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Table with 4 columns: EDITORIALS / CORRESPONDENCE / NOTES, PAGE, NOTES, PAGE. Includes items like 'Regulation of Petroleum Storage in Berlin', 'Coal Trade Notes', 'General Mining News', 'Markets', and 'Financial'.

MR. CARL HENRICH, lately superintendent of the Detroit Copper Company's smelting-works at Morenci, Arizona, will leave San Francisco May 8th next, for New Zealand, where he is to erect and manage copper smelting-works, the plant for which has been built by Messrs. FRASER & CHALMERS, of Chicago.

ASPEN, Colorado, has developed the grounds for a genuine old-fashioned boom. The comparatively little attention it has attracted in the past has been due to the baseness of its ores and the difficulties in marketing them.

Mining, as our reports have shown for some time past, has been probably the most successful industry in this country, and the fabulous

fortunes made so quickly in camps like Aspen will again attract the attention of capitalists to legitimate mining as the most profitable field for investment.

PROFESSOR COOK's New Jersey Geological Report for 1884 is, as usual, both business-like and interesting. The picturesque feature of it is the basaltic quarry at Orange, views of which constitute a triple frontispiece. The principal geological discussion in the report concerns the Green Pond Mountain rocks, which, classed by Prof. HENRY ROGERS as Middle Secondary (probably Triassic), and by Professor COOK himself, in 1868, as belonging to the Potsdam sandstone, are now designated as Middle Devonian.

It is a curious feature of strikes and such like labor troubles that they occur so frequently when the depression of business makes exactions on the part of labor impracticable. In the case of a manufacturing industry, there may be this excuse for the workmen, that they do not believe what is told them as to the necessity of reducing wages, and they think they must put the sincerity of their employers to the severe test of a strike.

WE begin on another page a very interesting and valuable paper on the manufacture of ammonia from the nitrogen of coal. The subject is one of immense importance, especially if, as is claimed both by Mr. BEILBY and by some inventors in our own country, the nitrogen of the air may also be made available, as a by-product, in the manufacture of water-gas.

The following table of compositions will show the advantages to be gained in the heating power and flame intensity of the ordinary fuel gases by the reduction in the quantity of nitrogen:

Table with 5 columns: Composition, Siemens per cent., Wilson per cent., Beilby per cent., Water-gas per cent. Rows include Hydrogen, Carbonic oxide, Carbon dioxide, Nitrogen, and Marsh-gas.

MR. BEILBY's paper shows the steps through which his important investigations have gone, and will be a guide to those who may propose to explore in this fertile field.

Illustrations of MR. BEILBY's latest furnace will probably be given in the next issue of THE ENGINEERING AND MINING JOURNAL.

THE General Director of the Stolberg Company contributes to the annual report of the Mining and Metallurgical Society of the Aachen District an interesting review of the lead market for 1883. As to the production of lead in Germany, he shows that in 1868 it was about 50,000 tons; by 1872, it had reached 60,000; next year, it was 65,000; for the next two years, 70,000 each; in 1876, 75,000; in 1877, 80,000; in each of the two following years, 85,000; then it stood for two years at 90,000; then for two years at 95,000; and in 1884 it amounted to nearly 100,000 tons.

during the period named, from almost nothing to 140,000 tons annually. The tons named, we presume, are metric tons of 1000 kilograms.

More than one fourth of the product of Germany is furnished by the Mechernich Company, and about one sixth by the Stolberg Company.

According to this report, the total product of the world in lead was about the same in 1884 as in the previous year, namely, between 450,000 and 500,000 tons, and nearer the latter amount than the former.

As to modern methods of mining, the report says:

"In fact, the wild rapidity with which our deposits are now attacked and exploited permits such sudden enlargement of production as we have seen in America and also here among ourselves; but it also involves the early exhaustion of the deposits.

"When we read old mining books, when we study the history of our mines in the Hartz and Saxony, Bohemia, etc., we come upon the same names that still figure in our statistics and reports. The same deposit is worked for centuries.

"But will the vast deposits of the Rio Tinto last as long as the much weaker deposits of Ramon'sberg have done? The Himmelsfurst mine in Freiberg and the Dorothee mine in the Hartz, are very old and still active; while the Comstock, Eureka, Bingham, Leadville, and other mines of modern origin, even in Europe, have ceased to be productive. We think, of course, that what ceases will be replaced by something else; and this is in fact ordinarily the case. It is possible that the Congo and the Cameroons—and it is still more likely that Australia—may supply for a long time to come the losses from diminished production elsewhere."

It is a curious fact, by the way, that the mines from which the greatest supply of German lead comes are in territory that belonged to France until the Franco-German war. At that time, they were undeveloped; but their existence was known to the German geologists who, spectacles on nose, had reconnoitered the land in the interest of science, as their military brethren had done for the purposes of war. We have heard on pretty good authority that the German diplomatists received important hints on this subject during the negotiations as to the precise location of the boundary-line, from the German mining officials, and managed in consequence to secure for the empire those undeveloped fields which have since become so enormously productive. \*

#### CORRESPONDENCE.

[We invite correspondence upon matters of interest to the industries of mining and metallurgy. Communications should invariably be accompanied with the name and address of the writer. Initials only will be published when so requested.

All letters should be addressed to the MANAGING EDITOR. We do not hold ourselves responsible for the opinions expressed by our correspondents.]

#### Civil vs. Military Engineers.

EDITOR ENGINEERING AND MINING JOURNAL:

SIR: "Spectator" accuses me of misrepresentation for including in my estimate of civil engineers in the employ of the government the civil engineers employed on the Mississippi River improvement. As this work is carried on under the charge of engineer officers, I felt warranted in drawing in these figures. My object is, to show as accurately and as correctly as I can, the relative number of civil and military engineers employed on our river and harbor works, and to claim for the civil majority the same consideration that is shown the military minority. Two additional facts also warrant me in adding the number of civil assistant engineers employed by the Mississippi River Commission to the number given by "Spectator." I know, for instance, that permission to raise the salary of these assistants is asked of and granted by the "Chief of Engineers." Does not this fact bring these civil assistants in some connection with the last-named officer? Furthermore, the circular of the Chief of Engineers, to the effect that only men, graduates of technical schools and doing the duties of assistant engineers, should be given this title, was promulgated on the Mississippi River last summer, and was enforced. Was it the intention to reduce "apparently" by means of this circular the number of civil engineers employed on river and harbor work, and to furnish "Spectator" with the smaller number that he quotes? I must think so, as no effort was made to determine at the same time how many of the men appearing on the rolls as surveyors, rodmen, draftsmen were civil engineers. That the work done by these men is usually engineering work, and often such as to call for a most thorough technical training, I happen to know.

Mere figures taken from the rolls do not always show the true state of things, I admit; but if I have erred at all in using them in this case, I have erred in "Spectator's" favor.

My statement that our young lieutenants of engineers are not now employed in subordinate positions on river and harbor work has not been refuted by "Spectator," as he seems to think. They are not so employed, according to "Spectator's" own table, to which I beg to refer. First lieutenants on river and harbor work, where there are any civil assistants, always hold positions of a higher grade than these assistants. A first lieutenant is not ordered on such works unless he is placed over the heads of all civil assistants, no matter what their time of service and experience and the lieutenant's lack of experience on this kind of work may be. It is incompatible with the dignity of the officer that he be under the orders of a civilian. Names are available for "Spectator's" personal information. C. D. M.

EDITOR ENGINEERING AND MINING JOURNAL:

SIR: "Spectator," writing of my suggestion that the world's increase in knowledge of the use of high explosives is not entirely due to the constitution of the United States Corps of Engineers and the examinations they are required to pass, says, "One specimen must suffice." It is respectfully submitted that one specimen can not be allowed to suffice.

"Spectator" inadvertently overlooked two points that were made after quoting his assertion of the operations at Hell Gate, "That history alone contains nearly the whole argument at issue."

1. The earlier operations at Hell Gate were fully abreast of any contemporaneous knowledge of blasting.

2. Experience had been had in two instances, which were cited, analogous to the work at Hallett's Point.

This was not a Blossom Rock business, any more than it was a Malta business, or a nitro-glycerine business, and "Spectator" is requested to turn his attention to the whole business, which lies in the first paragraph of this communication, and it is hoped that "Spectator," who, in addition to a fair stock of general information, seems to have ready access to the esoteric knowledge of the corps, will, now that his attention has been called to it, kindly examine the specimen in its entirety.

When he wrote, "Observer" was cognizant of the fact that experiments had been made on Blossom Rock, and as they so shattered the rock as to give Von Schmidt a good deal of trouble from leakage, it is possible they should not have been called futile dalliances.

These experiments are described on page 7 *et seq.*, in the Report upon the Removal of Blossom Rock in San Francisco Harbor, California, by R. P. Williamson, Major Corps of Engineers, Brevet Lieutenant-Colonel, U. S. A., and W. H. Heuer, Lieutenant Corps of Engineers, 1870, published by authority of the Secretary of War, Washington, 1871. "Spectator" had the whole history of the Blossom Rock business in his hands when he wrote, but apparently relied on his memory rather than on a fresh perusal, as there are some circumstances bearing on the ability to conduct such operations by those whose names are given such prominence on the title-page quoted above that have escaped his notice. For example:

The powder was placed in casks, and "the cartridge was placed as near to the middle of the charge as possible." That Von Schmidt knew better, is seen on page 29, where a perforated gas-pipe was used to insure "the burning of all of it," that is, the gunpowder. By reference to Plates II. and III., it will be seen that blasts 6 and 7 were in the deepest water, from 16 to 21 feet, and 125 pounds of powder removed about three cubic yards of rock (a result not entirely futile). Yet, with this experience, we find, on page 10, "If Blossom Rock is to be removed, I think it can be done more economically by drilling and afterward by surface-blasting, than by surface-blasting alone. . . . After sufficient rock has been removed in this way to enable us to have a depth of 18 feet of water at high tide, then surface-blasting can be advantageously used!" The italics are my own.

The experience gained on Tower and Corwin Rocks, Boston Harbor, by a lieutenant-colonel of engineers, namely, "The pressure of the body of water, from 23 to 33 feet in depth, seemed to diminish largely the ordinary explosive effect of gunpowder upon rock, as seen in blasts in the open air" (see Removal of above rocks by John F. Foster, Van Nostrand, 1869), seems to have been unknown in San Francisco.

After using about 42 pounds of powder per cubic yard in the deepest blast, the proposition to follow below that depth by surface blasts is almost equal to the proposition to *chisel* eight feet of rock as an alternative in case blasting was not effective, made by a member of the corps as late as 1876.

In fact, what the corps of United States Engineers for Fortification and River and Harbor Improvements does not know about blasting and handling rock can be partly gathered from Volume 7 of the Institute of Mining Engineers, where, under the title of the Glyndon Blast, the effect of employing one of these gentlemen as "an expert in the matter of large blasts" is set forth, with other valuable information.

Whether or not this "eminent civilian contractor," as "Spectator" is pleased to call Von Schmidt, who signed himself Civil Engineer in his proposal to do this work, was at any time satisfied with "the cordial recognition of his merit," is not known to the writer; but when he read on page 37 of the above referred to report, "The boom was set to the proper depth of water; on it stood Lieutenant Heuer, with a lead line in hand," and saw no notice therein of civilian contractor Von Schmidt standing on his crib with a drill on his shoulder, the "cordial," etc., became like St. John's little book, and he went to Washington, where he got a patent for a new mode or method of removing submarine rocks; claiming—1. The method of entering a rock partially or wholly submerged, etc. 2. The method of removing the rock by forming therein a chamber or cavity, . . . charging the cavity with blasting agents, filling the cavity with water as a tamp, etc.

A careful search through the records of the Patent-Office would show some bubbles pricked, and would throw light on some positions that are not now fully understood.

Will "Spectator" read "the whole history of the Blossom Rock business," if he still retains it, and say whether or not he thinks Von Schmidt was the engineer of that enterprise and the others merely recorders, one of them gaining experience that was eagerly used at Hallett's Point, in spite of a decided exhibition of bumptiousness, and at the same time not to forget the proposition that the world's increase in knowledge of the use of high explosives is not entirely due to the constitution of the United States Corps of Engineers and the examinations they are required to pass?

Not wishing to write to the extent that will require editorial curtailment, I will leave "a good deal more to say" for another opportunity, if space can be afforded.

April 22.

OBSERVER.

#### The Sturtevant Mill, Stamps, and Rolls.

EDITOR ENGINEERING AND MINING JOURNAL:

SIR: In your last issue, I find another letter from "D" on the product of the Sturtevant Mill. The last paragraph is interesting. Although the microscopic observations made by "D" cover a very limited range, they suffice to prove that on the material treated *rolls* did the best work and *stamps* the worst. The Sturtevant Mill occupies an intermediate position, but whether nearest rolls or stamps is not made clear. More careful and extended observations might furnish some data as to the relative proportions of angular and rounded material in the pulp, and also tell us in what ratio this proportion seems to change with the degree of fineness. "D" promises soon to give us the figures we have been expecting. This is decidedly interesting, and I trust they may compel deductions that shall not be susceptible of misunderstanding or misinterpretation.

If "D" will kindly look over the first memorandum that suggested this little discussion, he will see that all the limitations have been introduced entirely by himself. If I hazard an opinion that broadly covers the whole ground, and he answers by an objection that applies but to a fraction of the same, he must not take it ill of me if I remain unconverted.

Nor do I wish him to believe me a partisan of stamps; for dry crushing, I have always considered these a most objectionable tool, which owes its adoption chiefly to the convenience of machine-shops and to the now classical prestige of wet stamps in the West. JOHN HEARD, JR.

Royalty on Mine Leases.

EDITOR ENGINEERING AND MINING JOURNAL:

SIR: As you are no doubt aware, very promising indications of gold and silver have recently been found in this district during the last year, some of the samples assaying hundreds of dollars per ton. The land here is mostly owned by individuals or corporations. The owners are willing to lease on reasonable terms, but are ignorant as to what such terms should be. Can you give me any information as to what proportions of the bullion are usually taken for royalty and what provisions are made in leases for an "honest count"?

[Gold mines are rarely leased in this country on a royalty; but in Nova Scotia, where the crown reserves the gold, silver, and coal, leases are granted on a royalty of two per cent of the gold produced, and the gold is valued at \$18 an ounce.

In the Province of Quebec, the conditions of lease by the Canada Gold Company, which holds a great part of the Chaudière gold-field, are three per cent of the gold produced, and the conditions of lease were given in the ENGINEERING AND MINING JOURNAL last week, page 258.

When a mine is opened and when facilities for marketing the ore are provided, tributaries take temporary leases at a certain proportion of the ore, the proportion depending on the prospect. In some cases, they pay 50 and even 75 per cent of all the ore they get. These are exceptional cases, however.—EDITOR E. AND M. J.

MARQUETTE, MICH., April 18.

COPPER MARKET REPORT OF S. RAUNHEIM.

Prices of copper have advanced lately, and are likely to continue higher for some time. It is evident that there is a decided scarcity of supply for the home consumption, and this supply can probably not be increased materially for the next five months, so that our manufacturers will have to pay higher prices to obtain the raw material required by them.

Furnace material is quite impossible to get, for the following reasons: The largest providers of such material are Montana and Arizona; I might say just as well the only ones at present.

Montana has contracted almost its entire production for 1885, to be delivered to Europe, the Anaconda having again sold 15,000 tons of matte to England, which, besides 7000 tons already sold this year, brings up its sales to 22,000 tons, or to its total capacity for 1885. The Clark's Fraction has sold all its material up to July 1st, and the Montana C. C., the Parrot Company, and the Bell Company for several months to come at good prices in England.

From Arizona, very little material is expected. It is stated, by good authority, that the Old Dominion Mining Company will shut down its furnaces May 1st. The Copper Queen's production is so far only 600,000 pounds a month; and the Longfellow's the same.

The furnace material at the disposal of our refiners from these sources, therefore, is only 1,200,000 pounds a month. Other sources, perhaps, 300,000, or 1,500,000 pounds monthly for the next four or five months.

Our home consumption of refined copper averaged last year about 6,000,000 pounds; this year, certainly not less. Hence it is to be seen that 4,500,000 pounds more a month are required. The available stock of copper in our country is almost insignificant, and more Lake copper will be required for our consumption than can possibly be delivered.

	Pounds.
The estimated production of the lake companies for 1885 is..	75,000,000
Deduct mines closed or to be closed May 1st.....	12,000,000
Leaves.....	63,000,000
Or per month.....	5,250,000
Of which to be shipped to Europe, as per contract, about.....	2,750,000
Balance left.....	2,500,000

To be disposed of in the United States.

To recapitulate: Against a monthly consumption of 6,000,000 pounds, are 1,500,000 of furnace material, and 2,500,000 Lake copper; 4,000,000 only expected.

This monthly deficiency of 2,000,000 pounds can only be made up by the available stock, little as there is, and possibly by re-imports of Lake and Arizona copper from Europe. The latter is impossible at our present prices.

After expiration of the European contracts, more furnace material for domestic use will be on hand, and the condition of the market will subsequently change. Meantime, manufacturers must prepare themselves to pay higher prices for refined copper.

Quotations: Lake copper, 11½@11¼c., cash. Baltimore b. c. w., 10½@10¼c. Baltimore a. c. c., 10½@10¼c. Orford brands, II., 10½@10¼c. Orford brands I., 10¼@10¼c. Arizona pig-copper, 9¼c. bid.

Transactions were larger than before and prices better, and this in the face of a decline in Chili Bars to £43 15s. in London.

234 PEARL STREET, NEW YORK, April 22.

**A New Bearing Metal.**—A new alloy known in Germany under the name of "glass composition," and placed in the market by Mr. Louis Dill, of Frankfurt on the Main, is reported to have found extensive application in that country. It is said to possess the qualities of the best composition used for bearing surfaces. It contains a certain percentage of a vitreous substance, which, expressed in figures, is very trifling, but is stated to be sufficient to impart to the alloy a durability and uniformity not hitherto reached. Even at a high rate of speed, the heating of journals is said to be avoided, and their unequal wear prevented. Moreover, the first cost of the composition is reported to be less than that of alloys of equal efficiency at present in use; and it is finally said to stand wear and tear remarkably well, even with a small amount of lubrication, and to be proof against atmospheric influence and the action of diluted acids.

ASPEN, THE BOOMING CAMP OF COLORADO.

Special Correspondence of the Engineering and Mining Journal.

The great interest manifested throughout Colorado in the comparatively new mining district at Aspen leads me to give the ENGINEERING AND MINING JOURNAL some facts of importance concerning the mines of that camp that have not yet been made public.

I have taken some pains to obtain definite information in regard to the production of the camp heretofore, the character of the ores, and the formation in which they occur. In presenting this information, I am able to furnish much data derived from the books of the Aspen Smelting Company and from those of the principal mines.

Aspen is not a new camp in the sense of having been recently discovered, the earliest work having been done here in the fall of 1879; but up to the latter part of 1883, very little development-work was done beyond the sinking of discovery-shafts. One or two mines, however, had produced some ore of good grade, but the camp never had the reputation of being a regular producer. In 1883, a small smelting plant was erected, but no attempt was made to put it in operation. It was sold to the Aspen Smelting Company, a New York corporation, which immediately proceeded to open an ore market. This gave an impulse to development, and the camp from that time is said to have steadily improved. In 1884, production had increased sufficiently to warrant the starting up of the smelting-works, which was done in July, and they have been in operation continuously ever since that time, having produced, as the books show, about 900 tons of lead bullion, of a grade of from 500 to 1500 ounces of silver per ton, the total content being about 750,000 ounces of silver.

In the mean time, Mr. J. B. Wheeler, a large owner in the smelting company, invested extensively in mining property, and at present is interested in almost every large producer in the camp. He also secured valuable coal lands about thirty-five miles below Aspen, and erected coke-ovens, which are now supplying coke for the Aspen Smelting Company.

NATURE OF THE ORE-DEPOSITS.

The mines of the camp are found in the mountains on each side of the valley of the Roaring Fork, in which the town of Aspen is situated. The ores are found almost entirely in sedimentary rocks, which are not very far distant from the granite that forms the backbone of the Continental Divide. While ore has been found disseminated through a large mineral belt in the vicinity, the largest producing mines, and those that have given Aspen its wonderful reputation, are confined to a mineralized contact in limestone. The geological series, where not disturbed, is said to consist of granite, then quartzite, dolomite, blue limestone, and slate, with porphyry lying over the blue limestone. The dip of the limestone is about twenty-five degrees, and the strike northeast and southwest.

The largest ore bodies lie either in or in the vicinity of the contact between the dolomite and the blue lime. Near the outcrop of the contact, the ore does not seem to be distributed in either foot or hanging-wall; but as depth is reached, large ore-bodies seem to have formed in both walls. The gangue is either dolomite or limestone, as the case may be, and also in places is largely made up of heavy-spar, which is the greatest drawback in the smelting of these ores. Zinc and copper are both characteristic of the ores of the camp, the percentage of zinc varying up to fifteen per cent, and of copper up to five per cent. Lead is abundant and in sufficient quantity for smelting purposes. It occurs as sulphide and sulphate, rarely as carbonate, thus causing the formation of large quantities of matte in smelting, unless a preliminary roasting is made.

THE VALUE OF THE ORE.

The high grade of the ore-bodies and their great extent and thickness are the remarkable features of the camp. As shown by the books of the Smelting Company, the average of all ores, made up in beds for smelting, varies from 125 to 150 ounces of silver to the ton. Thousand-ounce ore is often delivered in lots of ten tons. The smelting-books show one bed that contained 30,000 ounces of silver in about 30 tons of ore. The principal producing mines of the camp are the Emma, Aspen, Spar, Spar Consolidated, J. C. Johnson, and Vallejo.

THE BULLION PRODUCTION.

The output of the camp, as shown by the purchases of the smelter, amounted to about two million ounces, of which one million ounces were produced in 1884, and 1885 has already shown a product of one million ounces. In the latter part of 1884, the Aspen, which was worked under a lease until the middle of February, 1885, struck ore. In the sixty days remaining before their lease expired, 4000 tons of ore were produced, containing at the lowest estimates, made by the smelter and miners and on the actual weights of the ore, which is not yet sold, half a million ounces of silver.

This remarkable product was made without having any stopes or ground opened previously to striking the ore, and is a sufficient explanation in itself of the reason why thousands of people are coming to Aspen from all over the State. The Emma mine has a no less remarkable record in many respects, although its production has never been forced. Owing to a recent difficulty between the owners, resulting in an application for a receivership, a balance-sheet was produced in court, and sworn to by W. B. Devereux, the manager of the mine, which showed that, during the five months in which he had had charge of the mine, the net profit to the owners was in round numbers \$335,000.

The last five days' shipments from the Emma mine to the smelter, for which the ore was said to have been mined without any special selection, showed an average, by the settlement assays, of from 260 to 360 ounces, and netted to the mine \$59,000. I was told by a gentleman prominently connected with the mining interests, that the Emma mine raised a stope of 60 feet through ore averaging over 200 ounces as broken down, and from 8 to 12 feet in thickness. Be this as it may, I find, on looking over the smelting purchase-book, that the ore of the Emma mine almost invariably assayed over 200 ounces, and generally not less than twenty per cent in lead. With ore of this character, it is easy to account for the enormous profits that are said to have been made.

Next week, I will give you a continuation of this description of this booming camp and its mines. SPAR.

## MODERN AMERICAN METHODS OF COPPER SMELTING.\*

By Edward D. Peters, Jr., M.E., M.D.

## CHAPTER III.—(CONCLUDED.)

The following apparatus and method of procedure will be found convenient, although every assayer has his own private variations:

## MATERIALS AND APPARATUS FOR THE ASSAY ITSELF.

Nitric acid, C. P.	Glass funnel and filters.
Muriatic acid, C. P.	Sand-bath.
Distilled water.	A weighing-in-balance.
Strong alcohol.	An analytical balance.
Small beaker, 6-ounce.	

## MATERIALS AND APPARATUS FOR THE BATTERY ASSAY.

Copper vitriol of best quality.	Platinum capsule to hold solution, about 2½ inches in diameter.
Two one-gallon gravity cells, with zinc and copper elements complete; also connecting couplers, insulated wire, etc.	Heavy platinum wire, bent into a spiral.
Wooden stand, with brass ring for supporting capsule.	

When weighing out the substance to be assayed, sufficient of the same should be taken to yield about 150 milligrams of pure copper. Thus, in treating a 60 per cent matte, the chemist would weigh out 0.25 gram; while in the case of a 5 per cent ore, three grams would be the proper quantity. The finely pulverized material is dissolved in the customary manner, using the smallest possible quantity of acids, which in most instances may be nitric acid alone. In cases where it is found necessary to use muriatic acid, the solution should be evaporated until the volatile acids are completely driven off, and the copper present brought into the condition of a sulphate, by the addition of a very few drops of sulphuric acid. In this case, the presence of chlorides renders this determination inaccurate, while either nitric or sulphuric acid will give satisfactory results; for it has been thoroughly demonstrated that the old prejudice against precipitating from a nitrate solution was unfounded. After slight dilution with distilled water, the liquid is filtered into the platinum capsule, and the washing of the residue continued until this little vessel is nearly filled. This has usually a capacity of about 60 c. c., and is constructed of the thinnest platinum foil that has sufficient strength to permit handling when filled with liquid. The capsule containing the solution is now transferred to a brass ring of proper form, made to slide up and down upon a standard like a filter stand, and capable of easy connection with one of the wires from the battery. The battery may be placed in a distant closet or wherever convenient, the wires being conducted along the walls to where the precipitation is to take place, and fastened in position with little hooks or staples. The capsule being placed in its supporting ring, a stout platinum wire, coiled into a horizontal spiral, and supported by a movable clamp fixed to the same standard on which the ring slides, is lowered until the entire flat coil dips below the surface of the solution. It is clamped fast in this position, and its free extremity is connected by means of a little brass muff to the second battery wire, thus immediately establishing the current. The spiral should be connected with the copper or positive element of the battery, while the capsule, on which the precipitation is to take place, connects with the zinc or negative element.

The more or less lively generation of gas, which rises in minute bubbles to the surface of the liquid, as well as the rapidity with which the film of copper is deposited upon the interior of the platinum vessel, are indications by which the strength of the current, and consequent energy of the process, may be judged. About eight hours is the customary time for an assay, it being found convenient to connect the wires with the already prepared assay in the evening. A drop of the solution is tested the following morning with hydrogen sulphide water, and it can be instantly seen whether the process is completed or whether some additional time must be allowed. If this test shows the solution to be free from copper, it may be best removed from the capsule by siphoning off with a tube held in one hand while distilled water is added with the other, until the washing is deemed sufficient. After a second rinsing with strong alcohol, the capsule is dried by setting fire to the spirit that still adheres to the surface after pouring off all that will flow, and the capsule, with its adhering plating of brilliant rose-red copper, is weighed on an analytical balance. The capsule having been weighed at the beginning of the process, a simple subtraction gives the amount of the deposited metal. The result is not affected by allowing the current to pass through the solution for hours after all copper is thrown down, unless large quantities of silver, arsenic, tellurium, or certain other still more uncommon substances are present. In such cases, the copper should be precipitated by the Swedish method, and redissolved in a few drops of nitric acid: this will give a solution with which perfectly accurate results can be obtained by means of the battery assay. A brownish discoloration, or a decided diminution in the beautiful rosy red of the electrolytic precipitate, is not uncommon, and usually leads to discarding the test; but in a number of experimental cases, it was found that such discolorations had no effect on the accuracy of the result. The battery for this assay is exceedingly cheap, and, being the common Callaud or gravity cell that is used by the telegraph lines, instructions as to its management can be obtained from the nearest operator. The principal precaution necessary is perfect cleanliness and great purity of the blue vitriol used. The number of cells required for any given number of assays is always equal to the number of assays, plus one. Thus, while a single assay requires two cells, a dozen need only thirteen cells, which can be so coupled as to conduct the electric current through the entire line of solutions, each positive being always connected with its corresponding negative element.

## COST OF APPARATUS.

Two one-gallon gravity cells complete, with 5 pounds CuSO <sub>4</sub> and wire connections.....	\$7.00
Standard, with brass fittings and other connections.....	2.75
Platinum capsule, 30 grams, at 45 cents.....	13.50
Platinum spiral, 5 grams, at 35 cents.....	1.75
Total.....	\$25.00

The remaining apparatus necessary consists only of the ordinary glass-

\* Copy-right, 1885, by the Scientific Publishing Company.

ware, balances, etc., found in every laboratory, and the foregoing expense can be reduced some \$8 by substituting for the costly capsule a thin cylinder of platinum foil, which, being connected with the wire from the zinc element, is suspended in the solution, which is contained in a tall, slender beaker, the spiral in its turn hanging in the liquid in the center of the cylinder. The only valid objections to this assay are the expense of the apparatus and the slowness of the process. Its results, when executed by an experienced person, are accurate beyond even those of analytical methods, and arrived at with infinitely greater ease and celerity. The following figures were handed the author by a friend who was desirous of testing the accuracy of this assay, and who made seven determinations of the same sample of ore, weighing out different quantities in each case, in order to obtain varying figures in the calculation of the percentage:

No. 1.....	9.66 per cent.	No. 5.....	9.98 per cent.
2.....	9.67 " "	6.....	9.85 " "
3.....	9.74 " "	7.....	9.82 " "
4.....	9.61 " "		

It is evident that these results owe their remarkable uniformity to extreme care in manipulation and the employment of the most perfect apparatus. To prevent the possibility of any precipitation of silver in assaying argentiferous substances, a few drops of muriatic acid may be added, and as the residue left upon the filter will then contain all of this metal that was present, it may be at once tested quantitatively for the same, either by the scorification or crucible method, its freedom from copper rendering this process both simple and accurate.

A thorough practical familiarity with the four methods of assaying just described is necessary to every metallurgical chemist who hopes to do his work with satisfactory accuracy.

One of the main features of this work is an endeavor to furnish exact estimates of the cost of each and every metallurgical operation. The cost of sampling and assaying will vary with the salaries paid to assayers, the arrangements for sampling, etc. But in order to furnish some kind of a standard, the cost of sampling (exclusive of crushing, which is a necessary step in the metallurgical treatment) and assaying has been carefully footed up for a year on the books of an establishment partly dependent upon custom ore, and employing a single assayer at a moderate salary. The cost per ton of ore—which averaged 35 tons per day—was 37 cents for sampling and 18½ cents for assaying.

All refuse from the laboratory that can possibly contain copper, as well as specimens brought for inspection—unless deemed worthy of preservation—scrap copper and brass, old brass screens, and, in fact, every thing containing this metal, should be collected and added to the furnace charge from time to time, taking the precaution to let it go into one of the earlier operations, that the arsenic, antimony, and other deleterious elements certain to be found in such miscellaneous material may be thoroughly eliminated. The waste copper solutions produced in the laboratory should not be thrown away, but emptied into a cask containing a few hundredweight of scrap-iron, the exhausted, supernatant liquor being siphoned off when necessary, and the cement copper periodically collected and taken to the furnaces. Samples of ore, matte, etc., of interest only to the establishment itself, should be preserved in strong brown paper parcels, plainly labeled and systematically stored away. Occasion seldom exists for keeping them longer than three or six months, as any possible suspicion or accusation of error on the assayer's part would have been either investigated or completely forgotten within that period.

The sampling of blister copper and similar products will be discussed in the chapter devoted to Refining.

## THE LAKE SUPERIOR FIRE-ASSAY FOR ORES FREE FROM SULPHUR AND OTHER METALLOIDS.\*

The ordinary English fire-assay has been so frequently described, and is so little suited to American conditions, that it is not necessary to reproduce it here. In spite of the difficulty of its execution and the decided and constant inaccuracy in its results, it is so interwoven with the commercial customs of the Swansea copper smelters, and its replacement by one of the more accurate wet methods would involve such a revolution in the price-lists and methods of ore-buying, that it is likely to maintain its sway in the great ore market of the world for an indefinite time.

The Lake Superior fire-assay, on the contrary, is not only quick and inexpensive, but compares favorably in accuracy with the best wet methods. It is so peculiarly adapted to the conditions that have given it birth that no American work on the metallurgy of copper would be complete without a detailed account of it, especially as our domestic literature up to this time has made no mention of it. In the Swansea assay, the substance under treatment consists usually of a mixture of sulphides and gangue-rock, which necessitate a series of calcinations and fusions, culminating in a button of impure copper, which has still to be refined at a considerable loss. The Lake Superior assayer has the simpler problem of dealing only with native or oxidized compounds of copper, that can be reduced to the metallic state at so low a temperature as to preclude the adulteration of the copper button with any other metallic substances, and thus obviate the necessity of any refining process. In spite of the apparent simplicity of this method, it demands a good deal of skill and experience to obtain accurate results; but these once acquired, no assay can excel it in accuracy and celerity.

A glance at the composition of the substances operated on will render clear the objects to be accomplished. The material assayed consists of the concentrates from the jigs, tables, buddles, and other concentrating machines. This material is technically termed "mineral," and varies greatly in richness, composition, and size of particles, ranging in copper from 10 to 97 per cent, and in some instances containing a gangue of nearly pure ferric oxide, while in others it is highly siliceous. Nearly all grades of mineral contain a considerable proportion, from 3 to 10 per cent, of metallic iron from the stamp-heads, while a sample containing 50 per cent of titanite iron-sand is no unusual occurrence. It can readily be seen that no small skill is required so to flux these various mixtures as to obtain a clean and fusible slag, and a button of copper free from iron or

\* The author takes pleasure in acknowledging his indebtedness to Mr. Maurice B. Patch, of Houghton, Michigan, for valuable assistance in the preparation of this section on the Lake Superior assay. The position held by Mr. Patch as chemist to the Detroit & Lake Superior Copper Company is a sufficient guarantee of the accuracy of the following description.

other metals that may be reduced with comparative ease, and thus yield a far too high result.

**Sampling.**—The mineral is received from the mines packed in strong barrels, weighing, in the damp condition in which it arrives, from 500 to 2000 pounds, its weight depending on its degree of concentration, the character of its accompanying gangue, etc. As this material is to be refined at once, the barrels are emptied on the iron plates that form the floor in the neighborhood of the charging-door of the refining-furnace. After the contents of each barrel have been thoroughly and separately mixed, a small sample is taken from every package and put into a tightly covered copper can. Only the samples from casks of the same grade of mineral are placed in any one can, as each quality is assayed by itself, although six or more different grades of mineral may go to make up the sixteen barrels that usually form a furnace charge. If two or more furnaces are simultaneously in operation, the samples of the same grade are mixed together, to avoid the unnecessary multiplication of assays. The cans containing the samples are brought to a safe place and deposited in a box, divided into separate compartments, and containing a little water in the bottom, into which the tight copper cans are set, to prevent any loss of moisture in the sample, which might occur despite the close cover.

**Fluxes.**—Sodium bicarbonate, borax, potassium bitartrate (cream of tartar), ferric oxides, sand, and slag from the same operation are used to flux the gangue and other worthless constituents and effect the proper reduction of the copper. The chief impurity to be dreaded is sulphur, for which reason the best quality of sodium bicarbonate must be purchased and potassium bitartrate must be used instead of argols. The borax and soda are prepared by being melted in iron ladles, to drive off their water of crystallization, and then pulverized through a twenty-mesh screen. Clean, well-fused slag from former operations is reduced to the same degree of fineness, while the oxide of iron flux is prepared by pulverizing selected fragments of specular iron through a 50-mesh sieve. Any clean quartz sand answers for the silica needed.

**Furnace.**—A common natural draught melting-furnace is used, an inside measurement of 9½ by 18 inches being large enough to accommodate six Hessian crucibles. These are set in rows of three on two thin fire-bricks, the latter resting on the longitudinal grate-bars, and serving to raise the crucibles to the zone of greatest heat. Soft coal, broken to egg size, forms the customary fuel, and is carefully filled in around the charged crucibles, which are not placed in the furnace until the latter is in full heat. The crucibles employed are 4 inches high and 3 inches in diameter, and are provided with well-fitting covers made at the works from a mixture of fire-clay and sand; these are the more necessary because the assay often fills the crucible to within half an inch of the top.

The skill of the assayer is nowhere more evident than in the fluxing of the different grades of mineral, the composition of which was briefly noticed in the opening paragraph of this chapter. It is, of course, familiar to all chemists that sodium bicarbonate and ferric oxide act as powerful bases, while the electro-negative elements are represented by borax and sand, the potassium bitartrate exercises a strong reducing action, as well as furnishing an active base. The slag equalizes the entire mixture, being capable of neutralizing a considerable amount of either base or acid, and it covers the molten metal and protects it from oxidation. It is not to his skill in fluxing alone that the assayer trusts; of almost equal importance is the degree of temperature maintained, and the length of time that the assays are left in the furnace.

Good results can only be obtained by shortening the period of fusion to the utmost. This demands a very hot furnace at the outset, good fuel, and a lively draught. Under these conditions, an easily fusible assay will probably be entirely finished in twenty minutes, and from 25 to 30 minutes for difficult samples. It is quite safe to assert that, if the time necessary for a perfect fusion is increased to forty minutes, the resulting button will contain sufficient impurities, reduced from the slag, to give a result from 24 to 6 per cent too high.

This assay is applicable to silicates as well as oxides and native copper, and the results obtained from the assay of both refining and blast-furnace slags can not be excelled in accuracy by any other method.

A table of the different weights of fluxes used in assaying the various grades of mineral from the Peninsula Copper Company's works is annexed, as well as the mixture adopted for reverberatory slags and for very siliceous ore :

MINERAL.		Weight of mineral taken for assay, grains.	Borax, grains.	Soda, grains.	Slag, grains.	Potassium bitartrate, grains.	Sand, grains.	Iron ore, grains.
No.	Per cent copper.							
1	92	1000	60	55	200	300	.....	.....
2	86	1000	60	60	180	300	.....	.....
3	60	500	100	80	.....	300	.....	.....
4	33	500	150	160	.....	300	150	.....
5	20	500	180	200	.....	300	175	.....
*	35	500	140	140	.....	300	.....	100
†	5 to 20	500	200	200	.....	300	.....	.....

The percentage of slag-forming materials being so small in Nos. 1 and 2, it requires but a slight amount of borax and soda to flux them, while an addition of neutral slag is necessary to protect the molten copper. A smaller quantity of the ore is weighed out in the succeeding assays, as they are so poor in copper that a large amount of flux is required by the great quantity of gangue, so that the capacity of the ordinary crucibles would be greatly exceeded if 1000 grains were used. No. 3 mineral contains just sufficient ferric oxide to form a good slag with the mixture given; while in Nos. 4 and 5 this substance, as well as metallic iron, increases to such an extent as to require the addition of a considerable proportion of sand to flux this base and to prevent the adulteration of the button with metallic iron. The sample of Calumet & Hecla mineral

\* Calumet & Hecla tall-house mineral.

† Rich slag from refining.

given is typical of the treatment of very siliceous material. There is nothing remarkable in the considerable proportion of borax (an acid flux) used with even highly quartzose ores; for in addition to the fluxing powers of the soda that it contains, a boro-silicate is very much more fusible than a simple silicate. No peculiarities exist in the execution of this assay, the ore and fluxes are thoroughly mixed on glazed paper, and covered with a thin layer of potassium bitartrate after being poured into the crucible. In the No. 1 mineral, which is nearly as coarse as split peas, fragments of iron frequently exist, which come from the stamp-heads, and must be picked out of the sample after weighing out for assay; not that cast-iron will alloy with copper, but that the fragments will be found imbedded in the copper button after cooling. The grain weights are used instead of the metric system merely from habit, and because neither 100 nor 50 grams happen to be convenient quantities for assay, the former being too large and the latter too small, while 1000 and 500 grains are about the most suitable quantities, as determined by experience.

The results obtained by this method are surprisingly accurate. Duplicate determinations of the lower grade samples seldom vary more than one or two tenths. A difference of 0.4 per cent is a rare occurrence, even in the higher classes of mineral where the size of the metallic fragments renders the sampling, and even the weighing out, of a correct assay a matter of some uncertainty.

A few results from Mr. Patch's notes will confirm these statements. An average series of tests on cupola slags by the colorimetric method for the period of a month, duplicated by the fire-assay, gave a result 0.05 per cent lower for the latter test, the slag containing about one half of one per cent.

As an illustration of the results of this system when applied to very rich ore, a comparative test was made for eight days on No. 1 Calumet & Hecla mineral, with the following results :

Battery assay	80.100 per cent.
Fire assay	88.812 " "

A similar test on No. 2 Calumet & Hecla mineral :

Battery assay	77.590 per cent.
Fire assay	77.657 " "

A similar test with various samples :

No.	Battery assay.	Fire assay.
1.....		89.50
2.....		89.60
3.....	Mean = 89.544	89.70
4.....		89.70
5.....		77.40
6.....	Mean = 77.740	77.50
7.....		77.70
8.....		77.40

It is a somewhat curious fact that the slight loss of about 0.25 per cent of copper, which results from the passage of a minute portion of the metal into the slag, is just about counterbalanced by the impurities in the copper button from the reduction of ferric oxide, the amount of which is indicated by the following analyses of copper buttons—the only weighable impurity being iron :

Copper.	Copper.	Copper.
Per cent.	Per cent.	Per cent.
99.83	99.76	99.51
99.84	99.80	99.87
99.52	99.46	99.79

This account of a little known process will doubtless remove the impression so widely held by chemists that the Lake Superior copper assay is a clumsy and imperfect operation, and unworthy any advanced system of metallurgy.

**Electrical Working of Tramways at Brussels.**—Advices from Brussels state that the Compagnie Belge et Hollandaise d'Electricité has at length overcome all obstacles connected with the electrical working of the Rue de la Loi Tramway, Brussels. The Faure accumulators, 48 in number and with 820 kilograms, or rather over 16 cwt., of lead and oxide, giving out a useful effect of 66 per cent, are charged by dynamos put down for the purpose. The line, about a mile long and with heavy gradients, has hitherto been worked by horses; but it is found that a saving of 30 per cent is effected by electrical working.

**Coal Mining in China.**—A new effort to establish a line of railroad in China has been partially successful. Li Hung Chang, the viceroy, has been anxious for a long time to bring the coal from the Kaiping mines in Peking, a distance of 105 miles; but the people would not allow the English engineers to complete the work, and insisted upon building a canal. The canal, however, could not be brought to the mouth of the mine, so that the engineers were allowed to make a railroad 7½ miles long. At first, the authorities insisted upon the use of mules instead of a locomotive; but their prejudices have at last yielded, and three locomotives are now employed. These coal mines are said to be worked very scientifically, the only difficulty being that the glass of the patent lamps designed to protect against explosion is continually broken by the Chinese in order to light their pipes. Slowly but surely China is yielding to Western ideas.

**New Apparatus for Gas Analysis.**—At a recent meeting of the Société Technique de l'Industrie du Gaz of France, M. Chevalet showed a novel apparatus, simple and more sensitive than that of Orsat, for measuring the proportion of carbonic acid in coal-gas. The arrangement consists of a test-tube upon a stand, containing a known quantity of caustic potash. The top of the tube communicates with a graduated tube, the end of which dips into a vessel of colored water. After having driven out the air and filled the test-tube with gas, the cock is closed and the gas allowed to stand for from fifteen to twenty minutes. If the gas contains carbonic acid, the colored water rises in the graduated tube in correspondence with the absorption of the carbonic acid by the caustic potash, and the number of divisions marked on the tube gives directly the percentage of the impurity in the gas. Another arrangement of precisely similar design facilitates in the same way the estimation of the amount of hydrocarbons absorbed by bromine. Together, the two sets of tubes are stated to constitute a very convenient means of testing samples of coal-gas.

## GREAT ANTIQUITY OF THE AMERICAN RACES.

In an article in the *Zeitschrift für Ethnologie*, on the great antiquity of the human races, Dr. Kollmann takes American material to test his theory that the craniological varieties of mankind existed in quaternary times as they are found to-day. For this purpose, accepting the geological evidence of their antiquity as conclusive, he brings together observations and measurements upon crania from California, Illinois, Patagonia, Central Brazil, and Buenos Ayres. The first will be recognized immediately as the celebrated Calaveras skull. To the original measurements of Dr. Wyman, the author adds his own measurements taken upon Whitney's plate (*Auriferous Gravels of California*), using for a term of comparison the heads of six Indians who visited Basle in 1882. He finds the Calaveras skull does not resemble European but Indian crania in specific race characters, which have persisted since the glacial epoch. The less familiar cranium from Illinois, known as the McConnell skull, was found enveloped in drift material in a cleft in a rock-bluff. It is now owned by Dr. Schmidt, of Berlin, whose measurements are incorporated in the text with his conclusion, from a comparison of this skull with those in the collections at Washington and Philadelphia, that it is not unlike more recent long skulls from Illinois.

The rest of the study is based on material from South America. On the banks of the Rio Negro, Patagonia, in a stratum similar to that of the quaternary loess of the pampas, Moreno found two skulls that seem identical with existing forms. At the last Congrès des Americanistes, 1883, Lütken invited the attention of craniologists to the as yet unmeasured material representing the remains of thirty individuals, which Lund obtained in the cave of Sumidouro, near Lagoa Santa, Brazil. In a recent visit to Copenhagen, Dr. Kollmann measured four of the best preserved male crania, which, like one given by Lund to a Brazilian collection, and measured by Lacerda and Peixoto, are long, with broad faces. According to the latter authorities, they resemble the heads of Botocudos. The last of the group is one taken by Roth from the upper pampas formation of Northern Buenos Ayres. To Virchow, who took its measurement upon photographs, it recalled involuntarily the brachycephalic, prognathic skulls of Sambaquis. Nehring also stated to the Anthropological Society of Berlin that he has in his possession a Sambaqui skull from Santos that presents a real resemblance to this.

Assuming, as he does, says *Science*, that these crania are all pre-glacial, and finding among them both long and short skulls, Dr. Kollmann arrives inevitably at the conclusion that already in pre-glacial times the men of America had cranial and facial forms widely differentiated into varieties that have persisted until the present time, in spite of lapse of time and change of environment. The persistence of type leads him further to question the probability of an alteration of race characters from change of environment, or the possibility of the development of another, more perfect race.

## REPORT OF THE DIRECTOR OF THE MINT.

We have been favored with the following introduction to his report from Dr. Horatio C. Burchard, Director of the Mint:

The total deposits of gold and silver and purchases of silver bullion during the year at the institutions under my charge, exclusive of re-deposits, amounted to \$50,518,179 gold; silver, \$36,670,731. Of the gold, \$265,171 was of United States coin; \$6,328,922 foreign coin; \$11,217,309 foreign bullion; \$1,899,577 jewelry, plate, etc.; and \$30,807,200 was of domestic production.

The custom-house returns report the export of \$115,963 of domestic gold bullion, exclusive of \$22,950,289 United States Mint or Assay-Office gold bars.

It might be proper to add this sum, \$115,963, to the deposits of domestic bullion, and the value of the gold, some \$600,000, contained in the silver bullion exported, and also the amount of undeposited gold used in the arts and ornamentation, which, in the form of nuggets, native grains, etc., as stated in my last report, appears from responses to my inquiries to have been for that year over \$700,000, and in the form of bars from private refineries at least \$200,000; for the excess of the production of one refinery on the Pacific coast over its deposit at the mint, and the export of its gold bars during that year was \$130,000. These amounts, added to the gold deposits, would increase the production of domestic gold not less than \$1,500,000. Of foreign gold bullion received at San Francisco from British Columbia and the northern States of Mexico, amounting to about \$1,109,000, only \$400,000 was deposited at the San Francisco Mint as foreign bullion, and the remainder was, as shown by the statements of private refineries, refined before its deposit at the mint, and was included in the returns from that institution of refined gold of domestic production. Deducting this, would still leave over \$700,000 to add to the deposits of domestic bullion. To estimate, therefore, the gold production of the mines of the United States in 1884 at the amount reported as deposited from them at the mints and assay-offices is not in excess, and is probably an underestimate of the actual production.

Of the \$36,670,731 total deposits, exclusive of re-deposits, of silver bullion at the mints and assay-offices during the year, \$32,305,036 was silver of domestic production, \$415,263 United States coin, \$2,296,317 foreign bullion, \$1,246,773 foreign coin, and 407,339 jewelry, plate, etc.

The total exports of silver bullion during the calendar year 1884, at all the ports of the United States, including \$87,370 of foreign bullion, were \$17,914,697. Of this, \$2,148,578 were reported to consist of United States mint or assay-office bars, and about \$700,000 was Hawaiian coin manufactured from domestic silver deposited at the San Francisco Mint during the calendar year 1884, making the total export of silver bullion other than such bars and coin about \$15,000,000.

The imports of silver bullion were reported at \$3,256,938 and the deposits of foreign bullion at the mints and assay-offices \$2,296,218. This leaves \$960,720, which was probably exported and not distinguished from domestic bullion in the custom returns of exports. Deducting this sum from the latter, the remainder, about \$14,000,000, is the probable total net export of domestic bullion which had not been deposited at the mints and assay-offices. This estimation, must, however, be increased by the difference between the commercial price of the silver (the exporters'

valuation) and the coining rate in standard dollars (the unit of statistical estimation), averaging for the year nearly eighteen per cent. This would make the value of the undeposited exports of silver bullion about \$16,400,000.

It is probable that not less than \$100,000 worth of domestic silver bullion was furnished by private refineries to jewelers and others for use in the arts and manufactures. Adding to the \$32,305,036 domestic silver deposited at the mints \$16,400,000 as the undeposited silver exported, and \$100,000 consumed in the arts, would make the total silver production of the country during the year \$48,800,000, or, at its commercial value, about \$42,000,000.

This is some little less than Mr. Valentine's estimate of the silver production, \$43,525,925, which is understood to be based upon the commercial value of the silver at the place of shipment, or at least for the large silver-producing States and territories, such as Colorado, Utah, Arizona, Montana, and Nevada. The contribution of the mines of each State and territory, and of different localities, to the aggregate amount, is less readily ascertained, especially where numerous mines are worked, and refiners and smelters who receive their product keep no classified records.

It will be seen that my estimates of the annual gold production since 1873 (a period of eleven years) are comparatively but little in excess of the yearly deposits of domestic gold at the mints and assay-offices; and adding to the latter the annual exports and consumption of undeposited domestic gold, the estimates are sustained in nearly every case.

## DIVIDENDS.

Notwithstanding the reduced value of silver, as well as lead and copper obtained from argentiferous ores, 53 incorporated companies working gold and silver mines are reported to have paid in 227 dividends, about \$7,567,698, and exceeding the amount returned by them to stockholders in 1883.

The published lists of profitable mines exhibit, as usual, numerous changes, old corporations disappearing from the lists and new and recently developed mines taking their places. Of the famous and lucrative mines of the Comstock lode and Tombstone District, but one in each (the Kentuck in the former, and the Contention in the latter) have paid dividends.

The amounts disbursed to stockholders during the year as profits from the working of gold and silver mines located in the territories, have been as follows:

States and Territories.	Mines.	Dividends.	Amount.
Arizona.....	3	4	\$117,500
California.....	12	66	1,700,651
Colorado.....	14	34	1,419,000
Dakota.....	3	34	578,250
Montana.....	8	38	922,000
Nevada.....	5	18	201,500
New Mexico.....	2	3	190,000
Utah.....	5	24	2,257,500
Vermont.....	1	3	31,000
Total.....	53	224	\$7,417,401

## ASSESSMENTS.

During the year 1884, some 207 assessments have been levied on 117 mines in California, Nevada, Utah, Alaska, and Arizona. Of the assessments levied, it is estimated that over four million dollars have been paid. These assessments were distributed among the various States and territories as follows:

Arizona.....	\$137,000
Alaska.....	3,400
California.....	768,350
Nevada.....	3,632,950
Utah.....	68,000
Total.....	\$4,609,700

## CONSUMPTION OF THE PRECIOUS METALS AND DISPOSITION OF THE ANNUAL PRODUCT.

The appropriation of gold and silver during the calendar year 1884 to industrial uses can probably be safely estimated at the amount stated in my last annual report, based upon reports received from nearly if not quite all of the principal manufactures, namely, \$14,500,000 of gold and \$5,500,000 worth of silver, a total of \$20,000,000. All of this, however, was not withdrawn from the existing stock of bullion and coin available for monetary uses; for these reports and the statements received from the Mint at Philadelphia and the Assay-Office at New York show the use of \$1,882,600 gold and \$414,600 silver of old jewelry, plate, etc., which, deducted from the total consumption, would leave the amount of coin and new bullion consumed in the arts and manufactures about \$12,500,000 gold and \$5,000,000 silver.

I estimated that \$6,000,000 of gold and \$4,500,000 of silver of the domestic production of the year were used in the arts. These sums will probably represent the consumption of domestic bullion for the calendar year, although, on account of the depressed condition of many industries and lower rates of interest to invested capital, the amount demanded for ornamentation would be lessened. If the value of the gold and silver bars consumed for these purposes was greater than here estimated, such bullion must have been obtained elsewhere than from the mints and assay-offices, and the estimate of the production must be to some extent increased. The amount and disposition of gold and silver on hand and received at the mints and assay-offices during the year were as follows:

	Gold.	Silver.
Amount on hand January 1st, 1884.....	\$65,667,190	\$6,707,241
Deposits of domestic production.....	30,807,200	32,305,037
Other bullion and coin.....	19,710,980	4,365,695
Total.....	\$116,285,370	\$43,377,973
Disposition:		
Used in coinage.....	\$23,991,756	\$28,512,721
Delivered to manufacturers for use in the arts.....	6,135,695	6,076,862
Delivered for export.....	22,950,000	2,150,000
Balance in Mints January 1st, 1885.....	63,207,919	6,638,390
Total.....	\$116,285,370	\$43,377,973

The product of the year and disposition may approximately be stated as follows:

	Gold.	Silver.
Production.....	\$30,800,000	\$48,800,000
<i>Disposition:</i>		
Deposited, less foreign.....	\$30,000,000	\$32,300,000
Undeposited exports.....	116,000	16,400,000
Undeposited used in the arts.....	684,000	100,000
<b>Total.....</b>	<b>\$30,800,000</b>	<b>\$48,800,000</b>

The value of the United States Mint and Assay-Office bars and domestic bullion exported during the year appear, computed at their coining rate, to have been as follows:

	Gold.	Silver.
United States Mint or Assay-Office bars.....	\$22,950,289	\$2,148,578
Hawaiian coin.....	115,983	1,006,250
Undeposited domestic bullion.....	115,983	16,400,000
<b>Total.....</b>	<b>\$23,066,252</b>	<b>\$19,554,828</b>

The tables of specie imports and exports show that, notwithstanding the large net export of gold during the year, a portion of the gold production has been retained and placed in circulation. The export demand reduced the stock of gold bullion in the New York Assay-Office nearly \$23,000,000, yet lessened but slightly the amount of gold coin in the country. The subordinate effect of increased circulation upon prices and the more potent influence of expanding or contracting credits were again during the year, as often before, manifested in the fall of prices, notwithstanding an increase of paper and metallic circulation.

THE PRODUCTION OF AMMONIA FROM THE NITROGEN OF MINERALS.\*

By George Beilby.

The available sources of combined nitrogen at the present day are all, either directly or indirectly, organic. Cyanogen compounds and their derivatives, ammonia salts and alkaloids, nitrates and the oxides of nitrogen, are invariably produced from nitrogen that has previously existed in the combined form in organic tissues. The vast stores of such nitrogen contained in beds of coal and peat must, as far as we can see at present, remain in the future the main source from which the supplies for industrial use will be obtained. Owing to the abundant supply of natural nitrate of soda in Chili and elsewhere, it has hitherto been quite unnecessary to devise any artificial process for the production of nitric acid or nitrates. The guano deposits of South America were for many years the chief source of the ammonia salts used in agriculture, and caused the ammonia produced in gas-making to be looked on as a by-product, only to be worked up under favorable circumstances; the industrial production of ammonia for its own sake was therefore not seriously attempted. These facts must, to a large extent, be held to account for the lack of a vigorous and rational treatment of the subject of ammonia production from the vast stores of combined nitrogen existing in the old organic deposits of the peat and coal-fields. Turning, however, to the technology of cyanogen compounds, we find a much fuller record of technical research. The industrial world needed cyanides, and as no convenient natural stores of them had been provided—as was the case with nitrates and ammonia salts—cyanides had to be produced artificially. In the researches on the manufacture of cyanides, we might fairly expect to find the germ of a rational knowledge of such of the properties of organic nitrogen as are related to its conversion into ammonia. This expectation is not disappointed; the records of the researches of English, German, and French chemists in this field are not only deeply interesting, but they are both instructive and suggestive. The earliest studies on the behavior of the nitrogen of organic substances during destructive distillation were made in this connection, and it was then first recognized that the temperature of distillation had a most important influence on the ultimate distribution of the nitrogen among the products of distillation and the residual charcoal. Karmrod found, in carbonizing horn, that at three temperatures, ranging from a low red to a white heat, the residues contained respectively 7, 5, and 2 per cent of nitrogen, the last resulting from the highest temperature. The significance of such a fact as this, as bearing on ammonia production, evidently did not appear to the investigators, who were simply bent on devising an economical process for the manufacture of cyanides, and to whom the inevitable production of ammonia was an evil to be as far as possible minimized.

The rapid exhaustion of the guano deposits, and the increasing consumption of ammonia salts for agricultural purposes, so acted on the ammonia market that, in the year 1879, the price of sulphate of ammonia had risen to £20 a ton. This high price occurring along with a general fall in the value of several of the commodities produced at the same time, or by the same processes as ammonia, formed a powerful stimulus to producers of ammonia to increase their output, and at the same time roused the interest of those who, like the owners of blast-furnaces and coke-ovens, had hitherto allowed large quantities of ammonia to go to waste. The gas companies had for years been perfecting plant for washing out the ammonia from their gas, and the increased output thereby brought about must have been very considerable. Iron and coke makers turned their attention with renewed interest to the treatment of the gases from their furnaces and ovens for the recovery of ammonia. These efforts were directed to the recovery from the products of destructive distillation of the ammonia naturally resulting from that operation. It is now pretty generally understood that, in destructive distillation as ordinarily practiced in the gas manufacture, only from one sixth to one twentieth of the nitrogen of the material distilled is obtained as ammonia. This important fact was noted in more than one standard work on applied chemistry, but attracted no attention either in scientific or technical circles. Dr. Lunge, in his work on *Coal Tar Distillation*, published so recently as 1882, quotes a table of analyses by Dr. Meymott Tidy, showing the amount of nitrogen in various coals, and comparing the possible with the actual ammonia yields of the gas companies. The result of his comparison is to show that, in illuminating gas making, only one sixth of the total nitrogen was obtained as ammonia.

My own interest in the subject dates from 1870, when Mr. A. R.

\* A paper read before the London Society of Arts on February 12th, 1885.

Gillespie, managing director of the Oakbank Oil Company, suggested that I should analyze all the shales then known to exist in the Midcaldor field, both those which were considered worth working for the paraffine products, and those which were not. It was thought possible that some of the poorer oil shales might yet be sufficiently valuable for their ammonia to admit of their being profitably worked. The determination of the nitrogen in these shales showed that, by the process of distillation as then practiced, only one sixth of the nitrogen was obtained as ammonia. The fate of the missing five sixths at once excited our interest, and the research was carried on till the whole was accounted for. As oil shales are practically unknown in England, a few words of description at this point may make clearer what is to follow. The oil shales of Scotland are found below the coal measures, and are generally associated with marls, limestones, and sandstones. They are generally of a brown or gray color, the richer portions are tough, and cut like leather, while the poorer are stony and slate-like. They contain a very large percentage of mineral matter, sometimes as much as 80 per cent, generally about 73 per cent. When heated to redness in a close vessel, true shales do not soften or cake, the pieces alter neither in size nor shape, but after all the volatile matter is distilled off, the residue or spent shale, which is soft and black, has still the outward form of the original shale. There are four principal seams, or groups of seams, worked in Scotland; among these, one of the best defined and most extensively worked is the Broxburn shale, so called from having been first found at Broxburn, in Linlithgowshire. It is not, however, confined to that particular district, but is at present worked at points as much as from twelve to fifteen miles apart. This shale was in regular use at Oakbank in 1870, and special attention was therefore given to the study of the behavior of its nitrogen. By the process of distillation, as practiced at that date, the shale was subjected for from twelve to twenty hours to a low red-heat in iron retorts, a current of steam being passed through the retort during the distillation. The volatile hydrocarbons and other vapors were cooled by passing through condensers. The distillate from one ton of shale consisted of about 30 gallons of crude paraffine oil, and from 60 to 80 gallons of ammoniacal liquor, the large volume of the latter being due to the condensation of the steam passed through the retort. This ammoniacal liquor contained ammonia equal to about 15 pounds of sulphate. The primary object of the use of a current of steam in the retort was to obtain a maximum yield of paraffine products, through the protective action of the steam in sweeping away the hydrocarbon vapors as they were formed, and before they could be decomposed by overheating; but it is quite certain that this use of steam increased the yield of ammonia, the gain probably amounting to 5 or 6 per cent of the original nitrogen. The coke or residue of this shale (specimens exhibited), known as spent shale, was, in 1870, sent to the refuse-heap as of no value; but, in the three following years, the successive efforts of Mr. William Young and Mr. N. M. Henderson resulted in the invention of the Henderson retort, in which, by means of ingenious mechanical contrivances, the exhausted residue, or spent shale, was dropped while still hot into a slow combustion furnace, in which the small percentage of carbon, associated with a very large amount of earthy matter, was made to supply a large proportion of the heat necessary for the distillation of the shale. The ash, or earthy residue, was now obtained practically free from fixed carbon, and was sent to the refuse-heap.

Returning now to the researches of 1870, analysis of the Broxburn shale showed that it contained 0.72 per cent of nitrogen, and that, by the system of distillation then followed, the distribution of this nitrogen among the residue and products was such that of 100 parts of nitrogen in the shale—

17.0 parts appeared as ammonia in the watery distillate.
20.4 " " as alkaloidal tars in the oil.
62.6 " " in the spent shale.

Or, expressing these proportions in actual numbers, and calculating the nitrogen into its equivalent of sulphate of ammonia, the following results are obtained:

One ton of shale contains nitrogen equal to 78.4 pounds of sulphate of ammonia.	
The watery distillate contains ammonia equal to.....	12.7 lbs.
The alkaloidal tars in the oil contain nitrogen equal to.....	15.3 " "
The "spent shale" or coke contains nitrogen equal to.....	46.8 " "
	74.8 " "

The knowledge thus gained was the base from which all our subsequent researches were planned, and many efforts were made to win at least a portion of this hitherto unworked store of nitrogen. The problem which, in the light of present knowledge, seems so simple, was necessarily looked at from the oil-maker's point of view. From that stand-point, the value of the paraffine products being five times that of the ammonia, efforts were most naturally directed to the simultaneous improvement of ammonia and paraffine produced. Now, the first investigation has shown that one fifth of the total nitrogen of the shale went to the formation of complex basic substances of the oily distillate, from which they were ultimately separated by chemical treatment, and were then thrown aside as of little value, or were used as fuel. There was thus the double loss—of the nitrogen, which might have been ammonia, and of the carbon and hydrogen, which might have been paraffine or oils. It was natural, therefore, that the nitrogen in the oil should first attract attention, and that attempts should be made to gain an increased yield of hydrocarbons and ammonia simultaneously. The simpler and more stable bases, piccoline, pyridene, etc., were found quite refractory, except under such heroic treatment as inevitably sacrificed the hydrocarbons. By a modification of Berry's cyanide process, it was possible to convert the basic nitrogen into cyanides, but, of course, with complete destruction of the associated hydrocarbons. The more complex nitrogenous substances, on distillation, tend to break up into ammonia, simpler bases, and hydrocarbons; but the proportion of ammonia obtained by a single distillation is very small.

The use of slacked lime in the shale distillation was very fully and practically tested, but it was found that, at the temperature most suitable for oil distillation, no gain of ammonia was brought about. On the other hand, the crude paraffine oil was distinctly purer and more easily refined. Though this result does not at first seem in accord with results recently obtained by the use of Cooper's coal liming process in gas-making, yet in reality the two results are not inconsistent. In the case of limed shale,

the usual current of steam was passed through the retort during distillation, and the water of hydration of the lime in no way altered the condition of things within the retort. But the case of limed coal in a gas-retort is altogether different, for there no current of steam is passing through the material. True, most of the oxygen of the coal comes off as water, but this probably occurs at a very early stage of distillation; so that the water of hydration of the lime, coming off at a comparatively high temperature, does introduce a new condition of things within the retort. The most effective method of applying lime to the shale was found to be by washing it over with a thick milk of lime, the coating of lime being allowed to dry before the shale was put into the retorts.

As the result of these attempts to gain an increased yield of ammonia, simultaneously with a maximum yield of paraffine products, showed pretty conclusively that the end could not be attained by any simple or single process, the necessary and favorable conditions for the attainment of the one object being almost antagonistic to the others, it then, for the first time, occurred to Mr. William Young and the author to treat the residue, or spent shale, to a supplementary operation of steaming after the oil distillation was finished. In all of the earlier trials, the two operations, the distillation and steaming, were conducted in the same retort, and the temperature employed in the latter operation was little, if at all, higher than that suitable for oil-making. It was found that, by continuing this steaming for several days, a considerable proportion of the nitrogen of the spent shale came off as ammonia. During the steaming, a small quantity of gas came with the steam, showing that some slight decomposition of steam was taking place within the retort; but the fixed carbon of the spent shale, after the operation, was only diminished to a slight extent. This experiment showed that it was possible to obtain a large quantity of the nitrogen of the spent shale, but the method of doing so was evidently quite inapplicable commercially. The cost of plant forbade the devotion of two or three days to the steaming of every retortful of shale. The ordinary operation of distillation only occupies from twelve to twenty hours, so that the addition of from forty-eight to seventy-two hours for each operation would have reduced the power of the plant to one third, and thereby have trebled the working costs. The ammonia gain would have been more than swallowed up in these increased costs. Ultimately, we resolved to try how far the operation could be accelerated by the use of a higher temperature for the supplementary operation, and with this object a retort was fitted up. (Figure in original paper.)

(TO BE CONTINUED.)

## BOOKS RECEIVED.

[In sending books for notice, will publishers, for their own sake and for that of book-buyers, give the retail price?]

*Tables for Field Engineers.* Designed for Use in the Field. Tables containing all the Functions of a One Degree Curve, from which a Corresponding One can be Found for any Required Degree. Also, Tables of Natural Sines and Tangents. By Amos Stiles, Civil Engineer. Philadelphia: Published for the Author, and for sale by James W. Queen & Co., 924 Chestnut street, Philadelphia. 1885. Oblong 8vo, pages 156. Leather, flap. Price, \$2.

The author hopes that for practical field-work—especially in the location and building of railroads—this book will bring the aid, comfort, and relief often sighed for by the engineer weighed down with cumbrous volumes. The endeavor has been, to set forth with clearness some of the abridged methods found so convenient and easy in connection with the building of some of the most extensive railroads in America. No pretense has been made at mathematical demonstration—that will be left for those of more leisure.—*Contents:* Explanation of tables; to connect two tangents by a curve passing a given distance from vertical point; to find tangent to a curve; to find chord; to find versed sine; to find external secant; to change curve nearer vertex; to change curve to parallel tangent; to change origin of curve and radius; to change direction of tangent; to locate a tangent from an inaccessible point on a curve; to connect two lines without producing tangents to an intersection; Table I., radii and their logarithms, tangential effects, and middle ordinates; ordinates five feet apart; chord 100 feet; Table II., chords, versed sines, external secants, and tangents of a 1° curve for every minute of angle from 0° to 90°; Table III., natural sines and tangents, to every degree and minute of the quadrant.

[Treasury Department.] *Report on the Internal Commerce of the United States.* By Joseph Nimmo, Jr., Chief of the Bureau of Statistics, Treasury Department. Submitted December 31st, 1884. Commerce and Navigation. Washington. 1885. 8vo, pages x+171 and 4 Maps.

DEPARTMENT OF THE INTERIOR. BULLETINS OF THE UNITED STATES GEOLOGICAL SURVEY. J. W. POWELL, DIRECTOR.

No. 2. *Gold and Silver Conversion Tables.* Giving the Coining Values of Troy Ounces of Fine Metal, and the Weights of Fine Metal Represented by Given Sums of United States Money. Computed by Albert Williams, Jr., Chief of Division of Mining Statistics and Technology. Washington. 1883. 8vo, pages 8. Price, 5 cents.

No. 3. *On the Fossil Faunas of the Upper Devonian,* along the Meridian of 76° 30' from Tompkins County, N. Y., to Bradford County, Pa. By Henry S. Williams. Washington. 1884. 8vo, pages 36 (including Index). Price, 5 cents.

No. 4. *On Mesozoic Fossils.* By Charles A. White, M.D. Washington. 1884. 8vo, pages 86 (including Index) and 9 full-page Plates. Price, 5 cents.

No. 5. *A Dictionary of Altitudes in the United States.* Compiled by Henry Gannett, Chief Geographer. Washington. 1884. 8vo, 325 pages. Price, 20 cents.

No. 6. *Elevations in the Dominion of Canada.* By J. W. Spencer. Washington. 1884. 8vo, pages 43 (with title and list of illustrations for Vol. I.). Price, 5 cents.

Not Received.

[No. 1. *On Hypersthene-Andesite and on Triclinic Pyroxene in Augitic Rocks.* By Whitman Cross. With a Geological Sketch of Buffalo Peaks, Colorado. By S. F. Emmons. Washington. 1883. 8vo, pages 42 and 2 Plates. Price, 10 cents.]

**Rate of Propagation of Detonation in Solid and Liquid Explosives.**—M. Berthelot, in the *Comptes Rendus*, gives the following table:

	Meters per second.	Meters per second.
Compressed, disintegrated gun-cotton.....	3903 to 4267	Nitromannite..... 6908 to 7137
Granulated gun-cotton.....	3767 to 4770	Nitroglycerine..... 1386 to 1672
Starch powder.....	5210 to 5512	Dynamite..... 2331 to 2753
		Fanclastite..... 4685 to 5470

## THE RELATIVE VALUE OF COALS TO THE CONSUMER.\*

By Dr. H. M. Chance, Philadelphia, Pa.

Should inferior coals, in open market at competing points, command a price equal to that of the superior coals with which they come into competition?

This query seems absurd and the answer seems obvious. It might readily be supposed that the better coals always command a higher price; but every dealer knows that such is not the case, and that even when current prices are shaded on second or third-grade coals, the difference in price is rarely commensurate with the difference in quality.

To the consumer, this must be a matter of real practical importance—of dollars and cents—and it seems somewhat strange that it has not received more attention from practical men of business. Iron-masters buy their ore by the unit of iron contained in the ore, and the value of copper, lead, tin, manganese, silver and lead ores is estimated in the same way; but it is evident that this method could not successfully be applied to coal except in a broad and general manner; for the value of a coal is not wholly dependent upon the percentage of combustible matter, but varies with the relative percentages of water, sulphur, and ash.

By the analytical method, the sulphur is treated simply as an impurity; but as we have no means of estimating the damage resulting from any specified sulphur percentage, it is not possible to express in figures what concession should be made in the price of any coal containing a certain sulphur percentage to cover the damage resulting from its use.

Again: the relative proportions of volatile matter and fixed carbon, the structure of the coal, and its behavior in the fire, are all variable factors of great importance to the consumer; for it does not follow that coals showing the same percentage of combustible matter are of equal calorific energy, or equally well adapted to meet some special trade requirement.

But, other things being equal, it is evident that coals containing large percentages of water, sulphur, or ash should not command a price equal to those low in impurities.

The reports of the Second Geological Survey of Pennsylvania contain a great mass of material that may be used to much advantage when properly tabulated to facilitate comparisons; but, recorded as it is, in "reports of progress," its utility is lessened by the metamorphosis through which the coal measure nomenclature has passed in advancing from that of the First Survey to that finally adopted in the latest reports.

In the tables annexed to this paper, I have attempted to show what might be accomplished if this work were carefully and thoroughly extended to cover the whole State. The analyses of the two principal coal-beds worked in Clearfield, Center, Clinton, Jefferson, Cameron, Elk, Clarion, Northern Armstrong and Cambria counties are arranged in tabular form, and the general averages deduced from them are in sufficient contrast to merit the attention of all concerned in both mining and consuming coal from these counties. The figures in the columns marked "Fuel" show the sum of fixed carbon and volatile hydrocarbons—in other words, the combustible matter. The averages deduced from these tables to show the general character of the two beds are as follows:

FREEPORT LOWER COAL.—BED D.

LOCALITY.	No. of mines sampled.	Fuel.	Sulphur.	Ash.
Average for Clearfield County..	15	94.91	0.59	3.55
Average for Jefferson County...	26	93.94	1.00	3.76
Average for Clarion County.....	7	93.41	1.19	4.10
General average composition..	....	94.20	0.90	3.75

KITANNING LOWER COAL.—BED B.

Average for Alleghany Mountain group.....	25	89.77	1.68	7.98
Average Clarion County group..		90.31	2.12	6.28
Average Elk County group.....		89.02	2.77	7.15
General average composition..	....	89.76	2.10	7.08

The percentage of water does not vary materially in the averages, that of bed D being 1.17 and of bed B 1.06.

These analyses plainly show a marked difference in the quality of coal mined from these two beds, and this difference is sufficiently great to be of considerable commercial importance.

Care has been taken to exclude from these tables all analyses of beds the identification of which does not seem absolutely certain. A very few mines in this area—perhaps a dozen in all—are not shipping coal from either of these two beds, being opened on the Freeport upper, Kittanning upper, Clarion, Brookville, or Conglomerate coal-beds, the latter principally in Elk and McKean counties. The output from these mines (to which these conclusions do not apply) is quite insignificant compared with that from the two beds here discussed.

An inspection of the tables will show that not one of the twenty-five analyses of the Kittanning lower coal (B) reaches the fuel average of the Freeport lower bed (D); that only two† show less sulphur than the sulphur average of D, and that none shows an ash percentage as small as the Freeport lower ash average. On the other hand, of the fifty analyses of Freeport lower (D) coal, only one‡ shows as small fuel percentage as the Kittanning lower (B) fuel average, none shows as much sulphur as the average of the latter, and only two§ show as much ash as the Kittanning lower ash average.

The twenty-five analyses of the (nineteen mines) Kittanning lower

\* A paper read before the American Institute of Mining Engineers.

† And one of these was sampled by the owners.

‡ And at this colliery, the condition of the bed is purely local.

§ And at both these collieries, the high ash percentage is limited to a very small area of the bed.





## FURNACE, MILL, AND FACTORY.

H. H. Scoville, manufacturer of mining machinery, at Chicago, has recently sold and shipped a concentrating plant for the Cash Entry mine, near Los Cerillos, Mexico. The mine is owned by Chicago and Madison (Wis.) capitalists. The ore is low grade; carrying about 12½ per cent of galena and 26 per cent of zinc, with from 4 to 6 ounces of silver to the ton. The owners have developed the property to some extent, and have shipped from time to time selected lots of the richest ore to different works, but no very satisfactory results in a commercial sense have been reached. The Scoville plant consists of four concentrators and one pulverizer, all of new design as to mechanism and method of operation, although no new principle is claimed. Mr. H. H. Scoville, who is joint inventor with W. A. Koneman, has tramped the Rockies, has "panned" no little dirt in former years, and has a personal knowledge of the difficulties and wants of a concentrator for the San Juan District. He is also a mechanic. This plant was completed and set up in the Scoville works last year, and has been tested and proved successful on a number of different lots of ore from localities widely distant. Before the Cash Entry parties had the plant shipped, a quantity of ore from their mine was worked under their personal observation. The plant is expected to be running by May 15th. After a full test, if it is as successful as it promises to be, we shall be pleased to receive and publish the figures.

A dispatch from Ottawa, Ont., dated April 22d, says that a consignment of hardware from New York State has been seized by the customs authorities of this port, who are in possession of information to the effect that the goods were manufactured by prison labor. The importation of such goods into Canada is prohibited.

The rolling-mill of the Falcon Iron and Nail Company at Niles, Ohio, was totally destroyed by fire April 18th. The nail factory was saved with difficulty. The loss on building, machinery, and stock will aggregate \$75,000, on which there is an insurance of \$44,200. Nearly 300 men will be thrown out of employment.

ANOTHER OF REESE'S DORMANT PATENTS.—Messrs. Oliver Brothers & Phillips, licensees of the Clapp-Griffith steel-making process, were notified by Jacob Reese, the patent solicitor, on the 17th, that they must not infringe on his letters patent for detachable and adjustable converters with a vertically adjustable track section arranged below.

It is proposed that the capital stock of the reorganized Albany & Rensselaer Iron and Steel Company be \$2,500,000. Of this, \$1,750,000 have been subscribed and \$250,000 more pledged, leaving unpledged only \$500,000, which will probably be taken in Troy. Erastus Corning puts in the present works, valued at \$800,000, the cost of the furnaces, estimated at \$600,000, and \$100,000 for a new roof on the steel-works and repairs, leaving a working capital of \$1,000,000.

For two months past, the various rolling-mills at and near Youngstown, Ohio, have run quite steadily. The extensive mills of Brown, Bonnell & Co. have been irregular in running, though for a month they have done better than at any time since they passed into the hands of Receiver Lafayette Brown.

This week, the Valley Mills, Cartwright, McCurdy & Co., the Youngstown Mills, Haselton mills, and the Struthers mills have all run steadily on double turn.

At Cartwright, McCurdy & Co.'s, orders are reported plentiful, while Summers Brothers say they have orders enough to run steadily till the first of June. It is a noticeable fact that no advance in prices has occurred.

Trade opens very promisingly with the Hendey & Meyer Engineering Company, Denver, Colo. Besides good sales of mining machinery, it receives frequent orders for its Man's patent automatic cut-off valve, recently patented. In the last few weeks, it has obtained orders for a dozen cylinders for application to existing engines in various parts of Colorado; a few have already been fixed and reported on most favorably. The engine driving the machinery in the company's own works continues to give the highest satisfaction. A special engine for electric lighting, fitted with the new valve, is about to be shipped East, where it will be placed in competition with the best engines in the market, and be open to inspection and criticism.

Coxe Brothers of Drifton, Pa., have closed their store so far as giving or receiving store orders, and sell now only for cash.

The strike at Jeddo, Beaver Meadows, Drifton, and Highland continues. Nearly 3000 men are idle, with no hope of a compromise. Hundreds of miners and laborers have left during the week, some destined for points in Montana, while many Hungarians are returning to their native country.

## LABOR AND WAGES.

The following mines in the Pan-Handle District, Pa., which had been working at 3 cents, went out on the 21st, in order to encourage the strike: The Phoenix, Camp Hill, Pittsburg, Union, Hawk's Nest, and Cherry; on the Chartiers branch, the Glendale, Glass House, and Bower Hill miners. The effect of this will be to keep Pennsylvania Railroad miners from going back to work at 2½ cents on the 22d. There are still some mines on the Pan-Handle working at 3 cents and some at 2½ cents. A delegation of 200 miners from Mansfield recently left for the Tom's Run and Painter's Run mines, to persuade the miners to come out. The miners at Saw Mill Run have decided to stop work on the railroad contracts and not fill cars for railroad coal. They will continue to fill cars for the river trade. If the committee had not been successful, by to-morrow a dozen or more mines would have been at work, and all chances of victory for the miners would have been past. The sudden strength in the strike developed to-day was hardly expected even by the miners themselves. Nevertheless, the fact that the strike had so nearly collapsed will strengthen the operators.

The Port Royal, Pa., miners returned to work last week at the old price, 55 cents a ton. The only concession the operators made is pay every two weeks.

The Chicago, Wilmington & Vermilion Coal Company, of Streator, Ill., employing about 1500 miners, has posted a notice reducing the price of mining 5 cents a ton during the ensuing year. The company has heretofore paid 70 cents a ton for summer work and 85 for winter. A strike is expected.

The Castle Shannon, Pittsburg, Pa., coal miners have gone to work at the reduced rate, 2½ cents per 76-pound bushel.

Railroad coal miners of Turtle Creek, Pa., met on the 17th, and decided to make an attempt to get men out who are working for 3 cents a bushel, and if unsuccessful to go to work next at the best rate obtainable.

The coal miners of the Cumberland District, Md., have asked for an advance in mining from the present rate of 40 cents a ton to 50 cents a ton, to begin May 1st. The general impression is, that the companies will not grant this request; in fact, at the prices at which they have been selling coal, as reported in the ENGINEERING AND MINING JOURNAL, they could scarcely "make ends meet," if they had to pay more than 40 cents for mining.

The Amalgamated Association of Iron and Steel-Workers at the scale convention at Pittsburg, on Saturday, instructed the conference committee to demand \$5.50 a ton for boiling, and to allow reductions from the present scale of wages in some of the finishing departments. If this can not be obtained, and the committee is firmly convinced by the manufacturers that the trial will not warrant that scale of wages, it was instructed to accept a reduction of ten per cent all around. If this offer be rejected, a strike will be ordered by the Amalgamated Association. The conference will probably take place next Saturday. The new scale has not yet been presented to the manufacturers. It is understood that they will not sign it unless a reduction in the schedule has been made 12½ per cent lower than that of last year.

Twenty-one prizes, aggregating \$1138, were distributed among the employes of the Burden Iron Company's works at Troy, New York, for superior work during the past year.

The puddlers (100 in number) who left Pittsburg for New Zealand would, it is said, get \$4.50 a ton for puddling—a price, considering the low cost of living there, much higher than that paid in Pittsburg.

Over 200 miners, mostly Poles and Hungarians, who had been imported to take the places of the strikers in the Hocking Valley, left Carbon Hill yesterday, bound for their homes across the sea. They say they can not earn a living. The experienced miners are likely to remain.

The Reading (Pa.) Railroad car-shops have notified their men that they would be required to work thirteen hours each day beginning April 27th. The com-

pany has nearly 1000 coal and freight cars to be repaired, and it will take several months to do the work. During the past year, the men have only been working eight hours.

The glass-blowers' strike is said to have already cost about \$20,000 in the Pittsburg and Wheeling districts; but it is determinedly persisted in because of the belief that its failure would lead to a reduction of wages on the part of 18,000 men throughout the country.

The strike of the sheet mill hands at Emerson, Hammond & Orr's iron-works, Pittsburg, is recognized by the Amalgamated Association. The men, according to the firm, failed to give thirty days' notice that they intended to strike. The men first agreed to work three turns a day. The Amalgamated Association officials notified them that their charter would be revoked unless they obeyed the resolution passed at the last convention, limiting the production and prohibiting any mill from running three turns a day. It is announced that the strikers will be paid off to-morrow and discharged.

The workmen at the Bellaire, Ohio, Steel-Works quit work in a body April 23d, with the crucibles full of metal, which had to be run out on the ground. A difficulty occurred a week ago over the discharge of one man, and a committee waited on the superintendent, who refused to treat with them. They notified the company they would strike in ten days if the discharged man was not reinstated. The company posted notices to-day that the works would shut down Saturday for an indefinite time, whereupon the men left instantly.

## TRANSPORTATION NOTES.

Season freight rates, car lots, from Chicago to New York, 20 cents per 100 pounds on lead, bullion, ore, matte, etc., value not exceeding \$100 per net ton.

LOWER RATES FOR SOFT COAL.—The Beech Creek, Clearfield & Southwestern and the Pennsylvania railroad companies' lines run very close together in portions of the Clearfield coal region. In many places, both roads are bidders for the tonnage of the coal producers. Among the productions particularly desired are those of the Morrisdale mines, near Phillipsburg, operated by R. B. Wigton & Sons, of this city. The output of these mines is fifty cars a day. On Monday last, the Beech Creek road laid four miles of track to the Morrisdale mines, and on Wednesday thirty car-loads of coal were shipped over it, and will be handled from Port Richmond. It will come directly in contact with the soft coals in the pool, selling at least 60 cents a ton below the pool rates.

President Roberts, General Manager Pugh, General Superintendent Prevost, and a number of other officials of the Pennsylvania Railroad made a trip of inspection over the new Schuylkill Valley Road on Saturday last. The road has been completed to a point several miles above Reading. The road-bed and track were found to be in excellent condition.

## COAL TRADE NOTES.

## MASSACHUSETTS.

Some days ago, a mass of coal, containing twenty thousand tons, belonging to the Boston Gas Company, was discovered to have taken fire by spontaneous combustion. Since the discovery, gangs of men have been employed day and night in saving as much of the pile as possible. Up to the 19th, five thousand tons had been carried away. There is no flame to the fire, the coal simply smoldering.

## PENNSYLVANIA.

## ANTHRACITE.

An explosion of gas occurred at Waddle's mine April 23d. Two men were seriously injured. They entered with naked lamps an old opening where gas had accumulated.

The Committee of the Schuylkill Coal Exchange has given notice to all coal operators shipping by the Reading Railroad that the quota for the month of April will be filled by Saturday next. All shipments of coal will, therefore, be discontinued after that date. It has been arranged that all collieries in the Schuylkill region shall work on three-quarter time during May.

Mr. F. B. Gowen is devoting his whole attention to legal practice in his new offices in the Forrest Building, and has called but once at the Reading office since the 1st of April, and then only in the company of some

Baltimore & Ohio officials, who had business with President Keim.

It is said the Reading Coal and Iron Company is about to give a lease of its Plank Ridge colliery.

A blast at No. 1 shaft of the Delaware & Hudson Canal Company knocked a number of props out of position, causing the fall of a roof. Four men were buried, two of the men being killed instantly and the others seriously injured.

An explosion of gas occurred in the Phoenix Colliery at Pittston, Pa., this morning. About 100 men were in the mine at the time, and many of them were severely burned. After the explosion, all the miners hurried out through a second opening, and none was fatally hurt.

COKE.

The coke syndicate shipments have averaged 590 cars a day for the nine working days since April 1st, while the shipments of the outside operators in the twelve days worked in that time have averaged 175 cars a day. Through the indulgence of the railroad companies, cars have been freely supplied, and much coke loaded remains on the sidings without destination. Of course, there is a limit to this indulgence. The railroads will soon have to call a halt, and, if orders do not increase, the surplus coke will have to be stocked in the yards. The furnaces are generally overstocked with coke. The Joliet Steel Company has reduced its orders from 40 to 20 cars daily; the North Chicago Rolling-Mill Company is not taking as much coke as it was a month ago; the Eastern trade holds its own, and the Pittsburg furnaces are in full blast. West of Pittsburg, the iron business is strikingly dull.

In the Connellsville region, 2900 coke-ovens are idle, and 7671 ovens are running.

WEST VIRGINIA.

The South Gaston Gas-Coal Company was incorporated in West Virginia. The company's property is near Fairmount, West Va., on the Baltimore & Ohio Railroad, and its office is in Baltimore.

GENERAL MINING NEWS.

The illness of a member of our staff has interfered somewhat with the remarkable fullness and condensation of our usual mining and statistical news.

Mr. A. Peysson, of Philadelphia, has opened an agency at No. 703 Walnut street, making the purchase and sale of ores a specialty.

ARIZONA.

The territorial law just passed provides as follows: That locators place a substantial stake or monument of a permanent character at each end of the ground claimed, and others as near as practicable along the course of the ledge, and also similar objects at each corner of the claim; said stakes to contain in a conspicuous manner the name of the claim, and notices to be placed in monuments as heretofore. The line of stakes along the ledge shall not afterward be changed so as to affect the rights acquired by others. All locations must be recorded within sixty days.

Recorders are to receive for recording the sum of one dollar for the first folio, and twenty cents for each additional folio. It also provides for the indexing of all locations made and to be made.

It further provides that, before sixty days after the period fixed by United States law for annual expenditures (assessment-work) upon claims, claim-owners may file with the recorder of the county an affidavit setting forth that the full amount has been expended, as required by law, and containing a concise description of the character of such work, and in and for what year. From the time of the filing of such affidavit, the same shall be *prima-facie* evidence of the facts therein stated, and shall impart notice thereof to all persons; also, when one partner does not come to time with his part of the assessment-work, the other may do it and file notice of having done the same, with the recorder, he to keep an alphabetical list of such affidavits.

This law applies to placer claims.

The law goes into effect three months from the date of its passage.

ARIVACA.—Mr. J. A. Whitmore leaves in a few days to start up the old Arivaca 20-stamp mill, which has been leased by a California company represented by him. They are working the Last Chance, a gold ledge. Copper plates will be used and Duncan concentrators are going in. Ten stamps will be run at first. It is the intention of the company to do

custom work for surrounding mines at very moderate rates. The mill has facilities also for roasting.

COLORADO.

Forty-six cars of ore were shipped from Georgetown during the month of March. The amount was about 572 tons, valued at \$75,000.

It is reported that Mr. Buckland is to put up a concentrating mill near Montezuma, this summer.

The Empire properties of the Great Republic Gold and Silver Mining Company were sold last Monday under a \$15,000 judgment by Mrs. E. B. Taylor, sister of Captain Bates. The properties consist of the Silver Mountain, Sam. R. Platte, and Colorado State lodes. They were bought by C. R. Fish for \$15,260.

Burge & Co., comprising a pool of four practical miners, have taken a lease of the Hayes & Wheeler lode, at Missouri City, known in an early day as the Asberry lode, and at another time as the Golden Era, and are working at a depth of about 60 feet drifting and back-stoping. They have a well-defined vein, the smelting ore carrying galena, gray and bright yellow copper, which nets them over \$50 per ton.

The Lily Consolidated Mining Company, which is working the Lily group of mines, just over the divide from Russell, in the head of Virginia Cañon, has leased twenty stamps of the Richardson stamp-mill in Russell.

The German Consolidated Mining and Milling Company has reached a depth of 385 feet in the main shaft of the Bates-Hunter mine, and is still sinking. It is also working in six different levels of its segregated property. The company is now employing an average of 140 miners, and from 30 to 50 tributaries. The latter keep 25 stamps running steadily on mill-dirt, while the company has ninety in motion, a total of 115 stamps. Nine tenths of the smelting ore output of the property are shipped directly to Denver smelters in car-load lots, as also the tailings or concentrates from the stamp-mill dirt. Mr. Louis Marx, the General Manager of the company, furnished the *Register-Call* the following statement of the product of the mine for the months of January, February, and March, the first quarter of 1885, and the source from which it was derived:

January.	
Mill gold.....	\$14,039.37
Smelting ore.....	2,658.46
Tailings.....	2,561.25
Total.....	\$19,259.08
February.	
Mill gold.....	\$14,814.00
Smelting ore.....	3,619.19
Tailings.....	1,770.10
Total.....	\$20,203.29
March.	
Mill gold.....	\$16,925.21
Smelting ore.....	4,971.19
Tailings.....	3,348.50
Total.....	\$25,244.90
Grand total product for the first quarter of 1885.....	\$64,707.21

ADAMS.—This mine is looking very well. The ore sales from the mine last week amounted to \$34,000. This month, the property is working a greatly reduced force of men, being unable to get the ore hauled to the smelters. The management of the property, however, feels confident that it can get transportation for at least \$30,000 worth of ore this month, so that there will be no cessation or decrease in dividends in the future, notwithstanding the impassable condition of the roads. The company, moreover, has \$30,000 on hand to insure it against any contingency that might possibly delay the prompt earning of dividends.

BELLE OF THE WEST.—The Argenta Falls Mining and Smelting Company, Superintendent Wattles, expects next month to push work at this mine and on the concentrator.

CROOKE MINING AND SMELTING COMPANY.—The annual meeting of the company was to be held on the 10th. The English stockholders will probably take the control and operate the property. The English stockholders offer to put up £16,000—\$80,000—for the payment of the most pressing debts, the purchase of additional air-compressors and heavier engine and machinery, and the general equipment of the mine and such development-work as will put it into condition for steady and heavy production, the current bills to be met monthly.

IRON SILVER.—A strike is reported in the Lime lode, owned by this company and worked under a lease.

The newly-opened ore-body is reported to be several feet in thickness and of very good grade.

GARDEN MINING POOL.—This pool has declared a dividend of \$150 a share, or a total dividend of \$1050. The net proceeds will be deposited in the bank to create a fund that will be applied toward the purchase of the mine. Hence there will be no more dividends declared for some time to come. A small car-load lot of second-class ore weighing 16,076 pounds was sold some days ago to the Grant and Omaha Smelting-Works in Denver, which netted the pool \$72.40 a ton, or a total for the lot of \$581.73.

GLADIATOR.—Superintendent Shideler reports the Gladiator vein wider—3½ feet—where cut by the tunnel, and about the same character and grade of mineral as found above. The tunnel cut the vein at 160 feet and at a depth of about 100 feet from the surface. The ore carries also a small amount of bismuth.

LITTLE CHIEF.—A proposition to lease the last piece of vacant ground on this claim has been made to the company. The tract of territory for which negotiations are pending embraces the No. 9 shaft, situated near the southern end of the property. A number of the lessees of the Little Chief are doing well, and ore is extracted ranging in value from \$17 to \$71 a ton. The best mineral comes from the northern end of the claim, where the tribute workers are following small streaks of galena coursing through the iron. This character of lead ore invariably runs high in silver. The result of lease work during March netted the company above all expenses \$1000, which has been remitted to the New York office. The remittances since January 1st aggregate about \$4500, and the company has on hand over \$50,000.

MONROE.—Mr. S. H. Bushnell, manager of this company, has purchased a hoisting engine and boiler, and a large amount of tools and supplies. The company will put in a wire tramway soon, and will drive work with all speed.

SNOWDRIFT.—Mill-runs this month gave the following returns: One shipment gave 649 and 250 ounces in two classes; another gave 288 and 103 ounces; a third gave 150 and 113 ounces. The two latter runs were from stoping. The first run was from drifting, 30 feet of which yielded \$314.70.

TWIN LAKES HYDRAULIC GOLD MINING SYNDICATE.—Colonel Harvey, the new manager of this company, says that preparations for the beginning of spring work are making as rapidly as possible. Considerable repairing and building of flumes will be necessary, and as the season is over a month ahead of last year, the company will not be ready so soon as they might have been.

LAKE COUNTY.

LITTLE PITTSBURG CONSOLIDATED.—The trial in New York of the suit brought by Artemas H. Holmes, a lawyer, against Jerome B. Chaffee and David H. Moffat, Jr., has begun before Judge Peckham in the Supreme Court, Circuit. The plaintiff avers that he bought, in 1879, 650 shares of stock of the Little Pittsburg Consolidated Mining Company, and that the purchases were made through false representations as to the value of the stock. He paid, he says, for his stock some \$13,000, and received some dividends, meantime holding on to his stock till it became nearly worthless in the market. The case was called for trial before Judge Lawrence some time ago, when the defendants failed to appear, and an inquest was taken in which the plaintiff got a verdict for \$15,182.50. This default has been opened, however, and the trial begun in the regular way, both sides appearing. Mr. Francis N. Bangs and ex-Assistant District Attorney Adams represented the plaintiff as counsel, and Mr. Robert Sewell, Ira Shafer, and W. A. Wolf appeared for the defendants. The defense is a denial of any false representations. The trial is still going on.

PITKIN COUNTY.

Messrs. Wolfe & Lawrence, of Denver, are proposing to build a furnace at Aspen. Messrs. Harkins & Driver, of Leadville, also talk of building reduction-works at Aspen. The camp is improving rapidly, and business is "first-rate."

The old Shepard smelter has been purchased by Messrs. Black, Elliott & McFarland, of Denver, who propose erecting a third furnace. Mr. G. H. Hewitt has the only sampling-works at present; but others are projected, and there are ore-buyers representing Denver works in the camp.

It is expected that the Denver & Rio Grande Railroad will be extended to Aspen this year.

The Hidden Treasure and Bonanza mines have taken a

bond on Mr. W. Bulkley. The Hidden Treasure is the claim upon which Mr. Kenniff put in such hard work, driving a tunnel nearly 300 feet single-handed. He owns three fourths of the property. The terms of the lease are fifteen per cent royalty for ore under \$125 per ton; twenty per cent from \$125 to \$200; and twenty-five per cent for all ore that runs over that figure. The bond runs for one year, and is for \$80,000.

## IDAHO.

Supt. G. L. Havens, of the Mayflower Mining Company of Bullion, has secured an agreement with the Union Pacific Railroad for reduced rates on ore from Hailey to Omaha. The road charges \$20 a ton; but when 1000 tons are shipped, will allow a drawback as follows: On ore carrying 60 to 70 ounces of silver, \$16 a ton (or \$4 drawback). On ore carrying 50 to 60 ounces of silver, \$12 a ton (or \$8 drawback). On ore carrying 50 ounces of silver, or less, \$10 a ton (or \$10 drawback). This move will practically, if it succeeds, give us a \$10, a \$12, and a \$16 rate on low-grade ores. This ore must be good smelting, and carry not less than 20 per cent lead per ton, and the ore must come from entirely new mines; that is to say, from mines that have not shipped ore under the \$20 or any higher rate. Mr. Havens is doing a good work for this district, and it is to be hoped he will succeed in getting these lower rates established. He has already secured about 500 tons of ore that he can ship toward making up the 1000 tons; but he wishes to get 500 or 600 tons more, as, unless he does so, he can not obtain the low rates. Mr. Havens offers to help miners who have ore to mine to get it out to complete the 1000 tons. These new rates should greatly help the Wood River District. It is to be hoped the railroad will establish these rates.

## MEXICO.

News has reached Eagle Pass, Texas, of the discovery of rich gold-fields in the Santa Rosa Mountains, about 100 miles west from Santa Rosa, Mexico. The discovery was made by the Davis brothers, who were working a profitable silver mine in the same range, but have abandoned the silver mines and located claims in the gold-fields. The gold lies in quartz.

## MICHIGAN.

NORWICH.—The property of the company has been sold to Mr. Marmaduke Richardson, of New York, who, with his associates, will proceed to organize a new company, allowing the stockholders of the old company to take stock in the new company by payment of an amount to be fixed hereafter.

RABBIT MOUNTAIN.—Some late specimens of ore have assayed very heavily. A car-load was recently shipped to New York, where assays were made by the New York Metallurgical Works. Mr. H. Sahlgard, treasurer of the mining company, gives the following figures as the result of the assay: Ore No. 1 assayed \$3610 a ton; No. 2, \$1339 a ton; No. 3, \$198; and No. 4, \$143. The mine will be extensively worked this season, and between 2000 and 3000 tons of ore are on the dump.

RIDGE.—It is stated that the Ridge mine has decided to close down all work at the expiration of the tribute lease May 1st, until the price of copper shall warrant working at a profit.

ROPES.—The *Iron Agitator* gives the following information: We have paid the Ropes gold mine a visit. The lower level shows a richness of lode that assures satisfactory results. The cross-cut south from the drift to the east of No. 1 shaft has revealed a width of vein of full eight feet, which is rich in mineral on the entire face. On the hanging side, there is a streak of ore some ten inches in width that is very rich in gold and silver ore, and which will probably be laid to one side for the smelter, which would secure better results on this grade of rock than could be obtained in the stamp mill. From the bottom of the shaft, excellent rock is taken, as also is the case in the drift to the west. In the second level, west, the vein holds its original width, and the rock is of high grade. The lense has proved of great length here, and shows no sign of pinching. In the mill, some changes will be made. It is said that the coppers of the four new batteries put in operation last November have not been catching nearly as much as did the plate of the old battery, for the reason that they were not electroplated. What the mine has needed all along is a chemist and assayer to note every change and find the causes for the same. The Wiswell machine is now in operation, and in a few days will have some positive proof of its effectiveness as a crusher and amalgamator. It

treated a ton of rock in exactly an hour, when the first test was made. Mr. Uren has placed one of his ore concentrators in the mill to work in connection with the Wiswell. The Ropes is well deserving of the best milling equipment that can be procured, as also the most competent men to run it. It is a promising property, and is increasing in value every day.

THE UPPER PENINSULA MINING SCHOOL.—The Senate has increased the appropriation from \$20,000 to \$25,000 for the establishment of the mining school in the Upper Peninsula, and unanimously passed the bill. The bill locates the mining school at Houghton for the present.

## MONTANA.

ALTA.—Eight feet of rich ore, better than any heretofore found, has, it is said, been struck at a depth of 1000 feet from the surface, which has been reached by a 1400-foot tunnel. The company took out of the mine during the month of March over \$125,000.

BLUEBIRD.—This is rated as a valuable property. It shows a chute of ore said to be 12 feet wide.

BONANZA.—S. T. Hauser & Co. have begun work on the Bonanza, a rich gold mine about six miles from Helena. A large force of men has been set to work.

GREGORY.—We learn that the company has come to the conclusion that the 600-foot shaft now on the mine is inadequate for the proper working of the mine, and that it intends immediately to begin the sinking of a new double shaft.

HELENA MINING AND REDUCTION COMPANY.—We have received the following information from the secretary of this company, dated Wickes, Montana, April 17th: The Helena Mining and Reduction Company, by a vote of three quarters of its stock, has increased the capital stock \$500,000, or 100,000 shares, and made an exchange of the stock for the first mortgage bonds standing against the company. There has for some time been a rumor in circulation in regard to the consolidation of the Gregory and this company; but there is no foundation whatever for the rumor. I herewith inclose you a statement of our output for this year, beginning with January 1st. Our fiscal year begins October 1st:

Product from January 1st, 1885, to March 31st, 1885, inclusive.

Month.	Gold, ounces.	Silver, ounces.	Lead, pounds.	Copper, pounds.
January.....	469.96	49,362	542,640	5,017
February.....	442.78	53,224	691,212	...
March.....	962.25	62,736	775,709	...
Totals.....	1,874.99	165,322	2,008,961	5,017

## NEVADA.

Improvements are going on as rapidly as possible at the Eureka Consolidated works.

The Eureka Star mine shipped 1½ tons of ore to the Richmond reduction-works recently.

It is reported in the western part of the State that a company is organizing in Virginia City to turn the Carson River, near the Santiago mill, the project being to clean out the bed of the stream and capture the tons of quicksilver and amalgam that are supposed to be there.

The Mineer & Holiday mine, at Silverado, has made a shipment of ore to the Eureka Consolidated furnace.

It is generally believed that operations will be resumed at the Richmond works by the 1st of May.

The King Lear is said by responsible mining men to be one of the most promising mining properties in Eureka District. During the past week, it shipped 17 tons of ore to the Richmond reduction-works.

It is reported on good authority that a new strike has been made in a ledge of the Pittsburg Consolidated mine, at Lewis, that discloses ore so rich in gold that the precious metal can be plainly seen with the naked eye all through the quartz.

The Bay State mine, at Newark, has begun shipping ore to the Richmond reduction-works. Three tons were brought in in one day.

The Eureka Consolidated mine is looking and producing well. In fact, the mine is said by those knowing its condition to be looking better to-day than at any time in a year past.

A tributer in the Bay State mine shipped to the Eureka Consolidated furnace five tons of ore lately.

Six tons of ore have been sent in to the Eureka Consolidated furnace from the Swallow mine, at Mineral Hill.

The Silver Lick on Adams Hill shipped 3½ tons of good ore to the Richmond reduction-works the past week.

The Hamburg mine, in New York Cañon, shipped 10½ tons of good ore to the Richmond furnaces the past week.

CHOLLAR.—The face of west drift No. 1 on the 3000 level has entered the outer edge of the vein at the south line of the Hale & Norcross, and will hereafter be designated as west cross-cut No. 1. The material in the face is quartz, carrying seams of ore. The finding of these ore-bunches on the skirt of the vein is said to indicate that it has widened rapidly in its descent from the 2800 level of the Hale & Norcross, as they did not strike ore in cross-cut No. 1 on that level until it had been advanced over 40 feet into the vein.

EUREKA CONSOLIDATED.—A reporter of the *Sentinel* has visited a recent discovery on the seventh level of this mine, known as the Bennett & Mulcoy pitch. He says: Up to the present time, quite a number of tons of ore have been extracted from the pitch, but sufficient work has not been done on it to ascertain or even approximate its extent. The character of the ore thus far extracted is carbonates and black sulphurets, carrying considerable lead in places, and may run from \$60 to \$90 a ton. The ore in places is quite rich, and if partially assorted, would work probably \$150 to the ton. The discovery is undoubtedly one of considerable value, and its location and the manner in which it was found strengthen the belief that the upper levels of the mines on Ruby Hill have not yet been half prospected. F. Robbins, the Superintendent, writes, under date of April 5th, as follows: During the past week, we have hoisted 22 cars of ore. Our principal work this week has been in cleaning out levels, laying track, and hoisting waste from prospectors. Williams pitch, on the seventh level, continues to improve and looks very well. We have been sinking a winze on the ore this week, and have now attained a depth of 30 feet below the point at which the ore was first discovered. We have had ore all the way down, with no signs of its giving out. The foot-wall, which we followed, has pitched back of us, and we are now going straight down with ore on all sides of the winze. We hope to have a connection from the eighth level made with the pitch in about a month, when we can make a better showing of ore-shippments from this place than we are able to make at present. Blamy's pitch on the first level, Kinne Kinsman's pitch, third level, K K mine, and Bennett's pitch above the seventh Lawton level show great improvement; Bennett's has a streak of ore 4 feet wide and 7 feet long that assays from \$60 to \$80 a ton. The smelting-works are rapidly approaching completion, and will probably be finished by the first of next month. A telegram from the San Francisco office, April 16th, says that there is a great improvement in Bennett's ore-body above the seventh level.

HALE & NORCROSS.—No change in the situation. West drift No. 4 on the 2900 level is pushed ahead as rapidly as the nature of the ground will admit, it being soft and requiring close timbering. The formation in the face is heavy blue clay mixed with quartz. West drift No. 2 on the 3000 level will soon enter the vein at a point midway between cross-cuts Nos. 2 and 3 on the 2900 level. It will take some time yet to develop the ore-body said to be on the 3000 level. John W. Mackay, on April 12th, visited the lower levels, and examined the developments thus far made. He expresses himself as well pleased with what he saw. He says the ore upon the 2900 level presents more of the characteristics of our old-time ore-bodies than any thing he has seen for years. As regards the 3000 level, he is of the opinion that the ore-body will be found to extend to that depth, judging from the heavy east clay and all else to be seen as far as openings have been made. He says it will, of course, take time to properly open up the mine, and people must have some patience. Mr. Mackay will be on the Comstock a few days, and will remain on the Pacific coast all summer. The following from the *Chronicle* of April 16th gives the rumors there circulating concerning the "bonanza." It is needless to repeat our old advice, that it practically makes little difference what is found, the "management" will absorb the profits and the outsider will lose his money. A liberal discount must be made for Western exaggeration in these reports: Since the 15th, there has been a marked improvement in the Hale & Norcross mine on the 2900 level, but the grand feature is the strike on the 3000 level. West cross-cut No. 4, on the 2900 level, which was last evening in quartz showing some stringers of ore, to-day has its whole face in ore of a



now quite firm, and is quoted at 3.50c. for Desilverized ; 3.45c. for Soft Missouri lead ; and from 3.40@3.42½c. for Hard lead. Our consumers' stocks are light, and we look for more activity next week.

Messrs. Everett & Post, of Chicago, wire us to-day as follows :

The market remains about the same—if any thing, a shade firmer. There is a somewhat better feeling, due to growing inquiry. There is but little doing, and business has been quiet, with sales of a limited character. The market is quoted from 3.42½@3.45c.

Spelter.—There is nothing of moment doing, merely a hand-to-mouth trade. We may quote at 4.15@4.25c. for Domestic.

Silesian is nominal at 4¼c.

Iron Market Review.

American Pig.—The market is without change. From nearly every quarter it is reported as dull and very little doing. Nevertheless, the total amount of iron consumed in one form or another is larger ; but in this, as in every other branch of trade, the margin for profit is small, and it requires a large turn-over to make much money.

We continue to quote No. 1 Foundry \$18 ; No. 2, \$17 ; Gray Forge, \$16 ; for good Lehigh brands, with a variation of 50c.@\$1 above these figures for special brands, and about the same amount below these for outside or inferior irons. These figures leave a fair manufacturing profit, and there are enough furnaces satisfied with them, and that are now idle, to keep the market from advancing much, even should a more active demand spring up.

Scotch Pig.—This article still comes in in small quantities, and is sold in lots of from 5 to 30 tons. The prices remain unchanged at about \$21 for Coltness to \$18 for Eglinton, with the usual intermediate gradation for other brands. Cables received at the Metal Exchange to-day quote : 52s. 6d. for Coltness, 42s. 3d. for Eglinton. Warrants, 41s. 9d.

Steel Rails.—The prices, though quoted at \$27@ \$28 at mills, are in reality a matter of negotiation. We hear of a sale by the Cambria Works of 2000 tons of 30-pound steel rails, delivered at Savannah, Ga., at \$31. Unless some special rate of freight is obtained, this would make the price at the mill \$25.

Philadelphia. April 24.

[From our Special Correspondent.]

Pig-Iron.—Two hundred and fifty tons of No. 1 Foundry iron were sold this week at \$17.50. There are offers in hand for some five or six hundred tons of Nos. 1 and 2, which will likely go on buyer's terms, No. 2 iron is rather weak and more plenty than No. 1. There are a good many inquiries in hand to-day for Gray Forge, and buyers think \$15 is the outside price. Sellers are disposed to meet buyers half-way, but the week's business has been unusually light. There is no improvement in demand in manufactured iron, and hence mill-owners are not very urgent. Southern irons are offered at \$15.

Foreign Irons.—There are no sales of Spiegeleisen or Bessemer to report this week, but offers for small supplies that will not be filled on the terms offered. Nominal quotations for Bessemer are \$19.25. Spiegeleisen is offered at \$26 ; Ferro-manganese, \$70@\$72.

Muck-Bars.—One sale of Muck-Bars was made to-day at \$26, but \$27@\$27.50 is the average price for a good article.

Merchant Iron.—Several orders ranging from five to twenty-five tons have been taken, some at our city mills, and others in the interior, at about \$1.65@\$1.70. Manufacturers are endeavoring to secure orders, but find buyers indisposed to accept terms offered, excepting for supplies for immediate delivery.

Nails.—Nails are nominally \$2.20, but better terms could be had. Most of the buyers have their requirements for ninety days taken care of. An occasional car-load lot is ordered.

Steel Slabs.—There are parties here from the West for steel slabs, and they are meeting with some success. The Pennsylvania Company is doing a good business in steel slabs, and reports a steady demand at firm prices.

Locomotives.—The Paterson Works have just received an order for twenty locomotives. The Baldwins here expect to close shortly for two or three good orders.

Plate and Tank-Iron.—The demand for plate and tank-iron shows no improvement. Every thing is done in a hand-to-mouth way. Mr. Hoffman, No. 208 South

Fourth street, has been appointed the Receiver for the American Ship-Building Company at Port Richmond, owing to the long-continued illness of Receiver Goringe. There has been no work done there since the first of January.

Structural Iron.—There seems to be a good deal of confidence expressed among manufacturers of structural iron as to the volume of business that will be placed during the summer. The mills are not much crowded with business just now, but there seems to be enough to satisfy all hands, who are easily pleased. Angles are 2 cents. If all the capacity is built that is contemplated, the combination of beams and channels would be threatened. All of this week's business has been made up of small orders. The representatives of different companies are actively seeking new business, and report favorable progress.

Steel Rails.—There are offers for large blocks of steel rails, but makers have not yet accepted them, though it is believed they will yield. There is an active demand for slabs, which manufacturers are showing a disposition to use.

Old Rails.—Old rails are quoted at \$17.50@\$18, with an active demand, especially for interior points, at \$18.25 and \$19.

Scrap.—Selected Scrap readily commands \$19, and stocks are light. Nearly all other kinds are plenty and with but a moderate movement.

Louisville. April 22. [Special Correspondence.]

The market for pig-iron has not improved in tone. Sales are light and not much disposition to buy except for immediate use. Many of the furnaces were holding No. 2 Foundry iron at \$16 last week, but now most of them are holding at \$15.50, and the market may be quoted about 50 cents off for Nos. 1 and 2 Foundry iron. We quote for cash in round lots as below :

Table with columns for item name and price. Includes categories like SOUTHERN COKE, HANGING ROCK, SOUTHERN CHARCOAL, SILVER GRAY, SOUTHERN COKE, and HANGING ROCK.

Pittsburg. April 24.

The Metal Exchange has the following telegram this afternoon :

Prices are weak but not quotably lower ; sales restricted to actual wants of trade for mixtures. Iron dealers report very dull. No large transactions are expected until the buyers' scale question is settled.

The following lots have been closed this week :

Table listing various iron products and their prices, such as Gray Forge Lake ore, Bessemer, and Wrought Scrap.

Coal Trade Review.

Anthracite.

The production of anthracite has almost reached the full April quota. The Reading closes down tomorrow, the 25th, and it is said the Lackawanna has already filled its quota.

The production has reached about 7,600,000 tons, or say 400,000 tons more than the quota calls for to the end of April. We repeat the monthly quotas : January, 1,500,000 ; February, 1,500,000 ; March, 1,800,000 ; April, 2,400,000 ; total, 7,200,000. The excess is chiefly due to the Pennsylvania Railroad working outside of the combination. The May quota will be 2,400,000 tons.

The market has not taken the full output during the past three weeks, and stocks are accumulating, but probably the whole April quota will be absorbed by the end of the month.

The market is now well supplied and there is a perceptible sluggishness in the trade, which shows itself in somewhat lower prices.

For Wilkes-Barre, Scranton, Lackawanna, Pittston,

and Reading free-burning coals, we quote fair selling prices :

Table listing coal and other products with prices, including Broken and Egg, Stove, Chestnut, Pea, and Buckwheat.

Or say 5 to 10 cents less than a week ago.

The demand is dull for stove, fair for broken and egg, and with some of the companies good, while with others rather dull for chestnut.

We hear of one of the companies selling Broken as low as \$3.10, and Pea \$2. We have also heard of a contract with a Massachusetts mill where Broken coal is delivered at \$3.50 a ton, in the place of Cumberland coal, which was supplied last year. This leaves the price f. o. b. Philadelphia, \$2.50, or 50 cents below the circular rates. The absurdity of publishing the nominal circular rates is too apparent to need further comment.

The financial condition of the Reading is a source of constant anxiety to the trade. Should the pressing need of funds lead it to make concessions in price, it is easy to see that the company will insist on mining its full quota of the 31,000,000 tons (including the "fighting million"), and since the Pennsylvania Railroad is not limited, and will no doubt considerably exceed its quota, the market may readily be overstocked, unless a general revival of business comes to our aid, and prices will necessarily be weak under accumulating stocks.

The labor question at the mines comes in to modify this outlook. A strike is now in force at several collieries in the Lehigh region. If it should become general—which, however, is not probable—the supply of coal might run below the demand and prices advance. At present, the prospect, we regret to say, is rather the other way.

THE WESTERN ANTHRACITE TRADE.

We last week called attention to the last "plan" of the Western Anthracite Association to regulate trade. It has been regulating it for some years past, each year on an improved plan, and the result is, that Stove coal is selling in Chicago to-day at \$4.50@\$5 a net ton and Broken and Egg at \$4 a net ton. Let us see what the cost of laying coal down in Chicago is, or was at last year's tolls :

Table showing costs per ton for Mining, Tolls, Shipping expenses, Lake freights, and Chicago charges.

Average present selling price, say \$4.50 a ton ; Association circular prices, \$6.03@\$6.43 a net ton.

The Reading Company, we understand, has refused to accept as its quota in this year's Western business its proportion of the coal shipped West large year, but in reality it makes little difference whether a basis be agreed upon or not so long as the company is able to produce more coal than the markets will take, and the company's financial condition obliges it to force sales, the market will be demoralized, any "agreements," "pools," or "plans" to the contrary notwithstanding.

The following table of mean temperatures during the months of March and April up to the 20th, is of interest as bearing upon the recent spurt in coal :

Table showing mean temperatures in degrees Fahrenheit for March and April 1st to 20th for various years from 1881 to 1885.

Bituminous.

The bituminous trade is uneventful, though we hear of some contracts secured by Cumberland companies, and on the other hand, we hear of a contract taken away from Cumberland by anthracite, as referred to above.

It is stated that the cotton print mills in the East have agreed to stop four weeks between now and July. This will reduce the consumption of coal somewhat. The Hudson River section of the New York Central Railroad is said to have closed a contract with Beech Creek coal, and it is said that the New Central Company, which for years has furnished the company with Cumberland coal, has received a small order.

The Rome, Watertown & Ogdensburg contract is in



DIVIDEND-PAYING MINES.

NON-DIVIDEND-PAYING MINES.

Main table with columns for Name and Location of Company, Capital Stock, Shares, Assessments, Dividends, and Date and amount per share of last. It lists 181 different mining companies and their financial details.

G. Gold. S. Silver. L. Lead. C. Copper. \* Non-assessable. † This company, as the Western, up to December 10th, 1881, paid \$1,400,000. ‡ Non-assessable for three years. § The Deadwood has previously paid \$275,000 in eleven dividends, and the Terra \$75,000. ¶ Total number of shares, 500,000; 50,000 shares have never been issued, and are still held by the company.



NEW YORK MINING STOCKS.

DIVIDEND-PAYING MINES.

NON-DIVIDEND-PAYING MINES.

Table with columns for Name and Location of Company, Highest and Lowest Prices per Share at which Sales were Made (April 18-24), and Sales. Divided into Dividend-paying and Non-dividend-paying mines.

Dividend shares sold, 30,558. Non-dividend shares sold, 35,725.

Production Bituminous Coal for week ended April 18th, and year from January 1st:

Table showing Eastern and Northern Shipments and Western Shipments of bituminous coal. Columns include Region, Week, and Year for 1885 and 1884.

Production of Coke on line of Pennsylvania RR. for week ended April 18th, and year from January 1st:

Table showing production of coke on the Pennsylvania RR line. Columns include Region, Week, and Year for 1885 and 1884.

FINANCIAL.

Mining Stocks.

New York, Friday Evening, April 24.

The mining market this week has been rather dull, although the dealings have been more generally scattered throughout the list.

The Comstock shares were moderately dealt in at weak prices. Consolidated California & Virginia ruled at irregular prices, selling at from 68@75@70c.

The Bodie stocks ruled at firm prices, but were quiet. Bodie was strong, selling at from \$1.50@1.65. Bulwer rallied from its recent weakness, and was quite strong; it sold at from 29@36c.

The feature of the market was the stock of Horn-Silver. It has been the favorite this week, and shows heavy dealings, the transactions amounting to 10,700 shares.

The remainder of the market was of but little interest. We give a complete summary elsewhere.

The Metal Exchange has taken an important step by adopting a uniform warehouse receipt for pig-tin, which warehouse men, licensed by the Exchange, will be required to use to make good delivery on Exchange contract.

not be at the risk of any extra charges. The rates for storage are fixed at 20 cents a ton a month, or about 1/2 of one per cent of the value of the goods per annum.

Coal Stocks.

The stock market has been very quiet during the past week, the dealings having been mostly confined to stocks influenced by special occurrences. War has been something of a factor in the market, but it does not figure to nearly the extent it did.

The following securities were sold at public auction in Philadelphia during the week: \$3000 Colebrook Railroad Company's 1st mortgage 6 per cent, at 36; \$1000 Colorado Coal and Iron Company's 1st consolidated mortgage 6 per cent coupons from August, at 65 1/2; 3 shares Pennsylvania Steel Company, par 100, 167; 20 shares Crane Iron Company, par 50, at 20.

The Pennsylvania Railroad lines east of Pittsburg and Erie show a decrease in net earnings of \$243,442 for the month of March, and \$713,093 for the first three months of this year, as compared with the corresponding periods of 1884.

