law would require certain specific provisions against accident, and in addition to these the exercise of ordinary care against possibilities which could not be easily foreseen; and the only way to ensure the use of the preventions is to have an unceasing inspection. The evidence of the inspector is then conclusive as to one-half the responsibility, and his minute knowledge of the circumstances enables the jury to form a good opinion upon the amount of care exercised. Formerly the mining law of some foreign States was founded upon the method of requiring responsibility *after* the accident. But it did not work. Men were punished, but lives were not saved; and though the penalties were legal, it was not so sure they were just. The laws have therefore been changed in the direction we have indicated as proper in our law of accidents. Fixed requirements were made, and inspectors appointed to see that they were not neglected. These were not only of a mechanical kind, but the inspectors could criticise the mode of work and compel a change if their views were sustained by higher authority. Thus the responsible parties knew exactly what was required of them, and this responsibility being carefully defined, the law finished by imposing the severest penalties, criminal and civil, when any lack of care could be proved. Our laws relating to responsibility for accidents impose the penalty, but neglect the system which alone can make that penalty either just or effective to prevent accidents.

Mining Statistics of Victoria.

THE mineral statistics of the British Colony of Victoria, for 1872, by R. BROUGH SMYTH, contain many details in regard to the production of the mines of this colony. The following are the most important: Of the mineral productions of Australia, and especially of the Colony of Victoria, gold occupies the first place, the production of other mines being as compared with that of the gold mines, exceedingly small.

The production of the placer and quartz mines of the Colony of Victoria amounted, according to the estimate of the public officers having in charge the Mine Register for the year 1871, to 1,368,942 oz., and for the year 1872, to 1,331,378 oz.

Of this there were bought by banks, according to the mine inspectors, in 1871, 1,290,895 oz., and in 1872, 1,218,094 oz.

According to the Commissioner of Commerce and Customs there was exported of the gold produced, in—

	1871.	1872.
	1,355,477 oz.	1,160,553 oz.
and delivered to the Melbourne mint	....	121,966 "
Giving a total as shown by official control, of	1,355,477 oz.	1,282,519 oz.

The production of gold from quartz in stamp mills is given as follows:

	1871.	1872.
From 924,705 tons, and 954,571 " , respectively, of crushed quartz	484,303 oz.	568,382 oz.
or 10 dwt., 11.39 grains, and 11 " 21.81 " , respectively, per ton.		
From 167,197 tons and.... 67,183 " , respectively, of slimes, cement and tailings	21,914 "	8,973 "
or 2 dwt. 14.91 grains, and 2 " 16.11 " , respectively, per ton; and		
From 3,562 tons and.... 5,009 " , respectively, of sulphurets and buddled stuff	9,114 "	13,636 "
or 2 oz. 11 dwt. 4 grs. and 2 " 14 " , respectively, per ton.		
The total from the stamp mills is, therefore	= 515,332 oz.	590,991 oz.

This is, however, not the product of all the veins, but only of those in regard to which the keepers of the mining register have been informed. The owners of mines are not all willing to furnish information in regard to their business; but generally they permit an examination of their books.

Comparing the production of gold in the two years named, we find a decrease of 73,564 oz. in 1872, as against the previous year. At the same time, there was a larger quantity of quartz crushed in 1872 and more sulphurets and buddled stuff were treated, from which 75,659 oz. more of gold were extracted, than from the same materials in 1871.

The average number of workmen employed in the extraction of gold in the year 1871 was 58,111 against 54,659 in 1872, and of these 15,669 were Chinese in the former year, against 14,158 in the latter. The total number of workmen was therefore diminished in 1872, by 3,452, and that of Chinese by 1,511. If we compare the gold exported and that delivered to the mint with the number of workmen employed, we find, that, for the year 1871, there were produced, per man, 23.327 oz., or valuing the ounce in round numbers at £4 sterling, £93, 6*s.* 2*d.*, and in 1872 = 23.464 oz., or £93 17*s.* 1½*d.*

The production of gold in Victoria, from the discovery of this metal in the colony, in 1851, up to the end of the year 1867, was 35,361,504 oz. In the last five years it was:

In 1868 with an average of	63,282 men	=	1,474,187 oz.
" 1869 " " " "	68,073 "	=	1,367,903 "
" 1870 " " " "	60,371 "	=	1,281,841 "
" 1871 " " " "	55,111 "	=	1,368,942 "
" 1872 " " " "	54,659 "	=	1,331,378 "
Total in the last five years			6,824,251 oz.
Total production from 1851 to end of 1872		=	42,185,755 oz.

As mentioned above, the production of other mines, besides those of gold, in the colony of Victoria, is unimportant. The following was produced in the year 1872: Silver, only 850 oz.; among the exports were: 294 tons 19 cwt. of tin-ore, 92,960 lb. of metallic zinc and only 5 cwt. of copper. Of antimony ores there were raised 1,573 tons 15 cwt., and of this 1,408 tons 1 cwt., besides 39 tons 8 cwt. regulus, were exported. Of 100 tons of lead-ores raised there were 6 tons 5 cwt. exported. Finally, there were 10 tons 8 cwt. of stone coal, 2 cwt. of kaoline, and 25 tons of stone-slabs produced.

In the production of the last mentioned ores and metals there were employed:

For the production of tin-ore	= 203	workmen.
" " " " copper-ore	= 29	"
" " " " antimony-ore	= 42	"
" " " " lead-ore	= 15	"
" " " " iron-ore	= 2	"
" " " " stone-coal	= 34	"
" " " " slates and stone-coal	= 33	"
Total	358	"

In order to foster the production of gold, the yearly government rental of £1 sterling per acre was reduced in December 1872 to 10*s.*, and the government was in every way trying to encourage mining as much as possible.—(From a translation and extract by Dr. BURKART in *Berg- und Hüttenmännische Zeitung*, Jahrgang XXXII., No. 44.)

Iron Ores for the Centennial.

A Letter to SAMUEL J. REEVES, ESQ., President of the American Iron and Steel Association, 522 Walnut Street, Philadelphia.

DEAR SIR:—The Executive Committee of the Centennial Commission have received a large number of communications, emanating from prominent ironmasters, manufacturers, chemists and business men in every section of the United States, requesting the Committee to take some action upon the proposition of Mr. J. BLODGET BRITTON, to secure a comprehensive exhibition of the iron ores of the United States in the Centennial Exhibition. The writers of these communications have, in almost every instance, assumed that, to make a collection, classification and analysis of ores is properly within the province of the Commission, and they, therefore, have suggested plans by which the proposed exhibition of ores will secure wide-spread co-operation among those interested in the development of the mineral resources of the United States.

Waiving all discussions of the importance of such an exhibition, and conceding the incalculable benefit accruing from the efforts of the people to make this collection of ores a complete display of the mineral wealth of the country, the Executive Committee of the Commission desire to state that, in their view, it is wholly impracticable for the Committee to take such charge of the work of collecting, classifying and analyzing ores as contemplated by the writers of the communications referred to. They will provide a place in the Exhibition building for the exhibition of specimens, and will endeavor to secure all conditions necessary to a favorable display and to afford every requisite for a satisfactory examination by visitors. But they cannot take charge of the preliminary work of collection, as that would involve the employment of salaried officers, the consumption of time otherwise needed, and the entailment of heavy expenditures for the purpose of assisting in the display of but one of the many products of this favored land. Other industries may claim this attention from the Committee as well as the iron interest, and it can very readily be seen that such an extension of the powers and duties of the Centennial Commission was not contemplated by the act of Congress which called them into being, nor could it be attempted by them without a serious complication of the present heavy task. Boundless would have been their field of labor and endless the demands upon their time, had they been made the representatives of the individual industries of the country in addition to their present duties as directors of the Exhibition.

In this view of the matter, the Executive Committee respectfully decline to assume the responsibility of making the collection of ores requested, and refer it to the American Iron and Steel Association as an organization composed of men not only pecuniarily interested in all that pertains to iron, but also abundantly competent to assume the direction of an undertaking at once important, necessary and laborious. The office of the American Iron and Steel Association is at Philadelphia, sufficiently near the headquarters of the Centennial Commission to insure perfect knowledge of all the requirements of the specimens to be exhibited and of the nature of the place in which they are to be shown, which is necessary to the completeness and satisfactory arrangement of the vast work here contemplated.

The Executive Committee do not make this disposition of the labor sought at their hands without a full understanding of the pecuniary burden it will necessarily impose upon the recipients. They, therefore, suggest that a fund be raised by private subscription to defray the inevitable expense of the collection of ores, and placed in the hands of the Treasurer of the American Iron and Steel Association. The Association should designate some skilled metallurgist of national reputation, marked enthusiasm and cultivated taste to receive the various specimens and arrange them properly in a suitable place until the time shall arrive for their removal to the Exhibition buildings, and afterwards to superintend their collection in the place to be assigned by the Centennial Commission. To the Governors of the different States and Territories the duty of appointing suitable persons to make the local collections, and forward them to the officer designated by the Association, may be intrusted.

Local agents will be able to collect the various specimens of ore, which should in each case weigh not less than fifty pounds, as suggested by Mr. BRITTON, and while care should be taken to select the best samples, analyses of the ore both by mine-owners and consumers should be transmitted with them in order to make the collection interesting and its published description accurate. As nearly all the ores used have been analyzed, there need be very little expenditure for the services of chemists, and no time will be lost in waiting for the result of their investigations. In all cases a map of the locality whence the ores are procured should accompany the specimens, so that the display will be geographically perfect. To demonstrate beyond dispute the nature and extent of the deposits of ores to be represented, geological maps should also be sent, and, in case a State has made no geological survey, it should be induced to make one of its iron fields. The value of such an enterprise to the development of the resources of a State is fully shown in the benefits resulting to the State of Indiana from the admirable survey by Prof. E. T. Cox, now partially completed. These proofs of the actual wealth of the mineral deposits of each section are imperatively necessary to make the proposed collection worthy of the confidence which the capitalists of this county and our expected visitors from abroad will undoubtably repose in it. I am, Sir, yours, very respectfully,

D. J. MORRELL,
Chairman of the Executive Committee.

The Chilian Method of Amalgamation.

THE first process employed in Chili was that of the ordinary *patio*, but this was soon supplanted by another method which formed the basis of that now in use. This consisted of treating rich sulphurets in copper vessels with cupric sulphate, sodium chloride, and mercury. At the end of a little time almost the whole of the silver was amalgamated; being, however, only accomplished at the expense of a large amount of mercury, the loss frequently being 200 to 250 per 100 of silver; in spite of which this process was frequently employed for the treatment of ores containing more than 0·02 per cent silver, owing both to the rapidity of the operation, it taking less than two hours when aided by heat, as also to the small percentage of metal (scarcely 0·0002 to 0·0003 per cent.) left in the tailings. The enormous amounts of argentine chloride, iodide, and chlorobromide produted at Chanarcillo soon demanded a more rapid, though less exact, process than the old one. In order to obtain some idea of the amount of ore requiring treatment, it will suffice to mention that the single mine of Descubridora produced in the years 1831—51, the sum of ninety-three millions of dol ars.

In the new process applied to these ores, they were crushed and pulverized as in the old method. The pulverized ore was carried by a stream of water to settling basins of sheet iron, 6½ feet in diameter, and 9½ feet deep. The stream was conducted in turn to different basins, which, when once filled, are left to stand from eight to ten hours to permit the slimes suspended in the water to settle at the bottom. At the end of this period the clarified water was decanted off and the slimes were transferred to *tinas*. These *tinas* consist of wooden vats, having a cast iron bottom, and are 5 feet 10 inches by 3 feet 11 inches. These are provided in the line of their axis with a shaft having cast iron arms which slide over the bottom of the vat. The charge placed in these *tinas* was about a ton and a half. The ores are a mixture of chlorides, iodides, and bromides, having a gangue composed of the carbonates of lime and baryta as well as clay and oxide of iron. The charge of the vat was completed by the addition of mercury, about twenty times as much of this being added as there is silver in the ore. The shaft was then set in rotation, making about four revolutions per minute. This operation lasted twenty-four hours, at the end of which the amalgamation was supposed to be completed. A stream of water was then introduced, and the rotation continued. The slimes were removed by the water, and carried into settling basins. When the water ran clear from the vats an orifice was opened in the lower portion of the vat, and the mercury and amalgam which ran out were received in a cast iron vessel, called *cocha*. The amalgam was then squeezed in a thick piece of cotton, and then laid aside for distillation. The wages, loss of mercury, and various expenses cost 9 dols. 30c. per ton for ores containing less than 0·005 per cent. silver. The entire operation, including crushing, took about sixteen hours. The tailings carried off by the current of water, and which were caught in settling basins, contained 0·0008 to 0·001 per cent silver, in the case of ores of the above-mentioned richness, and never exceeded 0·002 for richer ores of the same character. The silver obtained contained scarcely 0·01 per cent. of impurities.

The process just described subsequently underwent several modifications. The time occupied in treating the ore in the vats, exclusive of lixiviation, was reduced to six hours; and ores were treated in this manner containing as high as 30 per cent. silver. Owing to the increase in the proportion of sulphurets as the mines were sunk deeper, the results of the method of amalgamation just described underwent modifications; the percentage of metal in the tailings being augmented to such a degree as to diminish the yield of silver. The tailings, which were thrown to one side at the time of amalgamation, formed near the works enormous masses of poor ores, whose contents increased daily; the more so, as to these were added such ores as were thrown aside when picking over the ores. Attempts were made to recover the silver contained in these large bodies of tailings, for which purpose various experiments were tried. The first one tried was the Freiberg process of roasting and chlorination; the results obtained were very unsatisfactory, owing to the inexperience of the workmen. Experiments were then made by chlorination and subsequent treatment with ammonia, which was still more unsuccessful, owing to the high price of ammonia. The argentic sulphate process (Ziervogel's) did not yield any more satisfactory results.

Recourse was then had to the process which we have first described, and which had been so long abandoned. As we have stated, rich ores called *negrillo*, which were sulphurets, were treated in copper kettles together with cupric sulphate, sodium chloride, and mercury. The reactions which took place were the following:—

The cupric sulphate was transformed into protochloride in the presence of sodium chloride, thus:— $CuSO_4 + 2NaCl = CuCl_2 + Na_2SO_4$. The heated cupric protochloride, coming in contact with the copper of the kettle formed subchloride—$Cu_2Cl + Cu = Cu_2Cl_2$. The cupric subchloride, in the presence of argentic sulphide and mercury, reacted on the sulphide, the affinity of the mercury for silver promoting the reaction—$Ag_2S + Cu_2Cl_2 + nHg = 2AgHg + CuCl_2 + CuS + (n-2)Hg$. In this manner the amalgam was formed. As we have seen, this process, as formerly carried on, occasioned the loss of a large amount of mercury. The reaction by which the cupric protochloride was converted into subchloride was at that period at the expense of the copper kettles and the mercury. Thus a great loss of mercury was occasioned, and the copper vessels were rapidly destroyed. When, therefore, a return was made to the process, the first thing sought for was the production of the subchloride in special vessels and by other means.

Recourse was had to the following method: "The sodium chloride is dissolved in water; 5 parts of salt per 100 of ore. Cupric sulphate is also dissolved in water until a Baumé's aërometer indicates 20°. Sodium chloride is added to saturation. By this means the cupric sulphate is converted to protochloride. The protochloride is then transferred to a wooden vat, into which metallic copper is charged at the same time. The liquors in the vat are then made to boil by introducing steam at a pressure of three atmospheres. At a temperature of 100° C. the cupric chloride reacts on the metallic copper, and thus forms the subchloride which is subsequently employed in the amalgamation. The reaction is known to be finished when, on taking 50 c. c. of the solution, and introducing it into a litre of water, the oxychloride precipitates as a white powder, leaving the liquid entirely colorless. The subchloride is used as soon as made, and care must be taken to preserve it from contact with the air so as to avoid the formation of insoluble oxychloride. To prevent this oxydation the solution is slightly acidulated with sulphuric acid. We will now proceed to the treatment proper of the ores.

The ores are first crushed. For this purpose an apparatus called *trapiche* is employed, resembling the mill employed in the manufacture of oil. Two vertical cast-iron wheels, each weighing about four tons, form the chief portion of the machine; each of these has a rim of wrought iron or steel. These wheels are mounted on arms set in motion by a motor of some kind. They are given a velocity of ten to twelve revolutions per minute and rotate on a disk, called *solera*, made either of cast iron or steel, and on which the ore to be pulverized is spread. The ore is thus crushed to a fine powder. While the wheels are rotating a current of water is made to flow continuously, which carries off the ore as it is crushed. The quantity of the water depends on the fineness to which the ore is to be crushed. The current of water is then made to flow through a succession of tanks, in which it deposits the ore it has carried off. The water escapes perfectly clear from the last reservoir. When the first tank is completely filled with ore, the current of water is cut off, and the slimes allowed to precipitate for eight hours. The clarified water is decanted, and the slimes, forming a thick paste, are shovelled out on to a level floor, where they are left until completely dried by the air. The capacity of each tank is about 16½ feet by 6½ feet at the base, and 3 feet 4 inches high.

In the amalgamation proper the ore, properly dried, is charged into casks whose capacity varies from one to four tons; those of four tons' capacity being preferred at present, whose dimensions are 5 feet 10 inches by 4 feet 10½ inches; the thickness of the staves is about 3 inches. The arrangement of the casks is almost identical with that formerly employed at Freiberg. A charge is composed of four tons of ore with a sufficient amount of *saumure* to form a thick paste. A varying quantity of *magistral* is added, depending on the richness of the ore and the nature of the gangue. When the latter is calcareous, more *magistral* is used than when it is argillaceous, or ferruginous, since the calcareous gangue decomposes a portion of the cupric subchloride. For an ore containing less than 0·002 per cent. silver having a mixed gangue, from 28 to 38 litres of *magistral* is used. The casks are made to rotate for twenty to thirty minutes, in order to give the paste time to form; then the mercury is introduced, being about twenty to twenty-five times the amount of the silver in the ore. The rotation of the casks is then contained at the rate of four or five revolutions per minute. Six hours suffice to complete the operation.

If the ores subjected to this treatment contain a large proportion of argentic chloride or bromide, 25 lb. of lead are added to the mercury for every 100 lb. of silver. This lead is added as amalgam; it serves to prevent the chloridation of the mercury. The reaction of the argentic chloride is: $2AgCl + Cu_2Cl_2 + nHg = 2CuCl_2 + 2AgHg + (n-2)Hg$. The lead chloridises more readily than the mercury; the chlorine and bromine set at liberty by the decomposition of the argentic chlorides and bromides reacting on the metal; thus avoiding, in the first place, the loss of mercury which would result from the chemical combination; and, secondly, another loss, much more considerable and purely mechanical, due to the division of the mercury into little drops by the mercuric chloride, which, when once formed, envelops them in a thin pellicle which destroys the homogeneity of the metal, and prevents it from reuniting. The mercury is thus reduced to a powder, occasioning great loss. The use of lead reduces this loss from 150 to 25 parts per 100 of silver.

When the amalgamation is completed, the next step is to wash the amalgam, which operation is performed the same as in the Freiberg process. After which follows the refining of the amalgam, which contains cupric oxide and sulphide. The first of these is formed by the reaction of the lime of the gangue on the protochloride, the last by the reaction of *magistral* on the argentic sulphide. The refining is divided into two parts, the mechanical and the chemical. The former is performed in a *tina* analogous to that already described, the process being to charge the amalgam into the vat, adding ten parts of mercury to 100 of the former. A current of water is then introduced, and the shaft is made to rotate at the rate of sixty revolutions per minute. In this manner the whole of the cupric sulphide and a very small quantity of the oxide are removed. This operation is finished when the water escapes perfectly clear. To proceed to the chemical refining, the water in the vat is permitted to escape, and two parts of ammonium carbonate per 100 amalgam are added. The shaft is caused to rotate from four to five hours, and the amalgam is then washed, when it is found to be entirely freed from cupric oxide.

The distillation of the amalgam takes place in a closed vessel *per descensum*. The furnace is formed by a cast iron bell, the lower portion of which stands in

a basin of water in which the mercury condenses. The upper portion of the bell is surrounded by a circular wall; the fuel being charged into the annular space between the wall and the bell, which is about 3 to 5 inches. The spongy silver (*pina*) which is obtained is remelted in a reverberatory. It is necessary to thoroughly rabble the metallic bath; the remnant of arsenic remaining is thus removed by contact with the iron tools, forming an iron arsenide which floats on the surface and is easily removed. The silver thus obtained is 980 thousandths fine.

The process which has just been described is applicable to all silver ores, with the exception of argentiferous copper pyrites, galena, blende, and such ores as contain more than 1 per cent. of free arsenic, the latter largely augmenting the loss of mercury. In this manner it is possible to treat tailings not containing more than 0·0004 per cent., and ores not containing over 0·0006 per cent. silver. So long as the richness of the ores subjected to this treatment does not exceed 0·005 per cent., the tailings obtained do not contain more than 0·00015 to 0·0002 per cent. silver. The ores subjected to treatment are never reduced to an equal percentage by mixing, as it is found much more profitable to treat the rich ores separately. In this case the operation is completed much more rapidly, the interest on the capital thus running for a much shorter period, thus compensating to a great extent for the cost of treating the refuse of the operation. The mercury which has been used five to six times becomes so charged with impurities as to retard the amalgamation. It is purified by adding 20 grammes of sodium amalgam to every 200 lb. of mercury.

The works are usually placed near a stream of water, in order to have both the water and motive-power necessary for the various operations. Works of sufficient capacity to treat eight tons per day consist of—1. An area of 550 yards for dumping ores. 2. Two *trapiche* set in motion by a motor of six horse-power. 3. Four basins. 4. An area of 1,100 yards for drying the pulverised ores. 5. Two amalgamating casks, with a motor of eight horse-power. 6. A vat to receive the wash-water of the casks and to recover the comminuted mercury. 7. A vat for washing the amalgam. 8. A distilling furnace. 9. A melting furnace. 11. Two vats in which to dissolve the sulphate. 12. A basin constructed of hydraulic cement for the *saumure*. 13. A caldron in which to treat the *saumure*. To which must be added the basins for clarifying and purifying the waters. These last are made to pass through quicklime in order to recover the copper salts. They are thus rendered limpid and potable. The persons employed consist of a superintendent, an assistant superintendent, an assayer, a clerk, a foreman, and ten workmen.

The cost per ton of ore, containing 0 002 per cent. silver, is—Pulverising, 1·49 dols.; mercury, *magistral*, *saumure*, 3·72 dols.; refining the amalgam, ·04 dol.; distillation, 0·4 dol.; melting and refining, ·09 dol.; tools and various expenses, ·93 dol. to 1 dol. 0·3c. [These values are given in coin.] This does not include interest, the operation taking such a short time, nor a sinking fund of the capital.

The great charm of the Chilian method of amalgamation is its great simplicity. This process eliminates a large number of the operations preceding the amalgamation, or considerably simplifies them. If, for example, it be compared with the European method of amalgamation as formerly carried on at Freiberg, it will be found to be infinitely superior both for rapidity and simplicity. It entirely does away with the difficult operation of roasting, which is delicate in its manipulation and the cause of almost all the loss of silver. Even when compared with the American method of amalgamation as carried on in Mexico, it is infinitely superior as regards rapidity. It replaces the doubtful and hypothetical reactions of this process by chemical reactions which are both exact and clearly defined. In one word, it solves in the most simple manner a question in silver metallurgy which has never been hitherto accomplished but by roundabout means, *i. e.*, the elimination of the sulphur and the direct union of the silver and mercury. Finally it may be stated that, while elsewhere amalgamation must give way to the fusion with lead as soon as this becomes possible, as applied with us it will not be the case, since it greatly surpasses this process. It is unknown who was the inventor of this method; it can only be stated that this process has been constantly in use at Copiapo since 1862. *Prof. Prime in Am. Chemist.*

Mineralogical Notes.

Willemite.—Transparent crystals from Franklin, N. J., gave, in two trials of different specimens, on Jolly's spring balance, specific gravity, 4·26 and 4·25. A. F. CANFIELD obtained, by the usual method, with another specimen, 4·29. These results are somewhat higher than given by DANA, who puts the highest at 4·18. The crystals were found in only one locality by Mr. CANFIELD, and are perfectly transparent.

Indiferous Sphalerite, from Roxbury, Conn.—The very dark, easily cleavable sphalerite, which occurs with siderite, and on being crushed gives a peculiar fetid odor, contains an unusually large percentage of indium. By careful manipulation the indium line *a* can be observed with the spectroscope by testing the raw material, without acids.

The following method was finally selected for determining the amount of indium present. Sixty grammes of the purest specimens were treated with hydrochloric and nitric acids, then evaporated with sulphuric acid to expel all nitric acid, filtered, digested with excess of zinc for several days, boiled for some time the last day, the solution decanted, and the zinc and spongy precipitate dissolved in nitric acid. The solution was evaporated with sulphuric acid, diluted slightly with water, a small residue of plumbic sulphate filtered out, ammonia added in excess, the precipitate collected on a filter, redissolved in sulphuric acid, and this operation repeated twice. In the solution thus obtained not a trace of lead or copper could be found. It was then divided into three equal parts. To one an excess of ammonia was added, and the precipitate of Fe_2O_3 and In_2O_3 weighed. The second portion was divided into halves and the Fe_2O_3 in each determined by potassium permanganate. To the third portion ammonia was added in excess, the precipitate filtered out, dissolved in hydrochloric acid, treated with barium carbonate, filtered, and the filtrate tested with ammonium sulphydrate for zinc without success. In this way the mineral was found to contain 0·0255 per cent. of indium, calculating the oxide as In_2O_3, at. wt. of indium 113·44; or 0·0245 as InO, with at. wt. 35·9. Using the latter, WINKLER found in Freiberg zinc 0·0448 per cent. of indium. MEYER found 0·0142 in Freiberg zinc produced by a different method of reduction, and HOPPE-SEYLER found 0·0228 in a specimen of wolframite of unknown origin.—GMELIN-KRAUT, *Handbuch d. Chemie*, 1871.

Franklinite, pseudomorphous after calcite, from Mine Hill, N. J.—This pseudomorph, handed me by Mr. CANFIELD, is black, somewhat lustrous on a fresh fracture, and shows traces of cleavage. It occurs in well-defined crystals, corresponding to the type rhombohedron of calcite, and appears from analysis to be a mixture of franklinite and a hydrated oxide of manganese. The result of a full analysis of one specimen was:

HO (direct)	11·293
CO_2	3·488
SiO_2 (or insol. res.)	0·170
Fe_2O_3	14·627
Mn_2O_3	58·387
ZnO	5·285
CaO	4·739
MgO	1·253
KO and NaO	undet.
	99·242

Two other specimens, in which the Fe_2O_3 only was determined, gave 12·777 and 16·129, showing that the mineral is probably a mixture. There is so much potas-a present, that the red line is a conspicuous object in the spectrum afforded by the mineral.—*Prof. H. B. Cornwall in Am. Chemist.*

Lead Burning.

MESSRS. MERRYWEATHER & SON, fire engine makers, London, have drawn the attention of the public, by a letter to an English paper, to the process of "lead burning," which is greatly superior to jointing lead by means of "plumber's solder." They urge its adoption on the grounds that it is far cheaper to have a pure lead joint rather than a solder joint, because it lasts longer and costs only one-sixth that of the latter, and as an instance of cost we give the following from actual experiment at Messrs. Merryweather's works.

By lead-burning process:

	s.	d.
One man and one boy will joint 90 ft. of lead on a roof in one day, say, wages	9	0
Strip lead, including waste, 30 lb.	7	0
Use of machine	1	0
	17	0

By soldering process:

	£	s.	d.
Two men will join 90 ft. of lead on a roof in three days, say wages	1	16	0
Solder, 67 lb at 1s.	3	7	0
Firing (on the roof) three days, for heating irons, melting solder, lamp black, &c., 1s. 6d.	0	4	6
	£5	7	6

The machine is a simple contrivance, consisting of a wooden vessel fitted with acid and zinc chambers; there is also a circular bellows; pipes are connected with each and terminate with a three-way piece, to which the burner is affixed. Its cost is about £20, and by its use such disasters as befel Canterbury Cathedral and the Alexandra Palace, would probably be entirely prevented.

Casualty.

The Bristol (Eng.) *Daily Post* gives the following account of an extraordinary accident and a still more extraordinary cure. We fear our contemporary has made some mistake in his dimensions, for even the words, "powerfully built," are hardly sufficient to describe the size of a man who gets stuck in a 10 ft. tube. On Saturday afternoon an accident, which was nearly proving fatal, happened to a man named Adam Drewe, employed at the iron works, Scend, near Melksham. It appears that the large iron tube, about 30 ft. in circumference, through which hot air is blown from the engine, sometimes gets obstructed by ashes, and then a man has to creep into it for the purpose of removing them. This was the case on Saturday, and Drewe, who is a powerfully-built man, got into the tube for the above purpose. Not making his re-appearance, a man was sent into the tube to search for him, and found him jammed in a narrow part of the tube in an insensible state. After some difficulty he was pulled out, still insensible, with several scars and burns on his body. Now comes the most extraordinary part of the story—the Staffordshire mode of bringing him to life, and it was as follows:—A hole was dug in the ground large enough to receive Drewe's head, and into this hole his head was put, face downwards, and carefully covered up in the "mother earth," with the exception of a small hole left when breathing time came. Wonderful to relate, there were soon signs of returning life, and Drewe so far recovered as to "unearth" himself. Brandy was administered to him and he was soon himself again.

MINING SUMMARY.

Nevada.

SUTRO TUNNEL.

The Gold Hill *News* of Oct. 28, says: A few weeks ago we had the pleasure of examining the great work of the Sutro Tunnel, and alluded to the difficulties encountered by the Civil Engineer Department in effecting an accurate connection between the east and west drifts.

We are enabled to state that all the difficulties referred to in the foregoing article (republished in the *Journal* of Nov. 18,) are overcome, and the connection which has been so much talked of in professional circles, is a *fait accompli*. And right here we may state that even the most skilled civil engineers, well acquainted with the subject, deemed a difference in the connection of from two to five feet, a very close hit. As we previously predicted, Mr. SCHUSSLER was equal to the task.

At ten minutes of 11 o'clock A. M., on the 27th of October, the two drifts met. In the afternoon of the same day Mr. JOSEPH ARON, President, and Mr. HOOPER, Director, who were present at the time the connection was made, forwarded a message to Mr. ADOLPH SUTRO, London, of the following wording:

"SUTRO, October 27, 1873.

"Schussler connected tunnel to-day. Grade within ½ inch; center line, ¾ inch.
(Signed) JOSEPH ARON."

On the Saturday previous a dispatch was sent to the President in San Francisco, to leave there for Virginia on Sunday morning, and thus this gentleman with a party of others interested in the enterprise, arrived at the Tunnel just in time to witness the great event.

Early in the morning, on Monday, Mr. SCHUSSLER sent his old chain-man, JOHN HIGGINS (who has followed his footsteps for ten years and helped to make five tunnel connections during that time), over to shaft No. 1 to measure the progress made since Saturday morning. He came back in breathless haste and reported that the rock had, during the last forty-eight hours, turned softer, and that a progress of about four feet more than was anticipated had been made. Upon hearing this unexpected but favorable news, Mr. SCHUSSLER exclaimed excitedly, "They are within three feet of one another." He called young Ross BROWNE, his assistant, and both rushed into the tunnel up to the face of the header. Fifteen minutes after their arrival, a cartridge of giant powder being placed in a drill hole in the center of the face and ignited, blew a hole about ten inches square through the remaining barrier of rock.

The excitement caused by this event was intense, and the shifts of miners and foremen who were gathered in the respective faces, gave vent to their joy in an unearthly yell that made the old mountain ring; at the same time SCHUSSLER, BROWNE, and JACKSON, the foreman, rushed forward and shook hands through the opening, with BOB DE NOON, the Mining Superintendent of the company, Mr. BREW, foreman at Shaft No. 1, and all the boys on the shift. Enough rock was then knocked off with a pick to enlarge the aperture sufficiently to allow the men to crawl through from one drift to the other. As a matter of course a drink was had all around. The draught through the opening at the time was almost strong enough to force a man through it into the opposite drift. At this juncture the President, Mr. ARON, Mr. HOOPER and Mr. CLARK, who had just arrived from San Francisco, together with Mrs. SUTRO, Mr. SAFFORD and Mr. PITCHFORD, arrived on the spot, and by the aid of sturdy miners were launched through the aperture. Mr. SCHUSSLER received, with commendable modesty, the warm congratulations of the party upon the success of the undertaking, and requested them to delay a few moments to witness any discrepancies which might have occurred in his survey. The instruments were placed in position, and fore and back sights taken through the opening, and to the great astonishment of everybody the difference in his survey between the opposite drifts amounted to only one-half inch in the level and seven-eighths of an inch in the line! This result, although hardly credible, judging from the difficulties he had to contend with in making his surveys, is a truly wonderful triumph in the line of underground surveying, and adds fresh laurels to the brow of the champion civil-engineer of America.

At the date of this writing the barrier of rock has been entirely cut away, the track put in position, so that all traces of the point of connection are gone.

Colorado.

GOLD HILL DISTRICT.

Extracts from the *Rocky Mountain News* of Nov. 12:

The developments which have taken place in the mining region in the vicinity of Gold Hill and Sugar Loaf, in Boulder County, have attracted the attention of miners and capitalists in a marked degree. Recently the discovery of immensely rich gold-bearing quartz in the Cash lode set the country wild. This "discovery" has its friends and opponents. It is claimed by one party that it is part and parcel of a lode that will, throughout its extent, yield as great returns as have already been received. Others claim it to be a pocket that will soon be, if it is not already, exhausted. Be the results what they may, three successive blasts have developed equally as rich mineral as the first, and, taken in connection with an unusually rich vein of tellurium, the Cash lode may be set down as valuable not only to its fortunate owners but as an advertisement to the remarkably rich mines of Gold Hill.

Gold Hill mining district is one of the early discovered gold-bearing sections, and was then thoroughly prospected and worked. In 1860 there were over a dozen quartz mills, beside a number of arastras erected there. The owners of the quartz mills were attracted by the rich discoveries in the Gregory district, and nearly all were moved there in the fall of 1860-1. These mills prospered through the next year, but, discouraged by the resistant qualities of the ores, the miners finally became disgusted and abandoned the district. At this time the Horsefall, Hope and Williams were the most noted lodes, and, in 1863, an association of some twenty of the owners of the first named lode was formed, called the UNION company, who fitted up a six-stamp mill, which was run until it wore out. Since then, and until the value of the newly discovered tellurium was ascertained by the owners of the Red Cloud, but little has been done at Gold Hill; the cabins, stores and dwellings were torn down, removed to other points, or used as fuel. The machinery of the mills was removed or rusted out; the pay dirt in Gold Run and Aikin gulch was exhausted, and gloom, despondency and silence reigned where once busy thousands found employment, and the wildest excitement ran to its highest pitch.

The elevation of the summit from which the town and mining district take their names, is 8,636 feet; the town is perhaps two hundred feet lower. A ditch several miles in length and of large capacity has been constructed from the St. Vrain, and will supply the town with abundance of water for domestic purposes, and for ground sluicing Gold Run and Aikin gulch.

Reduction works are needed badly, the nearest being Professor HILL'S at Black Hawk. A ten-stamp mill run by steam, has recently been started by MORRISON & NUTT on Left Hand. Several gentlemen are contemplating the introduction of concentrating or reduction works, but none have made definite arrangements. There are now in sight thousands of tons of ore varying in value from fifty dollars up to the thousands. Many mines are taking out enough to pay the expenses of sinking, but the larger number are idle, because of the great expense of shipping the ore.

The following is a partial list of mines which produce paying mineral: Red Cloud, Cold Spring, Cash, Victoria, Eureka, Black Cloud, Empire, Horsefall, Evans, United States Bank, Gold Ring, White Rock, Seven-Thirty, Brick Pomercy, Jefferson, Alamakee, Hiawatha, Thunder Cloud, Oro Cash, Williams, Racine, Alpine, Grey Eagle, Livonia.

Of these, the Red Cloud is the most noted. From it was obtained the first assayed specimen of the now well-known metal, tellurium. As its owners are not desirous of selling any portion or interest in it, it will be readily understood that any allusion to it is not for a special purpose, other than as a representative mine of the Gold Hill district.

Tellurium, as defined by Webster, is "a metal discovered by Müller in 1872, combined with gold and silver in the ores, and received from the Banat of Temeswar. It is of a silver white color, and its chemical properties closely resemble sulphur and selenium." On account of its rarity and use in chemical experiments, its value varies from two hundred dollars per pound to almost any price that may be demanded, when in a pure condition. It is found in a number of combinations, and also native; in the latter case, it is almost always combined with from five to ten per cent. of iron and a small quantity of gold; when free from extraneous metals and untarnished, it is a steel white metal, brittle and easily melted, weighing a little less than iron, and having a degree of hardness about equal to that of rock salt. Its principal combinations are with lead, bismuth, and gold and silver, the proportions varying in different specimens to a considerable extent, especially as regards the quantity of gold and silver, occasioning a number of telluric minerals, all of which are popularly known under the name of tellurides.

The present known mines are in Nagyag in Transylvania, Offenbanya in Austria, Whithill in Virginia, Georgetown in California, and in Boulder County, Colorado. In the latter locality the tellurium occurs combined with gold and silver as petzite, and with lead, as altaite.

Prof. J. ALDEN SMITH is now carefully investigating the different lodes already opened. While on many points he is extremely reticent, he allows the following statement to be made: "The mines of Gold Hill are raising the richest ore in the world in quality."

Among the works now progressing and which will have an important bearing on the future value of mining property, is the Corning tunnel; it was commenced in March, 1873, is five and a half feet wide at the bottom and six and a half feet high. It has now reached a length of over 250 feet. Two lodes have been crossed, one of which is valuable. Starting on the northeast side of Gold Hill, it runs in a southwesterly direction, and when passing under the highest elevation of the hill will be more than 800 feet below the surface. The mineral already reached would pay the working expenses if there were works suitable for the reduction of the ore within reasonable distance.

THE RED CLOUD MINE.

A paper describing this mine was read at the Pittsburgh meeting of the American Institute of Mining Engineers, October, 17, 1872, by Mr. A. EILERS (published in the *Journal*), in which he gave the following figures as to the value of the ore: "So far, one lot of five tons of surface ore had been shipped, assaying $200 per ton in gold and silver. A second lot of first class undecomposed ore, six tons, yielded $400 per ton."

Subsequent to the above assays a shipment was made to a German smelting establishment. It consisted of seventy-six sacks, weighing, nett 6,077 pounds and containing total, 1,716.5 ounces of silver and 202.5 ounces of gold. The gross proceeds at the smelting works were: Silver, $1,425.31 coin; gold, 3,918.35 coin. Total expenses from New York to the works, $93.66 coin. The owners received, therefore, gross, $1.21 coin per ounce of silver and $19.35 coin per ounce of gold, and the total expenses of handling and shipping over three tons of ore from New York to the smelting works was only $93.66. Every pound of ore brought the owner, nett, 86.4 cents, or $1,728 coin per ton of 2,000 pounds. There are certainly very few mines in the world that can produce ores as rich as these by the ton.

At the late fair in this city, specimens of ore were shown, which assayed over $200,000 per ton.

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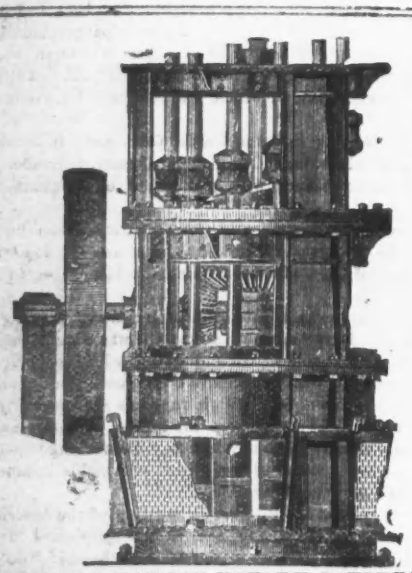

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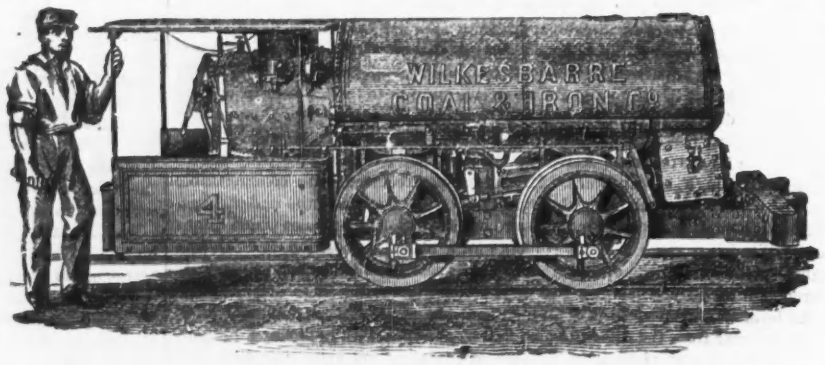

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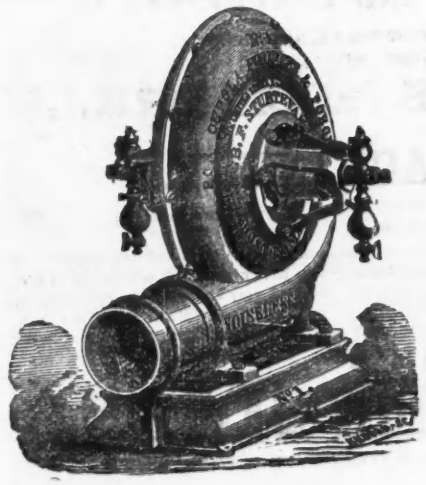

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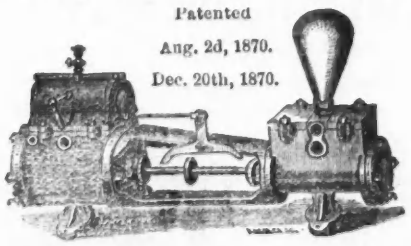

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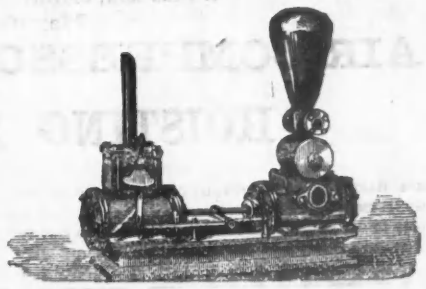

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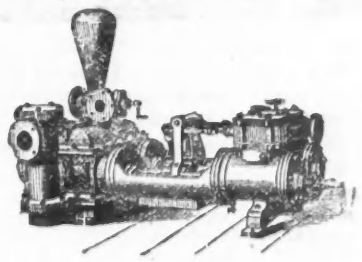

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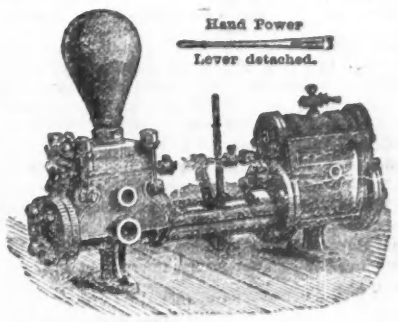

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