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ERRATA.—Mr. GEORGE J. ROCKWELL writes us that the following "errata" occur in his paper on "Chloridizing, Roasting and Lixiviation," published in ENGINEERING AND MINING JOURNAL, March 17th, page 198: Table IX., averages should read 46.5; 72.2; 51.3; 73.2. Table X., averages—cold solutions—should read 70.8; 78.3; 7.5. Table X., averages—warm solutions—should read 75.1; 84.1; 9.0.

THE COPPER PRODUCTION OF THE UNITED STATES IN 1887.

On January 7th we published in the ENGINEERING AND MINING JOURNAL the statistics of production of copper, lead and spelter in 1887. Last week we called attention to the accuracy of our reports of lead and spelter by comparing them with the statistical report of the U. S. Geological Survey, which was published April 7th, and showing that our early reports differed by rather less than one half of one per cent from the later Government reports. To-day we are enabled to give the Geological Survey reports of the production of copper (see our copper market report on another page) and we make the following comparison:

Table comparing United States Production of Copper in 1887. Columns: Source (Engineering and Mining Journal, United States Geological Survey), Amount (Pounds fine copper).

very first week in the year, was as full and accurate as that obtained by the Geological Survey nearly four months later—in fact, varied from this only about one-eighth of one per cent.

This full confirmation of our statistical reports is highly gratifying, and it again demonstrates the painstaking courtesy with which our producers aided us in obtaining early reports.

THE AMENDMENT OF THE ALIEN ACT.

The "Alien Act," which went in force last year, and which restricted the ownership of real estate in the territories to American citizens, has been amended by the United States Senate so as to exclude its application to mining property. The wording of the new bill, which was passed in the Senate on the 10th instant by a vote of 31 to 13, reads as follows:

"The act entitled 'An act to restrict the ownership of real estate in the territories to American citizens,' etc., approved March 3d, 1887, shall not relate to or in any manner affect the title to mineral lands or mining claims in the territories of the United States, which may be acquired or held under the mineral land laws of the United States, nor to mills or other reduction works or property used in the production of metals from said mineral lands or claims; but as to all such mineral lands, mining claims, mills, reduction works and other property, the laws of the United States and the territories shall be, until changed by act of Congress or an act of the territorial legislature, the same as though said act had not been passed."

The approval of the PRESIDENT is now alone required to put this act in operation, and there is every reason to believe that this will be promptly given.

The interests of the Territories will certainly be promoted by this act allowing the investment of foreign capital in the development of our mineral resources, and it can bring no possible danger to the State, such as we believe might follow the alien ownership of large tracts of agricultural land.

We hope that foreign capital will now seek more freely than ever the profitable investments our unrivaled mineral riches offer to these who combine prudence and honesty with knowledge in investing. There is no other country that offers such rich property and such security for investment as is offered in our mineral districts, both East and West, under the laws of the United States. And if the floating of wildcats and dishonest enterprises could be prevented, the profits on legitimate, prudently made mining investments here would quickly bring to us vast sums of money from foreign lands.

It is the disappointment which follows the investment of millions of dollars in worthless property (the millions going for the most part into the pockets of dishonest promoters and not into the development of the mines) that discourages the investment of capital in legitimate enterprises and brings injury and discredit on whole States and Territories.

THE DANGER OF ELECTRIC ARC CURRENTS.

The crusade against the poles which carry telegraph and telephone wires in cities had in the beginning mainly a sentimental basis. That such poles are ugly; that they injure the architectural effect of houses and faades, and that as their number and the number of their wires are increased, they become, in the opinion of every body, a nuisance, is beyond question. But positive, definite and measurable injury has not been traced to them in proportions at all corresponding with the outcry against them. There have been several interesting cases in the courts, illustrating this peculiar situation. In one instance, a party undertaking to prove that the telegraph wires seriously obstructed his supply of light was confounded by the exact figures showing how small was their effect in that particular. In another, the court awarded to a protesting house-owner the sum of five dollars as the total damages due him from a telephone company which sought to build a pole-line past his property. In another, the declaration that a line of poles had injured the value of property in a certain street was met with direct proof of sales at advanced prices. It appears that while every body dislikes telegraph-poles, it is hard to fix a business value on this sentiment.

As to the question of the public danger they involve, this too has been indefinite, and largely imaginary. Authentic instances of injury caused by falling poles or wires have been exceedingly scarce. We can not, indeed, recall any that are beyond dispute; and certainly the existence of swinging sign-boards in the city streets is far more perilous. There has been a real difficulty in dealing with conflagrations in high buildings, when telegraph-poles, carrying many wires, impeded the use of ladders, etc. This, however, was for a long time practically the only serious trouble.

But the case is terribly altered by the rapid extension of the powerful electric currents employed in electric arc-lighting. Here is indeed a danger, ever-present and tending to become omnipresent; and one which calls for careful and adequate remedy. The distribution both of light and of power by electrical means has come to stay. It is, as was the use of illuminating-gas before it, one of those improvements which civilization, having tasted, will not give up. But it does not follow that its use should not be regulated in the interest of public safety.

It must be confessed, however, that the demand of the newspapers, that all electric-light conductors shall be forthwith put underground, is

by no means wise. Whatever may be the sanguine prophecies and promises of inventors, the underground system has not yet been found which has stood the test of practice for this class of conductors. It must be found; or else an adequate protection against the accidents due to these dangerous currents must be secured in some other way; or else their general use over long distances must be prohibited, and either house-motors, driving local dynamos, or storage-batteries, or incandescent lighting, or some system the currents of which are less dangerous, must be substituted. But to order the electric light companies using these currents of high potential and large quantity combined to simply dig trenches and build conduits, and then "go underground," is mere bravado. It is "On to Richmond!" over again. As every body knows, we did get to Richmond at last; but the men who did that shouting rather hindered than helped the desired result.

LATENT COLD.

One of the instructive incidents of the recent blizzard in New York was the attempt of many persons to thaw the snow-drifts in front of their houses by building fires in them, and their ludicrous surprise at the failure of the experiment. Our worthy Mayor, who knows better than that, urged the proprietors of steam-boilers to turn jets of steam upon the drifts, as a public-spirited contribution to the work of clearing the streets—a more effective, but still not inexpensive method, as the following calculations will show. The principles of specific and latent heat are not changed when we apply them to what may be called latent cold.

The specific heat of snow or ice is nearly that of water; that is, it requires about the same amount of heat to raise the temperature one degree. But the latent heat of fusion is 140; that is, it requires 140 pounds of water losing one degree in temperature to change one pound of snow or ice at 32° F. to water of the same temperature; or one pound of water at 172° F., added to one pound of snow at 32° (or "just ready to thaw") would barely melt it, producing a total mass of water at 32°, or "just ready to freeze." If we assume the water to be used in the most effective way, namely, as steam at 212° F., injected into the mass of snow, and giving up its surplus heat in the most complete and rapid manner, we shall find that the latent heat of the steam, set free when it condenses to water, is an important factor; so that one pound of water, in steam at 212°, would, in condensing and cooling to water at 32°, convert into the same condition a little over eight pounds of snow.

The consumption of fuel required to produce one pound of steam at 212° from water at ordinary temperatures is in practice about one seventh of a pound. Hence we may say that the melting of a ton of snow would require the combustion under the boiler of at least 35 pounds of coal.

Snow produces, when melted, from one fourth to one eighth of its bulk in water, according to the degree to which it has been compacted before melting. Taking one fifth as a rough mean, we may estimate the weight of a snow-drift at 12.5 pounds per cubic foot, or 160 cubic feet per ton. A drift 25 feet long by 10 feet wide and averaging 4 feet in depth, would contain 6½ tons; and the steam to melt it would require the consumption of 233 pounds of coal.

It may now easily be seen why the burning of small bonfires in snow-furnaces, most of the heat of combustion going up the snow-chimney, produces so little effect. There is no penetration of the heat into the mass of snow—only a surface-action between the rapidly moving flame and the snow-walls. The specific heat of the gases of combustion is about 0.25 as compared with that of the snow. In other words, they must cool four degrees to warm the snow one degree. Their specific gravity is $\frac{2}{3}$ that of the snow; hence they expose but a small weight to its cooling action. In fact, one may see, in such a snow-furnace, the flame actually curling about the projections of the interior surface, without melting them. The conditions are too variable and complicated for a detailed calculation; but the very small stream of water which trickles away from the whole apparatus, to the disgust of the attendant small boy, tells the whole story.

An enthusiastic inventor produced, during the late climatic unpleasantness, a coal-oil blow-pipe, which was to be attached to the front of a horse-car, and to fuse the snow on the sides of the track as it passed. He declared that he could in this way clear about a mile in half an hour. But a calculation of the total calorific capacity of the oil he proposed to consume showed that it would take him some two months of steady blow-piping to perform the job; and the authorities to whom he applied wisely concluded to rely on shovels and carts and sunshine.

To return for a moment to the use of steam, it may seem that 35 pounds of coal consumed to thaw a ton of snow is not very much, but it must be remembered that this rests on the assumption that all the steam is thoroughly utilized, and none of it escapes into the air as steam. This, however, can only be secured by special arrangements. In one case, following the New York blizzard, it was found necessary to shovel the snow into a box, at the bottom of which the steam was intro-

duced. But if it must be shoveled anyhow, why not shovel it into carts, and haul it away?

Finally, the most serious practical difficulty of all arises from the fact that the product of such thawing is inevitably water at 32°, or "just ready to freeze." If the weather is sufficiently cold, or the escaping water encounters surfaces below 32° in temperature, it will regelate into a more or less solid mass, and flow no further. The only way to secure the complete removal of the thawed snow is to add fresh steam or hot water to the stream, so as to bring it, and keep it, well above freezing-point. On the whole, the removal of snow-drifts by means of steam is not likely to take its place among the great improvements of the century.

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 correspondents.

The Mineral Production of Canada.

GEOLOGICAL SURVEY OFFICE,
OTTAWA, April 16, 1888.

EDITOR ENGINEERING AND MINING JOURNAL:

SIR: I read with surprise in your issue of the 10th of last month the figures of the mineral production of Canada in 1887, collected by Mr. W. Hamilton Merritt, of Toronto. In comparing those figures and those in my table published in your last issue, your readers will be able to judge of the accuracy of Mr. Merritt's statistics. In your number of March 24th exception was taken by Mr. Merritt to your note, that in the case of copper his figures were certainly too high, under the plea that "copper" should have read "copper ore;" but, as the actual output of copper in Canada in 1887 was 40,800 short tons of ore, containing 3,260,424 pounds of fine copper, Mr. Merritt's statement that the production was 5267 tons, is as much wrong if you take it to be meaning ore or fine copper.

Statistics can not be guessed at and need to be collected with great care, and often at great trouble, to be of value to a country instead of injurious.

E. COSTE,

Mining Engineer to the Geological Survey in Charge Mining Statistics.

OFFICIAL REPORTS.

Central Copper Mining Company, Michigan.

The following information is taken from the directors' report of the operations in the year 1887. Production of mineral 1219 $\frac{1}{100}$ tons, which yielded about 78 $\frac{4}{100}$ per cent, or 1,923,279 pounds of refined copper; shipments, 2,199,133 pounds of refined copper, including 275,854 pounds of the product of the previous year, all of which has been sold. Production: 1,923,279 pounds copper, at 12 $\frac{1}{100}$ cents, \$233,045.41; silver, \$437.77; add interest received, \$8903.74; total, \$237,386.92. Costs: working expenses at mine, \$150,285.19; construction account at mine, \$12,552.12; smelting, freight, and all other expenses, \$32,453.75; total, \$195,291.06; net profit in 1887, \$42,095.86. There has also been credited real estate for "stumpage," \$3286.02; making the net increase in assets, \$45,381.88. The surplus from 1886, after payment of dividend, was \$216,10.431; making the net surplus, December 31st, 1887, \$261,486.19, out of which a dividend of \$2 per share (\$40,000) was paid February 1st, 1888. The expenditure for construction completed the new hoisting plant named in previous report. This machinery works satisfactorily, and provides ample power for many years to come.

The product for the year, although a fair average, is not as large as was expected at the beginning of the year, and shows a decrease of about twenty-four per cent from that of the previous year. In the early part of the summer the vein in several of the stopes became small and poor, and the yield was very light until toward the close of the year, when some rich ground was developed in driving the 27th level south, which added materially to the product. This decrease in the production accounts for the diminution of profit, notwithstanding a material increase in the average price obtained for the copper, which was caused by the rise in the market value during the last two months of the year.

The improved appearance of the mine continues to this date, and this circumstance, taken together with the better prices obtainable for copper, warrants the expectation that the results of the business of the current year will be more satisfactory.

AGENT'S REPORT.

Ground Broken.—Sinking in shafts and winzes, 229 feet, average cost, \$23.48; drifting on vein and cross-cuts, 1363 $\frac{1}{100}$ feet, average cost, \$6.93; stoping on vein, 2,547 $\frac{3}{100}$ sup. fathoms, average cost, \$12.85; stoping on flats, etc., 300 cubic fathoms. The total amount of ground broken in openings and stopes is 3214 cubic fathoms.

Production.—981 bbls. stamp copper, weighing 1,430,865 lbs.; 134 hdds. barrel copper, weighing 463,365 lbs.; 204 masses copper, weighing 545,160 lbs.; total, 2,439,390 lbs., or 1219 $\frac{1}{100}$ tons. Average yield of mineral per fathom of ground broken, 759 lbs.; average yield of ingot per fathom of ground broken, 598 lbs.

The total expenditure for the year is as follows: Mining and surface expenses, \$134,805.09; stamp mill expenses, \$16,068.47; taxes, \$2891.67; construction account, \$12,552.12; total, \$167,317.35. Less rents received, \$4480.04. Total expenses, \$162,837.31.

The Estrade High Speed Locomotive.—*Le Génie Civil* of Paris states that the Estrade locomotive La Parisienne, specially designed for high speeds, and built in the shops of M. J. Boulet, at Paris, is to undergo a series of official trials. It is fitted with driving wheels somewhat over eight feet in diameter, and the speed upon which the designer, M. Estrade, figures for ordinary running is something like 78 miles per hour. Its length is about 32 feet, exclusive of tender, and its weight, when empty, 38 tons. The results of the tests will be awaited with some interest.

THE CONSOLIDATED STOCK AND PETROLEUM EXCHANGE.

The accompanying illustration shows one of the most important buildings in the city and the one in which mining men have the greatest interest. The Consolidated Stock and Petroleum Exchange was organized in 1875 under the title of "The New York Mining Stock Exchange," the new title having been adopted after the absorption of five rival organizations, namely, the American Mining and Stock Exchange, the National Petroleum Exchange, the Miscellaneous Security Board, the American Mining Board and the New York Petroleum Exchange and Stock Board.

The exchange was organized in 1875 under the presidency of Mr. John

Stanton, to have a building of its own. This magnificent structure was commenced in 1887, and the Board room was opened to business on the 16th inst. The opening is thus described:

"At ten o'clock a man with a flower in his buttonhole and a look of peace and happiness on his face hit his desk with a rosewood gavel. As the click echoed through the vaulted arches under which he sat, two thousand men around the Byzantine columns upholding those arches gave a mighty cheer. Then a man in a new spring suit yelled a bid, the blackboard boy got in his work, the room traders shouted their offers, the old familiar vibrant hum arose, and the first day's business began—in the splendid new building of the Consolidated Stock and Petroleum Exchange of New York. Chairman Peters smiled pleasantly upon the



CONSOLIDATED STOCK AND PETROLEUM EXCHANGE, NEW YORK.

Stanton, the well-known treasurer and business manager of the Atlantic Central and Allouez Copper mines of Lake Superior, and he acted as president in 1877 also, since which time he has been the treasurer of the exchange. Mr. George B. Sutterlee was president in 1877-78 and '79; S. V. White in 1880-81 and '82; Chas. O. Morris in 1883, and C. G. Wilson in 1884-85, '86 and 1887.

The business of the Exchange has increased at a marvelous rate and the transactions have grown to rival those of the New York Stock Exchange in railroad stocks, while in mining stocks it has almost a monopoly. The membership of the Exchange has increased rapidly until it now exceeds 2500, and the treasury fund, which in 1877 was \$10,000, in 1887 exceeded \$400,000.

The exchange has reached such importance in its membership and transactions that it became necessary, in order to get suitable accommo-

crowd that packed the gallery, and Secretary Lewis leaned back in his chair with the air of a man to whom life could give no more of glory."

From the main floor, with its 10,000 square feet of space, the effect is indescribably strong, light and beautiful. From heavy Byzantine columns of chocolate granite, with elaborately carved capitals, rise long, graceful spans to the oblong skylight in the center of the ceiling. But above the galleries, which extend wholly around the room, these spans are broken with smaller columns of similar design, giving character and weight to the mezzanine story. The design, in fact, is an inspiration, and, finished as it is in light tones, is highly effective. On the Exchange Place side of the floor is the Chairman's rostrum, of chocolate and black marble. The blackboard runs across the New street end. Opposite the rostrum is the grand staircase leading to the galleries above. Such is the temple given over wholly to the business of the Exchange.

The building is a conspicuous ornament of lower Broadway, rising from the corner of Exchange Place, and running back to New street. The architect, Mr. Edward D. Lindsay, of 32 Liberty street, has confined the material employed to brick, terra cotta and carved sandstone, and has produced an imposing and thoroughly artistic effect. The style is Romanesque, eclectically treated, and the building is absolutely fire-proof.

Access to the Exchange room is secured by an archway in Broadway fourteen feet wide, and this opening can be diminished at will as the state of the weather or temperature demands. In fact, if necessary or agreeable, the entire Broadway front could be opened directly upon the main floor, giving free access along the whole line.

Upon New street there is an archway eighteen feet wide, with a staircase ten feet wide leading directly from New street to the main floor. By the side of this staircase a wide corridor gives access to both elevators in the basement, and besides to the restaurant, the members' cloak and toilet room and the Exchange Clearing House. This corridor is reached by a wide staircase from the northernmost entrance on Broadway, and a person can thus pass from New street to Broadway, or vice versa, without entering the main floor. This staircase also facilitates communication for the members in going to their cloak and toilet room. The entrances, vestibules and corridors are floored with marble or other tile, but the main floor is floored with handsome yellow pine laid in large panels separated by mahogany strips, so that as the floor wears it may be repaired in sections, thus entailing no interruption to business. The main floor is superbly lighted. The three arches on the south, the three each on Broadway and New street, besides smaller windows on Exchange Place and the great skylight, affords an area of glass equal to 4500 square feet of surface.

The "Mining Exchange" has now the most convenient home of any exchange in this country, and no doubt this will aid in calling attention to the important department of its business, that of dealing in mining securities. Unfortunately many of the shares on its list have represented worthless, and some of them highly disreputable, enterprises, but now that the Exchange has grown in wealth and dignity it is to be hoped that greater vigilance and care will be exercised in admitting stocks to quotation. It may thus become a very important aid to and promoter of the interests of legitimate mining.

MICA MINING IN NORTH CAROLINA.—I.

Written for the Engineering and Mining Journal by Wm. B. Phillips.

Modern mica mining began in North Carolina in 1868-69. Some little work was done in 1867, but beyond opening two or three pits, and getting out several hundred pounds of fine mica, not a great deal was accomplished. Reference has already been made in the pages of this journal* to the fact that some of the mines had been worked by the prehistoric inhabitants of the country, who disposed of the mica, in part at least, to the mound-builders.† These "old men" were possessed of considerable skill, not only in the location of good deposits, but also in the extraction of the mica. The first is proved by the fact that by following their "leads" modern miners have found the best mica, and the second by the fact that sheets of mica of considerable size have been found in old mounds. Although some evidences of the use of other than stone tools have been found in the old drifts, the principal method used by these "ancients" was fire setting.

They did not penetrate into the hard rock to any great extent, nor is it likely that they sank shafts. Curiously enough, the method employed for opening the deposits in those days, viz., by open trench, is that at present used in New Hampshire. Shaft-mining, vertical and underlie, is the exception in New Hampshire; it is the rule in North Carolina. In 1867, the Hon. Thomas L. Clingman, of Asheville, N. C., was induced by some New York mica dealers to undertake investigations in North Carolina for mica. Small sheets were then selling at \$8 per pound, and the supply was uncertain. He began operations in Cleveland County, and found some good mica, which was shipped to New York. This was late in 1867, or early in 1868, and is the first instance I have been able to find of the prosecution of mica mining, as a regular business, since the days of the Indian mound-builders. Some work was done at this time in Burke and Rutherford counties, also, but with no very satisfactory results. He then transferred his explorations to Yancey and Mitchell counties, selecting as the best spots what was afterwards the Ray mine, in Yancey, and the Silvers or Sink Hole, and the Buchanan or Clarissa mines in Mitchell.

The first work done at the Silvers mine was not, however, in searching for mica, but for silver. It was known that at this place were great pits and trenches, amounting in all to some 1800 feet in length, and in places 20 feet deep, with large trees grown up on the debris, and with every appearance of age. The very memory of these old miners had passed away, and nothing was left of them but their pits and trenches here, and pieces of mica found in the Indian mounds in the Ohio valley. Tradition, always busy with the unknown, had determined that these workings had been undertaken for silver. Some specimens of the rock from the Silvers mine were pronounced by the ubiquitous practical miner to resemble some rich silver ores from Mexico, but the assay proved them to be worthless. The first work done at the Silvers mine was for silver, and it was not until it was found that there was no silver that attention was turned to the mica.

One at least of his New York friends had accompanied Clingman to Yancey County to search for mica, but did not think well enough of the enterprise to continue in it. Clingman, however, continued the work of mica mining at the Silvers mine, and obtained several hundred pounds of fine mica.‡ Being called away by more pressing business, he instructed his foreman to collect the mica and store it away. This, however, was not done, and several large blocks were left on the ground. A stock-drover passing that way with his wagon took one of these blocks to Knoxville, Tenn. It was seen by J. G. Heap, of Heap & Clapp, dealers in stoves and tin ware, who at once recognized its value. He and his

partner disposed of their business in Knoxville and went at once to Mitchell County, N. C., and began mica mining.* This was in 1869. From that time and for several years they conducted a very profitable business, realizing for some of the mica, as Mr. Heap himself assured the writer, as much as \$11 per pound.

Heap & Clapp first worked the Silvers mine, and by following the old leads obtained large quantities of excellent mica. They cut new trenches, ran an adit in and sank several shafts. They also worked the Buchanan or Clarissa mine, by shaft and adit, and found it equally good. Several other mines were opened and worked, as the Deake and Flat-Rock. As local experience was acquired (the *sine qua non* in mica mining as in every other kind), they extended their operations, so that up to 1882 of the 400,000 pounds obtained Heap & Clapp must have mined by far the greater part. The average spot value of cut mica then was about \$2 per pound, some, however, selling as high as \$11. Even at \$2 the total value of the mica up to 1882 would be \$800,000. As to the profits, no very definite information can now be given. In 1880 the total real and personal capital invested in the North Carolina mica mines was \$6,900, and the value of her product \$61,675—every dollar invested returned \$8.93. I can not say of my own knowledge whether these figures can be accepted or not. If true, if they can be taken as fairly representing the capital and yield, they reveal a most remarkable state of affairs. The waste in mica alone, as we shall hereafter see, is from 85 per cent to 95 per cent in mica mining. That any mining operation utilizing at most only 15 per cent of the stuff brought to bank should return \$8.93 per \$1 invested is simply incredible. It is stated † that some of the free milling gold ores of Dakota are worked at a profit on \$2 a ton, that some stream-tin works in Cornwall yield only two pounds of black tin per ton,‡ and that the pay-dirt at the Eureka claim, near San Juan, California, gave a profit on three cents per ton.¶ So far as the refuse matter is concerned these examples show there are places where it far exceeds the North Carolina mica mine waste. But it is not stated that there was any thing like such a profit as is reported from the mica mines. It is so great as to be incredible. We shall hereafter see that the New Hampshire mines in 1880 yielded twenty cents per \$1 invested, which figure, while indeed somewhat low, is perhaps about right.

There has always been a curious reticence on the part of the North Carolina mica miners and dealers, and a corresponding difficulty in acquiring correct information. While indeed there are some notable exceptions (and to these I would return my warmest acknowledgments of their kindness) they serve but to make the background all the more obscure. I am often at a loss to know to what this reticence is to be ascribed. There are no more hospitable people in the world than the inhabitants of the mountains of Western North Carolina, nor any upon whose willingness to aid one in any laudable undertaking more assurance could be placed. And yet when it comes to mica mining they are reserved to the last degree, and it was only after repeated visits to the mines, and extended acquaintance among the miners, that I was able to acquire much information concerning the business.

It is proposed in the papers that follow to describe this business; the geology of the mining districts; the formation of the veins; dressing the mica; the percentage yield of cut mica from block mica, etc., etc.

(TO BE CONTINUED.)

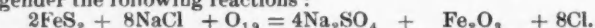
THE DEVELOPMENT OF THE AMERICAN CHEMICAL INDUSTRY.

By Dr. Francis Wyatt.

(Continued from Page 178.)

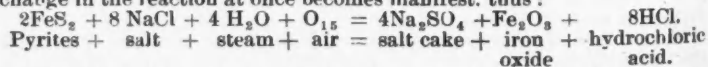
THE HARGREAVES PROCESS (SALT CAKE).

If the sole object of those industrious investigators who have identified themselves with the progress of alkali manufacture has not been merely to confer incalculable benefits upon the rest of mankind, they nevertheless have conferred those benefits by enabling us to reduce the cost of producing both soda and bleaching powder to a merely nominal figure. Hence for their attempted modifications of Leblanc's salt cake process, we owe a deep debt of gratitude to such workers as Longmaid, Mesdach, Thibierge, Kenyon, Hargreaves, Robinson, and many others whose names escape us, for demonstrating the practicability of producing sodium sulphate from common salt by the direct action of sulphur dioxide, and for thereby proving that the whole preliminary routine of vitriol making may be absolutely dispensed with. We shall not attempt to give the details of all the combinations suggested by these inventors; they are to be found in the text-books, and are familiar to the student; it will suffice for our purpose to state broadly that the most plausible of them consist either in roasting a mixture of common salt and pyrites, or in burning the last named in separate furnaces or kilns, and submitting the salt to the action of the gases in suitable vessels. In either case the operation may be conducted with or without the aid of steam, although in both cases its use or otherwise has an all important influence on the nature and composition of the resulting products. Taking ordinary rock salt and iron pyrites ground up and mixed together in the needed proportions as an illustration of this, we shall find that by roasting the mass in a reverberatory furnace with simply the aid of a well regulated draught, we engender the following reactions:



Pyrites + salt + air = salt cake + iron oxide + chlorine.

If, on the other hand, we do not solely rely upon the oxygen of the air, but have recourse to the introduction of a current of steam, the change in the reaction at once becomes manifest, thus:



Pyrites + salt + steam + air = salt cake + iron + hydrochloric oxide acid.

In the first of these two examples the iron pyrites, under the influence

* C. H. Wiley, U. S. Treas. expert, Internal Commerce of the U. S., 1886, p. 235.

† 24th U. S. Census, Vol. XV., p. 843.

‡ Report of the Director of the Mint on Precious Metals, 1884, p. 251.

§ Collins, Metal Mining, p. 56.

¶ J. A. Phillips, Mining and Metallurgy of Gold and Silver, p. 160.

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* W. C. Kerr, Vol. XXXI., No. 13, p. 211.

† Foster, Prehistoric Races of America, pp. 191 and 270.

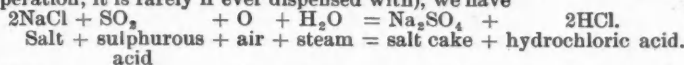
‡ Thos. L. Clingman, priv. com., October 25th, 1887.

of an intense heat, and with the aid of the oxygen sent in with the air become thoroughly oxidized; the sulphur being dissociated unites with oxygen in the ratio of two to one to form sulphurous acid (SO₂), while the iron combines with oxygen in the ratio of 1½ to 1 to form ferric oxide (Fe₂O₃). The presence of the salt, and the fact that there is a continuous excess of oxygen passing through the furnace combine to confer upon the nascent SO₂ a higher state of oxidation, and becoming thus converted into sulphuric anhydride (SO₃), it is enabled to drive away the chlorine from the NaCl, and simultaneously to take up still more oxygen while associating itself with the sodium. When the mass is finally taken from the furnace, therefore, it is composed of anhydrous sulphate of soda and ferric oxides, and as the first is soluble, while the second is insoluble in water, it is easy to separate the two compounds by lixiviation.

In the second example the introduction of the steam has greatly simplified and facilitated the entire transformation. The SO₂ is oxidized to SO₃ in far less time, while the chlorine of the salt, instead of being discharged in a free state, in which it is extremely difficult to be dealt with satisfactorily, enters into combination with the hydrogen of the steam, and forms the far more easily recoverable hydrochloric acid.

Thus stated upon paper, few things more feasible than this manner of producing salt cake could be imagined; and, yet, although several important manufacturers in various parts of Europe have endeavored from time to time within the past few years to adopt it (with some slight modifications of their own) in preference to the method of Leblanc, they have all met with failure, and been compelled, after considerable loss, to

while if steam be made to intervene (and since it so vastly facilitates the operation, it is rarely if ever dispensed with), we have



Thus, as we perceive, the sulphur dioxide (SO₂) resulting from the burning pyrites, effects, with the aid of the air and the steam, the transformation of the NaCl into sodium sulphate and hydrochloric acid in exactly the same manner, from a chemical standpoint, as by the furnacing of salt with oil of vitriol; while, speaking industrially, there is the important advantage of doing away with the manufacture of sulphuric acid, the construction of costly lead chambers, and the use of nitrate of soda or nitric acid.

Like all other modifications of accepted industrial methods, however, this one, as first suggested, was not without its serious drawbacks. Nor did these drawbacks fail to assist prejudice, stupidity, and jealousy, in opposing the most serious obstacles in the way of its progress. Probably its foremost difficulty was found to lie in the impossibility of thoroughly converting all the salt into sulphate! Inevitably attendant upon this were the natural consequences, that the sulphate and chloride were only to be separated by expensive lixiviation; that the recrystallized Glaubers salt had to be rendered anhydrous by calcination, and that the hydrochloric acid gas which passed off into the condensers was always contaminated by a sufficient proportion of sulphur dioxide to impair or destroy its general utility. How to effectually remove these impediments was the problem to be solved, and it was

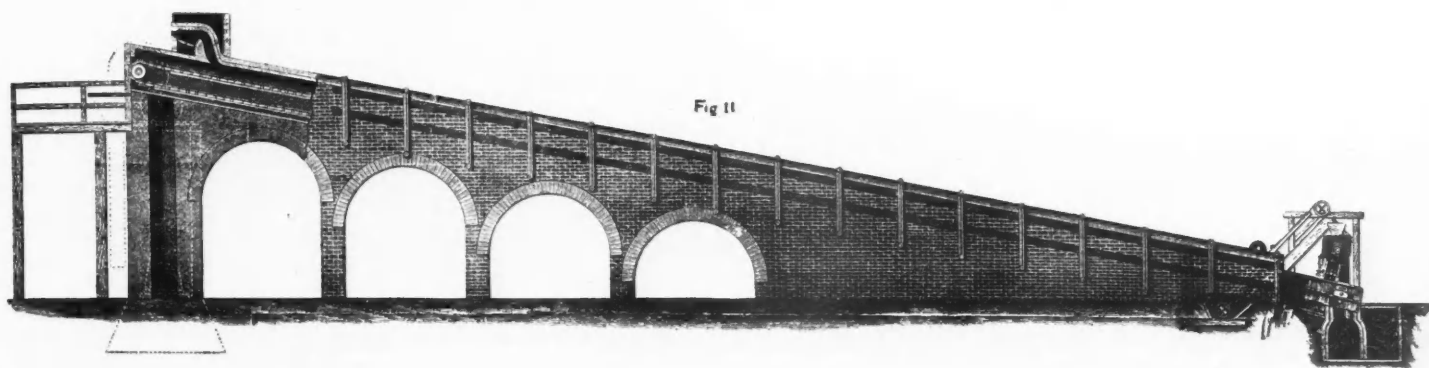


Fig 11

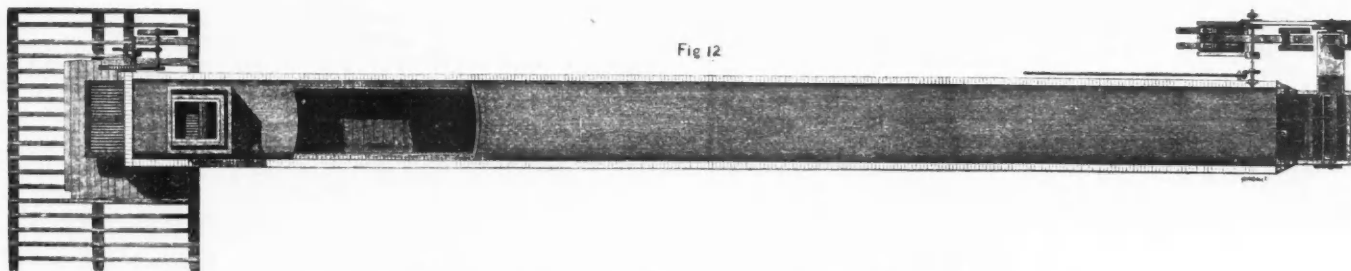
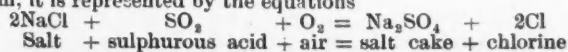


Fig 12

HARGREAVE'S APPARATUS FOR PREPARING THE SALT.

reject it. While we can not positively explain the reason why, practical experiments have proven that it is impossible to completely decompose the salt in the furnace. So large is the proportion, in fact, which frequently remains impervious to the SO₂ that it is necessary to treat it, when taken from the kiln and cooled, with a sufficiency of sulphuric acid to accomplish the conversion. In such cases it is imperative that the mass be recalcined at a very high temperature, to insure the reaction of the sodium bisulphate and to destroy all traces of sulphate of iron and alumina, and as this can only be done by reverting to the true Leblanc process. The result is the reverse of economical. We have heard it urged that this difficulty with proper management can be readily obviated—that, in fact, it has no right ever to exist, and as we are insufficiently enlightened by actual practical or industrial experience, we are disinclined to controvert the statement. Presuming, however, that all should go as “merry as a marriage bell” in the kiln—that the decomposition has been perfect, that no hitch whatever has occurred, there is still, in our opinion, an important, nay, an insurmountable objection to the process which effectually debars it from even partial adoption. Our calcined mass is, in all cases, largely composed of insoluble ferric oxide, which can only be eliminated by careful and repeated washing. When, by this washing the separation has been effected, the sodium sulphate has passed into solution and must be regained from the lixiviation water by evaporation and recrystallization. Now these crystals are not what we allude to as salt cake, but are merely Glaubers salts (Na₂SO₄ + 10H₂O), or, in other words, are made up of 1 molecule of sodium sulphate and 10 molecules of water, and they are of no earthly use for the purposes we are considering until, by a fresh calcination, the water has been driven away. When we reflect that this constitutes the third time of its passing through the furnace, and upon the trouble and cost thereby entailed for manipulation and fuel, we must see that it would be waste of time to make any attempt to adopt such a process here, and we may therefore pass on to consider the method of separately roasting the pyrites and bringing the gases only into contact with the salt, which, as we shall find, is much more worthy of our serious attention.

When the contemplated reaction in this case is induced in the absence of steam, it is represented by the equations



reserved for Mr. Hargreaves, of the firm of Hargreaves and Robinson, of Widnes, Lancashire, to satisfactorily solve it after much patient work and many persistent trials. To say that Mr. Hargreaves is now very generally and very justly regarded in Europe as one of the best chemical engineers of his time, would probably be a superfluous statement. A man of wide reading, great natural intelligence, practical ability and determination, whatever work he has undertaken he has always done well, and he is even reputed to never handle a piece of plant or machinery without improving upon it or making it afford its maximum results. He is also said to never either accept or propound a theory until he has subjected it to the tests of practical demonstration, and these are certainly the qualities which, more than any others, command success in the world of industry. When chemical manufacture has assumed its proper position among the institutions of America, it is to be hoped that we may rear up sons who will strive to possess them in as great a degree as Mr. Hargreaves, and who will have been taught that to merely imagine a process and prove its exactitude by figures in the laboratory is but a step in the right direction. We have no right to anticipate the universal acceptance or adoption of any invention by leading producers of great staple commodities, until we have proved it to be not only scientifically accurate but industrially economical. If examples of the truth of this maxim did not come before us all every day, we should find an excellent one in the process now under review. All those who had only studied the theoretical reactions it involves readily indorsed it, and admitted its feasibility; but no sooner did they seek to apply it to actual productive or practical work than they discovered it to be full of such dangers and unlooked-for difficulties as we have described, and, without the invention of the improved *mechanical appliances* by Mr. Hargreaves, which we will now proceed to describe, they would certainly have formally and forever renounced it. According to the inventor, while any kind of salt, even rock salt, may be used, the imperative point of departure is to convert it into uniformly solid masses, which, while of sufficient tenacity and resisting power, shall nevertheless retain the greatest possible porosity. His end in this particular is attained by feeding the ground material into a wooden box and there moistening it by a current of steam with continuous automatic stirring. Leaving the box in the form of a thick paste, it spreads itself upon iron plates which revolve very slowly upon endless chains over an inclined flue, and, coming

into contact with a set of stampers it is cut, by them, into small squares of a brick-like shape. This preparation of the salt will be readily understood after a glance at our illustrations in Figs. 11 and 12, which give the elevation, part section, and plan of the apparatus employed.

(TO BE CONTINUED.)

A NEW DEVICE FOR OPERATING BLAST-FURNACE CHARGING-BELLS.*

By Frank Calvin Roberts, C. E., Philadelphia, Pa.

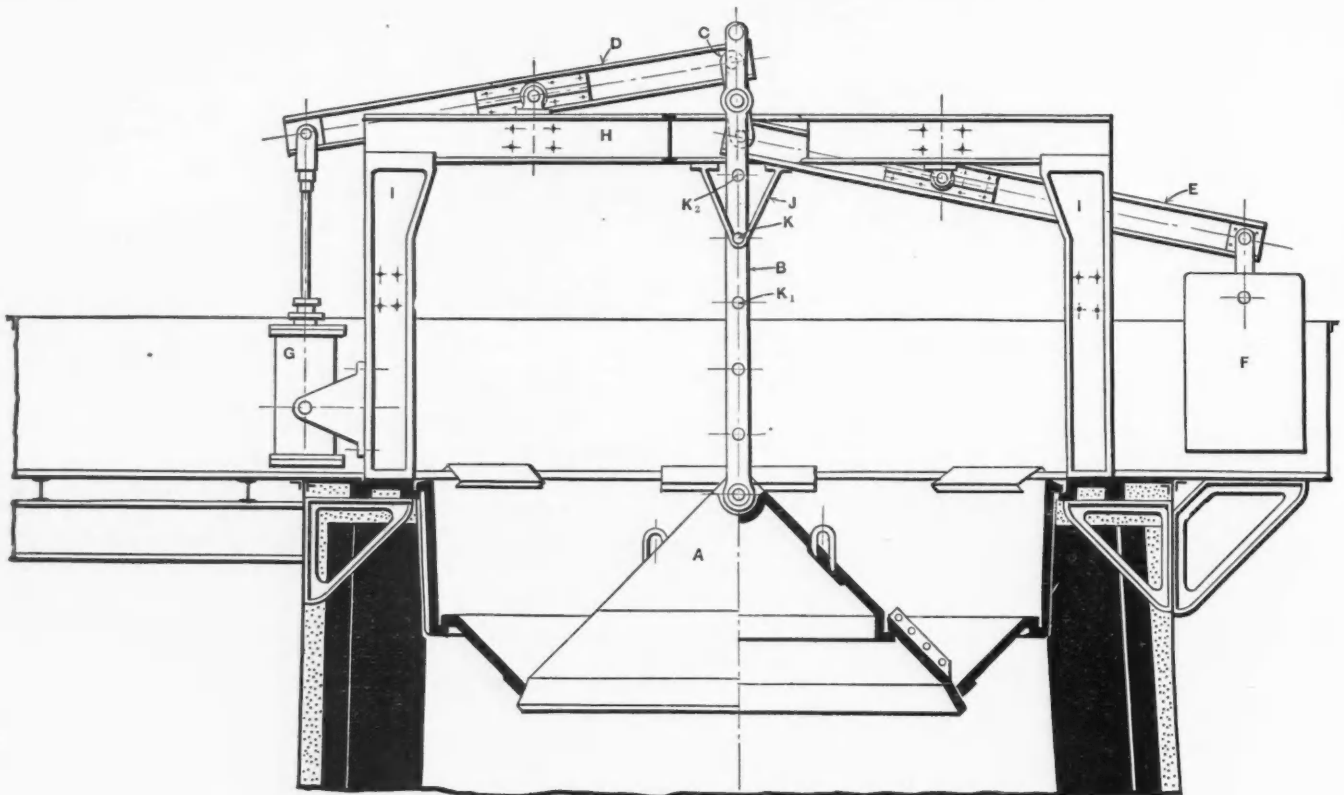
An examination of the various devices employed for operating blast-furnace charging-bells has led me to design the arrangement shown in the accompanying figure. In order to contribute to the even distribution of stock, the movement of the bell should be in a vertical line, since any tendency to side-thrust which may be induced operates to the detriment of the even distribution of material. It is also essential that a tight joint should be secured between the hopper-ring and the lip of the bell. This is possible when the bell, in returning after each discharge, seats itself instantly and firmly around its entire base. These requirements render it highly desirable that any tendency to the vibration of the bell should be obviated, and that, to secure proper action, the center of suspension should move in a vertical line. Again, the high temperature to which the bell rod is, at times, exposed, renders it necessary that some simple means should be provided for the adjustment of the bell to its seat.

These requirements are fulfilled in the design illustrated, in which *D*

air-cushion cylinder, connected to the beam *E*, has been applied to the following furnaces: Three 18 by 75 foot furnaces for the Alabama & Tennessee Coal & Iron Company, Sheffield, Alabama. Two 17 by 75 foot furnaces for the Sloss Steel & Iron Company, Birmingham, Alabama. One 15 by 65 foot furnace for the New York & Perry Coal & Iron Company, Shawnee, Ohio. Two 12 by 60 foot furnaces for the Nashville Steel, Iron & Charcoal Company, Nashville, Tennessee. One 12 by 60 foot furnace for the Decatur Land Improvement & Furnace Company, Decatur, Alabama.

Swedish Silver Production.—During last year the Sala silver mines, the only mines in Sweden producing metallic silver, yielded 2881 pounds of pure silver, all of which was delivered to the Swedish mint. The production last year was about 1 cwt. in excess of that of 1886.

Soapstone as a Paint.—Messrs. Holtzapfel, Newcastle-upon-Tyne, etc., have recently taken out patent rights for the manufacture of a composition from Chinese soapstone, which they strongly recommend as a reliable protection against rusting on steel and iron vessels, iron piers, and other structures. The soapstone, which is not affected by heat, atmospheric influence, or ordinary acids, is mixed in the new composition with a quick-drying varnish of great tenacity and hardness, producing a paint of much capacity and firmness, and presenting an enamel-like surface of a bright red color. Soapstone is largely used in China for preserving structures liable to disintegrate under atmospheric influences, and the effect has been most satisfactory.



ROBERTS' BLAST-FURNACE CHARGING-BELL.

and *E* represent the bell-beams pivoted to the eye-beams *H* and joined together at their extremities by the links *C*. From the centers of these links is suspended the bell *A*, by means of two rods *B*. The steam cylinder *G* is connected to the bell-beam *B*, and the weight of the bell is counterbalanced by the weight *F*, attached to the beam *E*. The operation of the device is evident. The dropping of the bell causes the centers of the link-pins to travel in arcs of opposite directions—the point of suspension between them maintaining a neutral or vertical line.

The adjustment of the bell to its seat is effected by varying the length of the piston-rod connection to the bell-beam *D*, by means of a clevis, with adjusting-nuts on the piston-rod above and below the seat of the clevis. This adjustment may also be secured by the insertion of a right-and-left nut (turn buckle) between the clevis and the piston-rod.

The bell may be easily removed by a slight modification of a familiar device. The spacing of the holes *K*, *K*₁, *K*₂, etc., shown in the bell-rod *B*, is equal to the stroke of the bell cylinders. Straps *J* are riveted to each of the supporting beams *H*, and are of such length that, when the bell is seated, a pin may be inserted into the hole *K*, with the extremities resting on the straps. The weight of the bell is in this manner supported independently of the beams *D* and *E*. The link *C* may be disconnected from the bell rod and lowered to a point where its center is opposite the hole *K*₂; connection being made between the link and the rod, steam is admitted to the top of the cylinder and the bell raised until the hole *K*₁ is opposite the lower extremity of *J*, when the insertion of a pin, as before, relieves the beams *D* and *E* of the weight of the bell. The operation, as described, is repeated until the bell is lifted clear of the hopper.

This design for operating blast-furnace bells, with the addition of an

* A paper read before the American Institute of Mining Engineers, February, 1888.

The Tehuantepec Isthmian Railway.—A rumor which is said to be trustworthy is in circulation in the city of Mexico to the effect that the Government is seriously considering a proposition for the completion of the railway across the Isthmus of Tehuantepec by an English syndicate. The road is to be well built, with steel rails, fine station houses and an abundance of rolling stock. The Government is to issue bonds at par, to run sixty years, with interest at 5 per cent. per annum. If the information is correct, the terms on which the money will be advanced are advantageous to Mexico. The loan, as it may be called, is not to be secured by the hypothecation of receipts of the Treasury, but by a claim against the receipts from the freight and passenger business of the road.

A Solid Timber Ship.—Undaunted by the disastrous end of the great timber raft built in Nova Scotia for parties in New York city, but which was torn to pieces by the seas and the fragments borne away to the Bermuda Islands, a second monster raft or solid timber ship for the same owners will be launched in June. The dimensions will be: Total length over all, 600 feet; width, 54 feet; depth, 38 feet. She will be constructed of about 25,000 spruce trees. The ship has no hold, but her hull is a solid mass from keel to deck, rounding up fore and aft. The vessel will carry six masts, each built 12 feet into the hull and fitted with spring stays and shrouds. She will be square rigged, with fore and aft trysails, and will be fitted with windlass, anchors, rudder and full steering gear. The foremast head and mizzenmast head will be fitted with crow's nests, each supplied with a powerful, self-feeding lamp, capable of burning for 30 days, so that in the event of the craft being temporarily abandoned at sea she will give timely warning by night to all approaching vessels. She will carry a crew of 20 men, for whose accommodation a large house is to be erected on the deck.

Asbestos Theater Curtains.—The London *Engineer* contains an illustrated description of the asbestos curtain for Terry's Theater, and also one designed for the Queen's Theater in Manchester. They are made of asbestos cloth specially strengthened by a fine wire running through each asbestos strand and stretched upon a counterbalanced iron frame sliding up and down in guides. A layer of asbestos cloth may be put on each side of the frame, leaving an air space between.

Chinese Objections to American Petroleum.—The State Department is advised that the Chinese government has entered upon a policy the object of which seems to be to forbid the importation of petroleum into the Chinese empire. It is suggested that the Chinese government is actuated in this movement by a desire to retaliate in some way for the restrictive legislation in the United States against the Chinese. American exporters have built up a large trade in oil with China.

A New Industry for South Wales—England.—The old steel works at Landore, Swansea, lately vacated by the Landore Siemens Steel Company for their new and extended works at Morriston, Swansea, have been taken by a new company under the name of Messrs. Mannesmann & Co. The principals, we understand, are A. Mannesmann, of Remscheid; J. Gordon of the Landore Siemens Steel Company; and Herr Krupp, of Essen. New plant has been laid down for the manufacture of steel pipes by the method patented by A. Mannesmann, and which has been in successful operation at Burbach, in Germany, for some time. The new company has spent a very considerable sum in laying out the works, and it is expected that the outturn will be on a much larger scale than hitherto attained in any of the continental works. A brief description of the process appeared in our issue of November 13th, 1886.

High-Speed Gearing.—*Engineering* says: During the last few years, and particularly since the adoption of double-helical teeth, a great increase has been made in the speed at which heavy gearing is run, and in many cases there are now successfully adopted speeds which in former days would have been regarded as utterly impracticable. The most striking instances of this which we have come across is in the case of a pair of double-helical wheels at the works of Messrs. R. Johnson & Nephew, wire-drawers of Manchester. These wheels, which were cast by Messrs. Sharples & Co., of Ramsbottom, Lancashire, are 12 inches wide on the face by 6 feet 3 inches in diameter, and they have now been running for over a year at 220 revolutions per minute, the pitch-line speed being thus 4319 feet per minute. Notwithstanding this enormous speed the wheels run with scarcely any noise, and their working has been most satisfactory. This is the highest speed we have heard of for geared wheels running iron to iron, and the fact that it has been adopted with success is a most interesting one.

Nickel Plating.—According to the *Bulletin Internationale de l'Electricité*, the following solution is employed for nickel plating by several firms in Hainault. It is said to give a coating of nickel firmly and rapidly deposited. The composition of the bath is as follows: Sulphate of nickel, 1 pound; neutral tartrate of ammonia, 11.6 ounces; tannic acid with ether, 0.8 ounce; water, 16 pints. The neutral tartrate of ammonia is obtained by saturating tartaric acid solution with ammonia. The nickel sulphate to be added must be carefully neutralized. This having been done the whole is dissolved in rather more than three pints of water, and boiled for about a quarter of an hour. Sufficient water is then added to make about sixteen pints of solution, and the whole is finally filtered. The deposit obtained is said to be white, soft, and homogeneous. It has no roughness of surface, and will not scale off, provided the plates have been thoroughly cleaned. By this method good nickel deposits can be obtained on either the rough or prepared castings, and at a cost but little greater than that of copper-plating.

Electric Coal-Cutting Machine.—The *Electrician* says: The application of an electric motor to coal-cutting machinery has been carried out by Messrs. Bower, Blackburn, and Mori, of Woodlesford. The framework or bed-plate of the machine is supported on wheels. Within the framework is mounted or applied the electric motor, which may be of any suitable construction. A rotary motion is transmitted to the shaft carrying the cutter bar through gearing. The lower part of the framework forms a circular turn-table, and is fitted so as to be capable of a rotary movement on the bed-plate, this rotary movement being effected by means of a worm, mounted on a shaft, supported in the bearing, attached to suitable brackets, mounted on the bed-plate, and worm-wheel segment attached to the upper part of the framework. By this means the cutter bar can be moved along by the attendant as the coal is being cut, and the proper feed given thereto. Although by preference the motor is carried on or attached to the coal-cutting machine, it may of course be placed at any convenient distance therefrom, and motion transmitted from such motor to the machine by gearing.

Mould's New Coal Getter.—Mechanical coal getters are not so plentiful in the collieries of England as on the continent. The tendency of modern legislation is to dispense with the use of powder in fiery mines. Even though water cartridges and non-flaming explosives are comparatively safe, there can be no doubt that the introduction of an efficient mechanical arrangement for breaking down coals without resort to the use of explosives would be a boon to the mining community. Mr. Enoch Moulds, manager of the Whitebarn Colliery, Newcastle, Staffordshire, has recently patented a coal getter which is said to be worthy of trial by colliery proprietors as a substitute for explosives in gaseous or dusty mines. The machine is constructed on the wedge system, so constructed as to exercise a pressure from back to front. Supporting the coal to be holed, the piston cylinder of the getter, 8 inches in diameter, is inserted, and by means of inclined planes the coal is gripped at the far end of the hole and then rifted backward to the face by the aid of hydraulic pressure. The result is an increase of the proportion of large coals obtained, and the shattering influence of an explosive is obviated. The quantity of water required to work the hydraulic jack is three quarts, and by an ingenious self-containing arrangement one supply is sufficient for an indefinite period. The parts of the getter are few in number, simple in construction. The machine only weighs altogether 102 pounds. The patentee claims that

the use of his coal getter has pecuniary advantages over that of explosives, regardless of its important bearing upon the proportionate yield of large coal.

Chance's Process for the Recovery of Sulphur from Alkali Waste.—At a recent meeting of the Society of Chemical Industry, Mr. Alexander M. Chance, of Birmingham, described a process for the recovery of sulphur from alkali waste, and of great practical value to alkali makers. At present, the whole of the sulphuric acid employed to decompose salt in the production of soda is lost. Some years ago a process was invented for recovering the sulphur from this waste, and rendering it available for the reproduction of sulphuric acid. That invention was instantly met by a reduction of 50 per cent in the prices charged by the foreign copper companies for the pyrites from which sulphur was conveniently procured. After that reduction it became cheaper to go on throwing sulphur into the waste heap than to recover it. Now Mr. Chance brings forward a greatly improved and cheapened process, by which every alkali maker can readily recover the whole of the waste sulphur. Lime is burnt in the ordinary way in kilns with coke, but the resulting gases, instead of escaping into the air, are pumped into vessels containing the waste calcium sulphide made into a creamy paste with water. The sulphureted hydrogen is expelled by the carbonic acid from the kilns, and is made to pass over heated oxide of iron. By careful regulation of the air supplied along with the gas the hydrogen alone is oxidized, and the pure sulphur is obtained in suitable condensers. Or, if it be preferred, the sulphureted hydrogen can be burned in proper apparatus and reconverted directly into sulphuric acid, which is again used to decompose salt, and thus recommences the cycle. The lime burned in the kilns is required either to absorb the chlorine expelled from the salt in case bleaching powder is manufactured, or to absorb carbonic acid in case caustic soda is required.

PATENTS GRANTED BY THE UNITED STATES PATENT-OFFICE.

The following is a list of the patents relating to mining, metallurgy, and kindred subjects, issued by the United States Patent-Office.

PATENTS GRANTED APRIL 17TH, 1888.

- 381,114. Coal-Drill-Bit. Daniel Corgan, Luzerne, Pa.
 381,115. Apparatus for Casting Car-Wheels. John R. Davies, Pullman, Ill., Assignor to the Allen Paper Car Wheel Company, of New Jersey.
 381,118. Apparatus for Separating Lead or Base Bullion in Smelting from Slag, Mattes and Speiss. Walter B. Devereux, Aspen, Colo.
 381,119. Apparatus for Separating Base Bullion from Slag, Mattes and Speiss. Walter B. Devereux, Aspen, Colo.
 381,138. Apparatus for the Transmission of Power. Thomas D. Hollick and William E. Rickard, London, County of Middlesex, England.
 381,149. Regulating Live Steam and Exhaust from Steam Engines. James J. Lowden, Boston, Mass.
 381,150. Separator. James J. Lowden, Boston, Mass.
 381,152. Valve for Steam Engines. John S. Marshall, Imlay City, Mich.
 381,156. Molding Apparatus. John B. McCormick, Holyoke, Mass.
 381,190. Cut-Off Valve. Aaron Van Gynsling, Albany, N. Y.
 381,199. Wire-Rod Reeling Machine. Horace A. Young, Worcester, Mass.
 381,200. Automatic Method of Draining Coal Mines. George Stitzmann, Millvale, Pa.
 381,211. Compensating Pump Rod. William H. Burnham and John H. Miller, Batavia, Ill., Assignors to the United States Wind Engine and Pump Company, same place.
 381,212. Pump. William H. Burnham and John H. Miller, Batavia, Ill., Assignors to the United States Wind Engine and Pump Company, same place.
 381,217. Reeling Apparatus for Rod-Rolling Mills. Fred H. Daniels, Worcester, Mass.
 381,222. Electric Motor. Philip Diehl, Elizabeth, N. J.
 381,226. Coating Metal Plates with Tin or Other Metals. Daniel Edwards, Richard Lewis and Philip Jones, Swansea, Eng.
 381,228. Means for Regulating and Controlling Electric Motors. Bradley A. Fiske, U. S. Navy.
 381,230. Machine for Slashing and Expanding Flat Sheet Metal to form Meshes. John F. Golding and George B. Durkee, Chicago, Ill., Assignors by direct and mesne assignments to the Expanded Metal Company, of Missouri.
 381,231. Machine for Making Slashed Metallic Screening. John F. Golding, Chicago, Ill., Assignor to the Expanded Metal Company, of Missouri.
 381,244. Utilizing Exhaust Steam. Moritz Honigsmann, Grevenberg, Germany.
 381,254. Regulator for Electric Currents. Edward B. Knowles, Brooklyn, N. Y., Assignor to the Mutual Electric Manufacturing Company, of New York.
 381,280. Machine for Making, Distributing and Driving Nails. Freeborn F. Raymond, 2d, Newton, Mass.
 381,287. Rotary Engine. James E. Sneyely, Chetopa, Kan.
 381,297. Machine for Slotting Tubes. John H. Vinton, Boston, Mass., Assignor to the Peninsular Novelty Company, Grand Rapids, Mich.
 381,301. Apparatus for Collecting and Utilizing Waste Lead-Fumes. George H. Ward, Jolpin, Mo.
 381,311. Machine for Cold Rolling Wire. Henry A. Williams, Taunton, Mass.
 381,320. Rolls for Making Barbed Wire. Michael J. Baumbach, Pittsburg, Pa.
 381,321. Apparatus for Reducing Bituminous Rock. George E. Belmor, San Francisco, Cal.
 381,322. Conveyor Apparatus. George C. Blickensderfer, Stamford, Conn.
 381,345. Brick-Machine. William Dengolesky, Boonville, Mo.
 381,365. Wire-Rope-Making Machine. Andrew S. Halliday, San Francisco, Cal.
 381,368. Steam-Boiler. Clementina J. M. Hayna, St. Louis, Mo.
 381,372. Apparatus for Electrolysis. Eugene Hermite and Charles F. Cooper, Pownall Road, Dalston, County of Middlesex, England, Assignors of one third to Edward James Paterson, same place.
 381,373. Apparatus for Measuring the Quantity of Water Flowing Through a Pipe. Clemens Herschel, Holyoke, Mass.
 381,374. Separator. Frank A. Hine, Tenafly, N. J.
 381,375. Lubricator. John R. Hodges and William M. Davie, Portage, Wis.
 381,383. Brick-Drying Tunnel. Ernst V. Johnson, Chicago, Ill.
 381,385. Ore-Crushing Machine. Smith W. Kimble, Denver, Colo.
 381,398. Dynamo-Electric Machine. Richard H. Mather, Windsor, Conn.
 381,404. Friction Roller for Cable Grips and other purposes. Thomas J. Mayall, Reading, Mass.; Lucy A. Mayall, Executrix of said Thomas J. Mayall, deceased.
 381,408. Wire Rod Reeling Machine. Charles H. Morgan, Worcester, Mass.
 381,421. Dynamo-Electric Generator. Elias H. Ries, Baltimore, Md., Assignor of one half to Albert H. Henderson, same place.
 381,441 and 381,443. Electric Meter. Elinu Thomson, Lynn, Mass.
 381,450. Feed-Water Regulator. James W. Weaver, Toronto, Ontario, Canada.
 381,451. Dynamo-Electric Machine. Jonas Wenstrom, Orebro, Sweden.
 381,453. Apparatus for the Manufacture of Armor-Plates. Alexander Wilson, Sheffield, County of York, England.
 381,456. Apron for Ore-Concentrating Machines. Geo. E. Woodbury, San Francisco, Cal.
 381,462. Combined Wire Stretcher and Tension. Matthew F. Connett, Jr., Peoria, Ill., Assignor, by mesne assignments, to the Star Fence Machine Company, same place.
 381,474. Device for Handling Heavy Masses of Metal. Luman F. Johnson, Cleveland, Ohio.
 381,480. Electric Meter. Samuel D. Mott, New York, N. Y., Assignor, by direct and mesne assignments, to the Schuyler Electric Company, Middletown, Conn.
 381,488. Gas Engine. George W. Stewart, New York, N. Y.

THE METALLURGY OF STEEL.*

By Henry M. Howe.

(Continued from page 273.)

But quite independently of this a mass of cogent cumulative evidence leads to the same conclusion. Its chief points are that the escape of gas from both molten and solid iron can be stimulated and arrested by purely physical means, and in case of molten iron by independent chemical means, both of which almost certainly act through the metals solvent power: that gas escapes and blowholes form when no gas-forming reaction is probable: and that the phenomena of the escape and absorption of gas in general by iron are very closely analogous to those of its escape and absorption by other substances in which it is undoubtedly in solution, if there be such a thing as solution.

From the fact that only nitrogen and hydrogen are found on boring cold blowhole-holding iron, and from other suggestive facts, it has been inferred that these gases alone cause blowholes: but this inference is not justified. There is good reason to believe that carbonic oxide co-operates in forming blowholes: this granted, it is uncertain whether it escapes from solution, or reaction, or both.

§§ 213 to 218 chiefly present the evidence and reasoning which show that a part at least of these gases escapes from solution, § 219 the reasons for regarding reaction as a contributory cause.

I must again point out that, though mechanical retention is not an important cause of the presence of blowhole-forming gases in the cases which we will now study, it may be under other conditions.

§ 213. EVIDENCE FROM THE COMPOSITION OF THE GASES.—We have seen in § 207 B, and Tables 55-75, that the hydrogen group always forms a large and usually the chief portion of the mould gases from rising, *i. e.* blowholes forming as well as from most of the classes of non-rising steel, of the soaking pit gases, and of the gases obtained on heating in vacuo; and that it is always practically the sole constituent of the gases found in the blowholes themselves on boring: in brief the gases exhaled before, during, and after the period when blowholes form are largely of this group. The chain of evidence could hardly be more complete. It is next to certain then that hydrogen and nitrogen are an important cause of blowholes; that their proportions cannot be mechanically accounted for;^a that they come from no reaction in the common sense of the word; and hence that they arise from previous solution in the sense here employed.

But, if more closely studied, some features of the composition of the mould gases suggest that hydrogen and nitrogen play an even more important part in the formation of blowholes than at first appears, and that the carbonic oxide which is often abundantly present in these mould gases is connected rather with the early escape of gas, which causes harmless frothing and scattering, than with the later escape during solidification, which causes rising and blowholes. (§§ 201, A : 207, E.)

I. The proportion of carbonic oxide is very much larger in the early than in the late escaping mould gases, constantly decreasing from say 80% in the spiegel reaction gases to say 13% in those of the soaking pit.

II. Spiegel-recarburized basic Bessemer steel, the only

variety of iron whose mould gases are known to be usually rich in carbonic oxide, scatters much but rises little, and is relatively free from blowholes.^a

Moreover, as the scattering diminishes, so does the proportion of carbonic oxide in the gases evolved. Thus, in numbers 84-5 and 86-7, Table 55, page 107, the proportion of carbonic oxide in the gases evolved by basic steel is much less after solidification than in the gases from the same steel during teeming, which is the scattering period, to wit, 54.1 and 62.6% against 81.7 and 77.9%. If we add ferro-silicon to the scattering, carbonic oxide evolving basic steel, the scattering and the proportion of carbonic oxide per 100 of gas evolved both decrease, while the rising may continue. (§ 202 C. : § 207 E., G.)

Further, there is reason to believe that the very treatment which causes this basic steel to scatter also causes it to evolve gas rich in carbonic oxide. For it is stated that basic ingot iron produced by interrupted blowing and without recarburizing, from which our spiegel-recarburized basic steel may be made, neither scatters nor evolves gas rich in carbonic oxide (Table 71). If recarburized with spiegeleisen it does both, if with ferro-silicon it does neither. (§ 202 C.)

We will now consider the evidence which, independently of the composition of the gases, shows that they arise in large part from solution.

§ 214. EVIDENCE FROM ANALOGY.—The solubility of gases in solids and liquids rises with the pressure: in solids and most liquids it falls with rising temperature: it is far greater in liquids than in solids: hence most liquids in solidifying expel much of their dissolved gases. Thus water in freezing expels air; silver spits, expelling its oxygen; copper and nickel expel gas, and blowholes

Fig. 15, CONJECTURED GENERAL SHAPE OF CURVE OF SOLUBILITY OF GASES IN IRON.

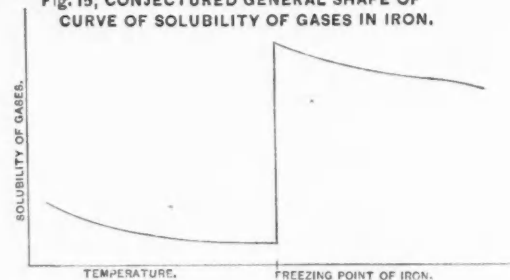


Fig. 15.

form within them. Figure 15 sketches the influence of temperature on solubility, a gentle rise as the temperature falls towards the freezing point, a sudden fall, another gentle rise as the temperature declines still farther. The absorption and expulsion of gases by solids and liquids, at first rapid then gradually slackening, is extremely protracted, probably ceasing asymptotically^b: agitation hastens the expulsion of gas from liquids. The gas expelled by freezing water forms lenticular blowholes, their longer axes normal to the cooling surfaces, and the blowholes themselves lie in regular layers parallel with those surfaces. This is probably true of other freezing liquids.

Mark now how accurately these phenomena are reproduced by iron. That the solubility of gases in both molten and solid iron rises with the pressure has already been shown, by the ebullition and tranquillity produced by lowering and raising the pressure to which molten metal is exposed (§ 188 C, § 202 D), and by the extraction of hydrogen, carbonic oxide and nitrogen from solid iron

^b Charcoal continues to absorb oxygen from the air for at least a month, though most of it is absorbed in a few hours or even seconds. Though gas at first escapes violently from aerated water when uncorked, bubbles long continue to attach themselves to the sides of the vessel which contains it.

* Copyright by the Scientific Publishing Company, 1887.

^a See foot note to § 211.

heated in vacuo, and their reabsorption when the first two gases and ammonia are exposed under pressure to the hot metal (§§ 172, 203). We have seen that agitation, as in pouring and stirring, expels gas from molten iron as from other gas-charged liquids (§ 202 E): and by its blowholes, and better by the violent escape of gas on very sudden cooling, that iron like other liquids expels gas in solidifying (Id.). We have noted the protracted escape of gas from hot solid iron in the moulds, in the soaking pit, and in vacuo (§§ 202 F, 203). Finally the shape and position of the cavities in ingot iron and steel, normal to the cooling surface, resembles those of the bubbles in a frozen ice bottle far more closely than we could expect, in view of the very different conditions under which water and iron solidify, and of the differences in their physical properties, thermal conductivity, specific heat, dilatation, viscosity, etc., which might well modify the shape and distribution of the gas bubbles profoundly. (§ 216.)

Three of these phenomena, the expulsion of gas by agitation, the shape and position of blowholes, and the protracted escape, may be harmonized more or less completely with the reaction theory, though to my mind they harmonize decidedly better with that of solution. I will not say that the phenomena of the expulsion and retention of gas by fall and rise of pressure, of its expulsion on solidification, and of its protracted escape, cannot be harmonized with the former theory, yet their accord with it must be forced, harsh and strident, while with the solution theory it is so harmonious, smooth and flowing that, even without the irresistible argument of the composition of the gases, this theory in its restricted sense would almost compel acceptance.

Two points suggest themselves in which the behavior of iron might at first be thought to differ from that of other solvents. Half blown Bessemer metal evolves gas copiously: it therefore seems to be supersaturated: if its solvent power falls on solidification it should still evolve gas and rise: but it is stated that it yields solid ingots.^a Rising however requires not only the escape of gas during solidification but that the metal shall be of a certain consistency^b and structure, which it may be inferred are lacking in this case.

Again, the escape of carbonic before and during solidification implies that the metal is supersaturated with this gas, we therefore expect to find it in the blowholes on boring the cold metal. Its absence is referred in § 217 to its reabsorption or decomposition.

A. *Temperature and Solvent Power.*—While freezing lowers the solvent power of iron as of other solvents for gases, there is no conclusive evidence that, at temperatures which do not include the freezing point, its solvent power follows the usual law and rises with fall of temperature: nor on the other hand is there good reason to doubt that it does. This uncertainty is not surprising in view of the complexity of our conditions, of the proximity of molten iron to its freezing point, of the long range of temperature through which freezing may extend, and of our limited experimental data. False inferences from our available evidence may be prevented by pointing out how inconclusive it really is. This I now attempt.

Parry's observation^c that the evolution of gas from solid iron could always be completely stopped by lowering the temperature from whiteness to redness, and always

started afresh when the temperature again rose, seems to indicate that the solvent power rises with falling temperature: for the loss of porosity when the temperature falls to redness is not complete enough to arrest the escape of gas totally. Unfortunately, we are in doubt whether the gas obtained at high temperatures came from his metal.^d

If it be true that the tendency to rise is stronger in cool than in moderately hot-blown Bessemer steel (§ 202 A), it would indicate that the former absorbs or retains more gas at the lower temperature of its manufacture than the latter, and hence has more to evolve in setting, which again would support the contention that the solubility falls with rising temperature. But here the phenomena are so complicated by differences of composition accompanying if not causing these differences in temperature, and by the proximity to the freezing point, at which the solubility curve reverses, that we cannot attach great weight to them.

On the other hand, excessively hot-blown steel is said to rise excessively. This is said to be due to a wholly different cause, a reaction between the carbon of the metal and the oxidized surfaces of the mould, which the high temperature causes the metal to wet. Carbonic oxide is thus generated, causing rising and external blowholes.

To test this Walrand polished the interior of one cast-iron mould, removing all oxide, and left a second in the usual oxidized condition. A lot of superheated Bessemer metal poured into both yielded a "perfectly sound" ingot in the former but externally honeycombed ones in the latter.^e We may reasonably question whether Walrand has here hit the true cause. This formation of external blowholes occurs in hot-blown basic ingot iron, even if it hold but 0.07% of carbon, and it is not clear that the little carbon present would be attacked by the oxide of the moulds with sufficient energy to account for these blowholes. It is highly improbable, to say the least, that the oxide of the mould could oxidize enough of the metal's carbon to produce the violent frothing which occurs before solidification, for this probably calls for the oxidation of at least 0.01% of carbon from the whole ingot: as the mould can only attack the outside of the ingot, a much larger local decarburization seems to be implied.

Parry's observation that iron absorbs hydrogen most readily at high temperatures might suggest that the solubility of this gas rises with the temperature. (§ 176 A.) But Graham found a comparatively low temperature most favorable, and Parry's observation, even if uncontradicted, would be more reasonably interpreted as meaning that iron, even though its total absorbing power be less, at first absorbs hydrogen more rapidly at a relatively high temperature because more porous.

The fact that Graham and Parry found that iron evolves much more gas in vacuo than it can be made to reabsorb (§ 206) might suggest that at the exalted temperature of its manufacture its power of dissolving gas is greater than at the relatively low temperature of their absorption experiments, *i. e.* that its solvent power rises with the temperature. But their results are directly opposed by those of Troost and Hautefeuille: and, indeed, during manufacture conditions other than temperature (*e. g.* the presence of nascent gases, § 172, 178 B,) may have favored the absorption of gas.

(TO BE CONTINUED.)

^a Table 71, § 202.

^b § 201 A.

^c § 203.

^d § 176 C.

^e Troilus, Van Nostrand's Eng. Mag., XXXIII., p. 365, 1885.

PERSONAL.

Mr. W. C. Wynkoop, editor of the *Mining Industry*, of Denver, Colo., is at present in this city.

Capt. W. P. Harris has succeeded Captain Wheeler at the Porcupine mine, Port Arthur, Ontario.

Mr. Wm. Allen Smith, Mining Engineer, has been elected President of the United States Cement Company, of Pennsylvania.

Mr. Mark Hopkins, the superintendent of the coal mines of Rock Springs, Wyoming, and assistant-superintendent of the Union Pacific coal mines, has resigned.

After a suspension of nineteen months the *Montana Mining Review*, Helena, Montana, has resumed publication. The publishers are Messrs. Williams, Thurber & Trowbridge.

Mr. Charles A. Ashburner, Engineer of the Fuel Gas and Electric Engineering Company of Pittsburgh, Pa., has gone to San Francisco to introduce the Westinghouse fuel gas system.

Mr. Frank Andrews, Superintendent of Beaver Reduction-Works, Port Arthur, Ontario, has been engaged as assistant superintendent for the Copper Cliff mine, Sudbury, Ontario.

Captain Richard Tretheway died suddenly at Sarnia, Ontario, on the 8th inst. He was connected with the Lake Superior mines for many years, and was the manager of the Silver Islet mine, which position he held until the mine closed down.

Mr. John Daniell, Superintendent of the Tamarack Mining Company of Michigan, has gone to Europe to visit the mines where perpendicular shafts are used, for the purpose of inspecting the machinery used above and below the surface, and all improvements that have been made in mining.

The New York Academy of Sciences has established a section on mineralogy. This section will meet when enough interesting material presents itself to insure a full evening of business, and will publish all papers presented before the Mineralogical Club in the proceedings of the academy. Mr. George F. Kunz was elected President and Mr. J. H. Caswell Secretary of the section.

Mr. Charles Bullman, mining engineer, is about to start for the United States of Colombia to develop some hydraulic mining properties for New York parties. Mr. Bullman is one of the many professional gentlemen who has received his appointment through the services of the *ENGINEERING AND MINING JOURNAL*, which publishes free every week the list of positions vacant.

Mr. Daniel C. Robbins, well-known as the head of the great drug-house of McKesson & Robbins, of New York City, died suddenly in Brooklyn the 15th inst. Mr. Robbins was prominently connected with the drug and chemical trade during his active business life. His last business enterprise was the manufacture of chemicals, and under his direction the New York Quinine and Chemicals Works was incorporated in 1886.

Mr. Thomas Silver, a well-known civil engineer and inventor, died in this city on the 12th inst., aged seventy-five years. In 1854 he invented a marine governor, which has since been in use in the British and French navies and very generally in the merchant marine of all countries, as well as in many stationary engines. His latest inventions were a mechanical lamp and a lamp-burner made to dispense with glass chimneys.

Prof. L. H. Bailey, of the Michigan Agricultural College, has been called to the Chair of Practical and Experimental Horticulture at Cornell University, Ithaca, N. Y. Twenty acres of the farm have been set aside for the horticultural department, and it will be made very prominent. Major Alvord having declined, Prof. I. B. Roberts, of the Cornell Faculty, has been appointed Director of the new experiment agricultural station.

Alfred Nobel, the distinguished Swedish engineer, whose work in the invention and introduction of high explosives in mining is familiar to every one in the profession, died at Cannes, France, on the 13th inst. Probably no other one thing, except the introduction of the rock-drill, has so reduced the cost of mining and tunneling as the adoption of high explosives, and no other engineers contributed so much to this as Alfred Nobel when he introduced nitroglycerine, taking it from the laboratory where its inventor, Sobrero, left it, and making it a practically useful aid in mining.

A mining engineer who is spoken of with high words of commendation, proposes (as stated in an advertisement under special notices on another page) to make a mining report as a thesis for the degree of Ph. D. at the Massachusetts Institute of Technology. The suggestion is novel, and the subject certainly offers the widest possible field for the investigation of problems of the greatest interest, and the work in competent hands should possess great practical value. We have no doubt some of our mine owners will gladly avail themselves of the opportunity, but we would suggest that the report and expert conclusions be published whether favorable or unfavorable.

The fifty-first meeting of the American Institute of Mining Engineers will be held at Birmingham, Ala., beginning Tuesday evening, May 15, 1888. Communications concerning the meeting may be addressed to Mr. Kenneth Robertson, at that place. It is expected that after the sessions at Birmingham the In-

stitute will visit Anniston, Ala., and the interesting mines, furnaces and shops in that vicinity. Since the accommodations for ladies at Birmingham are limited, it is suggested that ladies accompanying members should remain at the beautiful and commodious Anniston Inn during the Birmingham sessions. The special rates at the Anniston Inn for members and ladies will be \$2 per day. Communications engaging rooms, etc., should be addressed to Mr. Alfred L. Tyler, Anniston, Ala. Notices of papers to be presented at this meeting should be sent as early as possible.

FURNACE, MILL, AND FACTORY.

The foundry works of John T. Penney & Co., McKeesport, Pa., have been levied on to satisfy a judgment held by R. A. Penney for \$11,087.

The Sheffield Land, Iron and Coal Company's furnace at Sheffield, Ala., was to begin operations this week. Parties are negotiating about the establishment of a rolling mill at that place, and it is thought an arrangement will be effected shortly after the furnaces have started.

Messrs. Moore, Williams & Bailey purpose to go into the manufacture of cold-rolled steel at Pittsburg, Pa., and at present the necessary buildings are being erected. The product of the works will be used for watch springs and other articles where fine work is required. Sheet steel as thin as paper will be turned out.

The partnership existing between the firm of Hussey, Howe & Co., Limited, the well-known steel manufacturers, of Pittsburg, Pa., expires on July 1 next, and will be dissolved. It will probably not be renewed under the present title. The firm is one of the oldest in Pittsburg, having been organized in 1856 under the name of Hussey, Wells & Co.

The capacity of the Ensley Furnace No. 4, Ensley City, Ala., has been tested, and although no definite figures have been received, it is the belief that 170 tons or more will be found to be the total for each day's work. When No. 4's mates, Nos. 1, 2 and 3, are put into blast, the average output daily of this establishment will be about 650 tons.

Judge Wallace, at Rochester, N. Y., rendered a decision on the 14th inst. in the suit of the Shipman Engine Company, of Boston, against the Rochester Machine Tool Works, affirming the validity of the Shipman patent on the safety kerosene burner steam engine, and holding that the defendants had infringed an injunction, and ordered an accounting.

The business of the Diamond Prospecting Company, of Chicago, Ill., has been constantly increasing, and the company has been obliged to move from 22 West Lake street to larger quarters. The new offices will be at Nos. 74 and 76 West Lake street, where the company will have in stock a complete line of Diamond drills, bolting and hauling engines, steam pumps and other mining machinery.

The Trinidad Rolling Mills and Iron Company has been organized at Trinidad, Colo., with a capital stock of \$200,000, shares \$100 each, by Henry Schneider, Harry E. Mulnix, R. B. Holdsworth, F. A. Marriott and Thomas B. Collier. The objects of the company is the manufacture and sale of iron and of all its products, and to acquire and own all the lands, plants, buildings and machinery necessary to carry out the purposes of the corporation; the right to mine coal and own coal lands, manufacture coke, own iron mines and carry on the general business of merchandising. The transactions of the company will be in Trinidad, Las Animas County, Colorado.

It is reported that Messrs. Carnegie, Phipps & Co. will start up their Edgar Thomson Steel-Works at Braddock, Pa., on the 23d inst. Thus far only a few more than 500 of the strikers have voted by Rev. Father Hickey's secret ballot method to go to work, but the mills will be started, no matter how many report for duty on Monday. Manager Jones has had an interview with Sheriff McCandless, and also ordered several hundred cots to be sent to Braddock, and the presumption is that there will be a strong guard of deputy sheriffs on hand to prevent the violence which has lately been so much feared. A dispatch from Pittsburg, dated to-day, states: "A report has just reached there of a riot at Braddock. It is said that seven men have been killed."

At a meeting of the creditors of Graff, Bennett & Co., the iron firm which failed recently, held at Pittsburg, Pa., on the 14th inst., almost all the liabilities were represented. Assignee Miller presented a report showing the assets to be \$652,605.94, and a number of doubtful accounts.

The report was not satisfactory to the creditors, and on motion of the representatives of the Minnesota Iron Company, a resolution was adopted asking Mr. Miller to resign, and that the court appoint another receiver. Two suits in equity have been brought in behalf of the Minnesota Iron Company against John Graff and James I. Bennett, members of the firm. Other creditors of Graff, Bennett & Co. have issued executions aggregating \$102,608.42, levying upon other various properties of the firm and other property covered by the bill in equity filed in the United States Court on the 14th inst. The names of these creditors in these executions are as follows: Mackintosh, Hemphill & Co., \$967.36; Pittsburgh & Lake Erie Railroad Company, \$12,394.68; Chess, Cook & Co., \$14,727.75; Carnegie Bros. & Co., \$27,122.68; Carnegie, Phipps & Co., \$1551.46; F. N. Hoff-tott & Co., \$34,542.11; J. W. Friend & Co., \$10,548.

CONTRACTING NOTES.

Machinery and supplies wanted. See page xiv.

Contracts open will be found on page xix. New contracts this week: No. 859, Water-Works; No. 860, Light House Construction; No. 861, Railroad Track and Equipment; No. 862, Coal, Supplies and Dredging; No. 863, Water-Works; No. 864, Water-Works; No. 865, Chemicals, Castings and other Supplies; No. 866, Electric Lighting; No. 867, Iron Bridges; No. 868, Railroad, Grading, Bridging and Masonry.

The Louisville Water Company, Louisville, Ky., has awarded the contract for pumping engine machinery and boilers to the I. P. Morris Co., of Philadelphia, Pa., at \$235,000, and the contract for engine house, engine foundations and caisson complete, and the inlet and river work to the Soosmith Co., of New York, at \$172,189.55.

GENERAL MINING NEWS.

An advertisement of Messrs. F. D. Presco & Co., in another column, will certainly attract the attention of mine owners and managers of works, for this firm not only offers to furnish competent labor in any quantity, but is ready to guarantee against strikes. They inform us that during the past nine years they have supplied many thousand men to the Northwestern Railroad and other companies, and have never had a strike or disturbance of any kind among the men.

TENNESSEE COAL, IRON AND RAILROAD COMPANY.—It is stated that the president of the company is in New York arranging a plan to raise money to meet increased business caused by the enlargement of company's plant.

ALABAMA.

JEFFERSON COUNTY.

DE BARDELEBEN COAL AND IRON COMPANY.—The company is about to open a new coal mine at Bessemer, the daily product of which will, it is estimated, amount to about 600 tons.

TALLADEGA COUNTY.

ENTERPRISE GOLD MINING COMPANY.—A company has been organized at Talladega to work the Storey mine, and preparations are making for the erection of machinery.

ARIZONA.

PINAL COUNTY.

SILVER KING MINING COMPANY.—Official advices to us report that the large new engine for the mills is now running and furnishing power for one of the mills, and the extension of shafting, etc., is now in progress to connect the other mill, the two mills being virtually under the same roof. The work of providing, receiving and storage facilities at the railroad for crude oil from the oil wells of Ventura County, California, to be used as a steam fuel (and possibly metallurgical), is in progress, and the introduction of the oil will probably take place latter part of this month.

CALIFORNIA.

AMADOR COUNTY.

CHICAGO MILLING AND MINING COMPANY.—At the annual meeting the following officers were elected: P. J. White, president; C. H. Stafford, vice-president and treasurer. John Cupps was appointed superintendent and Lawrence Sutton secretary. The mine adjoins the Plymouth Consolidated Company's property. During the year good ore was encountered in sinking the shaft. It is the intention to erect a 20-stamp mill.

MONO COUNTY.

BULWER CONSOLIDATED MINING COMPANY.—At the annual meeting of this company, held at San Francisco on the 11th inst., the old management was re-elected, the only change in the Board of Directors being the substitution of A. Pettibone, representing a minority interest, for George W. Sessions. The old officers, consisting of John F. Boyd, President; Charles H. Fish, Vice-President; L. Osborn, Secretary; and John Kelly, Superintendent, were re-appointed. During the past year 1260 tons of ore were extracted and crushed, yielding bullion valued at \$10,445.31.

UNITED MAY LUNDY GOLD COMPANY, LIMITED.—The liquidator of this company has announced a final dividend of 1s. 0½d. per share, making, with the dividends previously paid, 18s. 6¼d. in the £1.

TUOLUMNE COUNTY.

Our correspondent writes us that he has just visited the Black Oak mine near Soulsbyville. The present showing of the mine is good, the body of ore found in the drift at the bottom of the 200-foot shaft, extending 130 feet in length, running north, has increased from one foot wide near the shaft to 8 feet wide at about 60 feet distant from the shaft. A raise of about 16 feet at that point shows that the same class of good ore continues upward, which, I am informed by the superintendent, is yielding in the mill at the rate of about \$20 a ton in free gold, and the sulphurets concentrated from this ore run up to over \$400 a ton, the vein averaging three feet wide as far as developed.

The Patterson mine, near Tuttle town, also owned by a St. Louis company, is running full blast and doing well on low grade ore, and is running a 20-stamp water power mill day and night, the sulphurets being saved by a plant of canvas concentrators, the ores of this mine is being mined and milled for one dollar per ton.

CANADA.

PROVINCE OF ONTARIO.

BADGER.—Prof. Eschweiler returned to this mine on the 20th inst. Advices to us state that this mine is looking splendid.

BEAVER.—Captain Hooper advises us that they have again found the vein, as strongly mineralized as ever.

COLORADO.
BOULDER COUNTY.

Our special correspondent writes from Boulder, under date of April 16th, as follows: While Boulder County has within its boundaries a number of good mines and a very much larger number of good prospects, there is little mining done, and the average yearly output of precious metals is only about \$525,000. There seem to be various causes for this condition of things, and first among them may be mentioned what is known here as the "Back-capper." I cannot give the etymology of the name—perhaps it hasn't any—but the thing itself is well known in all mining towns. It has various methods, but only one object, which is to extort from the mine owner who has been fortunate enough to find a market for his property a portion of the price under threat of breaking up the sale if his demands are not complied with. In many cases the money is paid, and where payment is refused the sale is extremely apt to fall through.

Another cause is the action of certain unscrupulous real estate brokers in Denver, who paint in lurid colors the certain loss of money if invested in mining operations or property, and the equal certainty of realizing enormous profit if Denver real estate is bought. Denver real estate is good (if it can be bought at reasonable prices); but let the mines fail, and Denver will go down. Prosperity in the mining districts means prosperity for Denver. The more money is invested in mining in Colorado the more will Denver real estate be worth. Some of the brokers seem to have overlooked these facts, and others—those of the curbstone variety—seem to have ignored them.

A third cause has been over capitalization. You have repeatedly called attention to this evil, and it is unnecessary for me to do more than allude to it here. The fourth cause is one that has injured this county severely in the past, and is still doing it great harm. It is what is known as the "game of freeze out." It is played in many ways, and always has for its object the acquirement by a few stockholders of the interests of others without consideration. A rather lively and interesting game of this sort is now being played at Ward by the owners of the Utica and New Boston. Work was begun on these properties about a year and a half ago, with the result of developing large bodies of good ore. Of course, the more valuable the mine the greater the inducement to the unscrupulous to secure the whole of it if possible. I do not suppose that your readers care very much about the details of a fight over mining property, and I will not impose on your good nature by giving them here. I only mention the matter to show that the property must have value.

About a year ago I told you of the rich discovery in the "Puzzler" at Ward—six feet of ore worth \$130 per ton. An adit has just reached the same ore-body, cutting it at a depth of 175 feet below the adit in which the discovery was made. I am informed that the ore-body is fully as large as in the upper adit, but no test of its quality has yet been made. There is no public assayer within twenty miles of the mine.

Mr. Hulings located an extension of the Puzzler, and has been running a cross-cut to strike the vein. He passed through one vein of solid ore six feet in thickness, but of low grade; and forty feet farther on has just encountered a vein of ore thirteen feet thick—said to be solid—value unknown.

Colonel Brainerd, President of the Chicago and Colorado Mining Company, is sinking on two of the company's mines with good prospects, and will shortly begin work on another.

It is reported that Mr. Hulings has sold the Columbia, but the report lacks confirmation.

It is reported that a payment of \$50,000 has been made on account, by the purchasers of the "Poor-man" at Caribou, owned by N. D. McKenzie. The Caribou is said to be shut down on account of breakage of machinery.

Joe Irwin, the elder of the Irwin Brothers, who took a lease and bond on the Belcher at Caribou, developed it and sold it at a very handsome profit, was buried on the 13th inst., having lived only two days after receiving his money. He worked hard all of his life and died almost immediately on receiving the reward of his labor.

COSTILLA COUNTY.

COLEMAN GOLD MINING COMPANY.—Mr. L. L. Van Allen, who was appointed by the Supreme Court of New York Receiver of this company, reports that he has sold the property for \$1000, of which \$69 is retained by him for fees and disbursements, and \$931 remains to be divided among those interested. The claims amount to \$1921.

GUNNISON COUNTY.

OMAHA AND GRANT SMELTING AND REFINING COMPANY.—It is reported that the Hon. H. A. W. Tabor and others have brought suit in Leadville against this company for \$30,000 damages. The suit arises out of ore taken from the Maid of Erin mine, by one S. G. Wright, and sold to the smelter as coming from the Vanderbilt lode.

SYLVANITE MINING AND MILLING COMPANY.—This company filed a certificate of incorporation with the Secretary of the State of Colorado on the 11th inst. The objects are stated to be the acquisition and ownership of mines, locations, mills and machinery, the erection of buildings, reduction works, etc., to operate the same, buy ores, etc. The capital stock is placed at \$5,000,000, divided into 500,000 shares. The company acquire possession of the Sylvanite, Buckeye and East Wing lodes and the Sylvanite tunnel site. The directors named are Winifred S. Baker, Norvin Green, John P. Branch, Theodore E. Leeds, William H. Wilson, William A. Clark, Granville P. Hawes, Patrick J. Wall, and Frank L. Underwood. The operations

of the company will be in Gunnison County, with an office in New York.

PITKIN COUNTY.

Ore shipments from Aspen for the week ended the 13th inst., amounted to 1705 tons. The Colorado Midland Railroad took out 1040 tons, and the Denver & Rio Grande 665 tons. Of this Denver secured 1283 tons, Leadville 370 tons, and Pueblo 52 tons.

ASPEN MINING AND SMELTING COMPANY.—The electric hoist made by the Sprague Electric Railway and Motor Company of New York will shortly be ready for operations. The dynamo is erected at the Aspen Smelting Works, and the wires strung to the Veteran tunnel, a distance of 5500 feet.

SUMMIT COUNTY.

WIRE PATCH GOLD MINING AND MILLING COMPANY.—This company has been organized at St. Louis with a capital stock of \$5,000,000, shares \$10 each, which were taken by the subscribers at 37½ cents per share. This leaves a balance in the treasury of \$28,000 after paying the purchase price of the property, which will be used in the erection of a 40-stamp mill, to be built at once. The officers are: John H. Douglass, was elected President; James M. Strickler, Vice-President and General Manager. The company owns the Elephant-Ontario mines.

DAKOTA.

LAWRENCE COUNTY.

The Dakota School of Mines, at Rapid City, will shortly begin a series of test experiments upon the refractory ores of Buby Basin, in the Northern Hills, under the leaching method suggested by Prof. F. B. Carpenter for treating such ore.

FLORIDA.

MARION COUNTY.

In our issue of March 3d we stated that coal was struck on the property of Dr. Kendrick at Anthony, at a depth of 200 feet. We are now advised that a higher bed of coal was struck at a depth of 79 feet. Borings show this to be a rather impure lignite.

GEORGIA.

BURKE COUNTY.

Marl mines are being developed in this county, and a fertilizer factory may shortly be erected.

IOWA.

The Senate passed the House bill relating to the payment of miners, amending by striking out the section requiring semi-monthly payments, but retaining the section prohibiting payment in store truck and orders. It also passed the bill providing for the greater safety of mines. It forbids the location of an escapement shaft within 300 feet of the main shaft without the consent of the mine inspector.

HARDIN COUNTY.

A vein of soft coal has been found near Lawn Hill at a depth of 230 feet, between layers of solid rock over 20 inches thick.

MAINE.

MOUNT MICA MINING COMPANY.—This company is preparing for quite extensive developments upon its property at Mount Mica the coming season.

HANCOCK COUNTY.

BLUEHILL COPPER MINING COMPANY.—This company's real estate at Bluehill has been sold at auction to Capt. Daniel Dunn, who purchased it for a New York syndicate.

MICHIGAN.

COPPER MINES.

CALUMET & HECLA MINING COMPANY.—The Calumet & Hecla mine is still closed and gas is being sent down. It is reported that last week an opening was made at No. 1 Hecla shaft and that the indications were such that it was thought best to keep the mine closed for a while longer. Eleven furnaces are now smelting copper at the Calumet & Hecla smelting works. In addition to this number there is one blister furnace in blast, making twelve in all, or nearly the full capacity of the plant.

CENTENNIAL MINING COMPANY.—It is probable that work will be resumed at this mine, which has been idle for some time. The Houghton Mining Gazette states that the management of the mine has been tendered to Supt. Johnson Vivian, manager of the Franklin and Huron mines. Mr. Vivian's former connection with the property gives him a thorough knowledge of its veins and workings.

GOLD AND SILVER MINES.

ROPES GOLD AND SILVER MINING COMPANY.—The company is considering the question of erecting chlorination works.

IRON MINES.

BESSEMER CONSOLIDATED IRON COMPANY.—The first annual meeting of this company was held in Milwaukee on the 10th inst. The following board of directors was elected: Daniel McGarry, of Cleveland; John E. Burton, of Milwaukee; Prof. Raphael Pumphrey, of Newport, R. I.; E. W. Oglesby, of Cleveland; Charles E. Coon, of New York; J. J. McGill, of Steubenville; W. D. Rees, of Cleveland; and Moses H. Brand and John A. Kennedy, of Milwaukee. A motion was adopted to establish a branch office at Cleveland. The new board elected Daniel McGarry President, J. E. Burton Vice-President, and C. E. Coon Secretary and Treasurer. Work will at once begin on Bonnie, Iron King, Blue Jacket and First National mines.

CHAPIN.—Some time ago the company discharged several hundred of its men, owing to the discouraging outlook for ore this season. Subsequently the company decided that a yet further reduction of the working force in the mine would have to be made, unless all its employes consented to submit to a cut in wages of 10 per cent. The matter was laid before the men, and they decided to stand the cut rather than have any more of their number thrown out of employment.

The reduction in wages is to be in effect only till the 1st of June, when the old wage rate will be again adopted if the condition of the ore market warrants.

IRON CLIFFS MINING COMPANY.—The new hoisting machinery has started up.

NORRIS.—The first sale of Gogebic iron ore for deliveries during the current season is reported by this mine—between 120,000 and 150,000 tons to the North Chicago Rolling Mills.

MONTANA.

DEER LODGE COUNTY.

HOPE MINING COMPANY.—Official advices to us show that the company is pushing work vigorously. The Porter and Potosi lodes are producing free milling ore, which supplies the mill. They show very large bodies of good grade ore in sight and blocked, and will supply the mill for about 18 months at least. The Silver Chief tunnel, now 666 feet long, promises a great future. It is in granite formation, and carries the same class of ore as the Granite Mountain Mining Company.

GALLATIN COUNTY.

At the Hauser coal mines, ten miles west of Livingston, twenty-seven coke-ovens are in operation, producing thirty tons of coke daily. Nearly all of it is consumed at the works at Wickes and Tosten.

LEWIS & CLARKE COUNTY.

EMPIRE MINING COMPANY, LIMITED.—The production for March amounted to \$22,500. The working expenses to \$14,000. The Whipperwill lode has been cut, and an upraise is being made to connect with old workings.

MONTANA COMPANY, LIMITED.—Official advices to us show that the production for March amounted to \$130,400 and the working expenses to \$56,000.

SILVER BOW COUNTY.

There were shipped in March from Butte and Anaconda 385 cars of copper matte. This being averaged at eighteen tons to the car (the railroad rule) gives 6930 tons for the month.

BOSTON & MONTANA CONSOLIDATED COPPER AND SILVER MINING COMPANY.—The new hoisting works has been started at the Mountain View mine. No ore has been taken out of this section as yet, and it will take some little time to get the hoisting works working to its full capacity.

VOLUNTEER MINING COMPANY.—This company, to the organization of which we referred in our issue of last week, has received subscriptions to almost all of the fifty thousand shares to be sold at 15c. per share, for the purpose of developing the property, which property joins the Anselmo. The projectors talk of sinking a shaft to the depth of 400 feet.

LEXINGTON MINING COMPANY.—Official advices to us state that the production for March amounted to \$9,204.40 in gold, \$79,804.60 in silver, making a total of \$89,009. The production for the first three months of 1888 was \$263,195.53.

NEVADA.

ELKO COUNTY.

RACKET MINING COMPANY.—This company, organized last November for the purpose of reviving the old El Dorado mine, has run a tunnel 247 feet and expects to reach the ledge within the next 50 feet.

RESURRECTION MINING COMPANY.—This company's 200-foot level is now 155 feet in length and showing the ore in the bottom of the drift to be fully as good as at any point above. Ore is now being assorted and sacked, and a shipment will be made as soon as the road becomes passable for teams.

STOREY COUNTY—COMSTOCK LODE.

From the Virginia City Chronicle we take the following: The Comstock mines and the mills adjacent thereto disbursed a total of \$239,682 for labor during the month of March. This was the largest sum paid out for the above purpose for nearly ten years.

The test runs at the Chollar new mill and the Mexican to determine the difference in cost between the Logan amalgamating process, adopted at the former, and the old system at the latter, resulted in a difference of about 50 cents per ton in favor of the old process, principally in the percentage of quicksilver saved. Two agitators are now being placed in the Chollar mill, by which it is claimed that this waste will be checked.

If the Logan process is abandoned it will be for the reason that it is much slower than the old process. By the Logan only three tons of ore in twenty-four hours is the average crushed under each stamp, while by the old system about four tons in that period is the average.

CONFIDENCE MINING COMPANY.—The bullion shipments thus far on April account are valued at \$38,608.44.

CONSOLIDATED CALIFORNIA & VIRGINIA MINING COMPANY.—The official statement of the ore worked and bullion produced in March amounted to 13,730 tons, yielding a total of \$420,485.12 in bullion, of which \$178,496.50 was gold, and \$241,988.53 was silver. The average assay value of the battery samples was \$36.70 per ton, and the average yield in bullion was \$30.62 per ton.

HALE & NORCROSS MINING COMPANY.—The bullion production for March amounted to \$188,000. The bullion product, April account, amounts to \$38,000.

NEVADA MILL AND MINING COMPANY.—The company has contracted with the Brush Electric Light Company to have dynamos placed on the 1500 level station of the Chollar main incline, to be operated by a Pelton wheel in position on the Suro Tunnel level, to generate electricity for operating the new 40-stamp mill now operated by a surface Pelton wheel.

NORTH CAROLINA.

DAVIDSON COUNTY.

PIEDMONT REDUCTION-WORKS.—The works near Thomasville, of which Captain Crosslemire is the superintendent, are in successful operation. It is stated that chemically pure zinc is now being made there. Captain Crosslemire is said to have discovered the process.

MONTGOMERY COUNTY.

NEW RUSSELL GOLD MINING COMPANY, LIMITED.—The mill has started up and work has commenced on the new mill foundations.

PENNSYLVANIA.

UNITED STATES CEMENT COMPANY.—We are officially advised that arrangements are making for the rebuilding of the works of this company, situated between Coplay and Whitehall on the Lehigh Valley Railroad, which were destroyed by fire last autumn. The company was doing a fine business in Portland and improved Rosendale cements, the demand for both of which is very large and constantly increasing. The company also controls the patents for Wellington's concretes for pavements, etc., a fine sample of which is in the yard of Riotta's metallurgical establishment in Washington street, New York. Mr. Riotta states that this pavement has been down over four years, without perceptible wear. Before putting in this pavement, he had not succeeded in finding any thing which would stand the wear for a single year.

COAL.

A new company of Philadelphia capitalists has been organized to work the extensive granite quarries at Falls of French Creek, near Pottsville. Operations have begun. The company has a contract to furnish Belgian blocks for paving the streets of Philadelphia. Mr. Robert Wood, of Philadelphia, is the manager.

CENTRALIA.—By an explosion of a boiler at this colliery on the 15th inst. four other boilers were displaced, and the building wrecked and set afire, damaging the property about \$3000. The colliery will be obliged to remain idle for about three weeks while repairs are being made. In the meantime, taking advantage of the enforced stoppage, the large hoisting engine at the present slope will be moved 200 yards east to the new slope, which is 2300 feet deep. It is said that the shipments of the colliery will be greatly increased by the change.

OIL.

Exports of refined, crude, and naphtha from the following ports, from January 1st to April 14th.

	1888. Gallons.	1887. Gallons.
From Boston.....	491,586	1,566,750
Philadelphia.....	31,267,608	32,819,208
Baltimore.....	965,514	1,894,689
Perth Amboy.....	5,553,007	4,319,415
New York.....	97,620,061	96,314,056
Total exports ..	135,897,776	136,914,118

The Chief of the Bureau of Statistics reports the total values of the exports of mineral oils from the United States for the month of March, 1888, and during nine months ended March 31st, 1888, as compared with similar exports during the corresponding periods of the preceding year, as follows: March, 1888, \$4,110,039; March, 1887, \$4,534,942; nine months ended March 31st, 1888, \$34,688,436, and March, 1887, \$34,011,004. The exports from the above-named ports comprise about 99 per cent of the total exports of mineral oils. It is stated on good authority that the distillation of 100 gallons of crude petroleum will yield 76 gallons of illuminating oil, 12 gallons of gasoline, benzine or naphtha, 3 gallons of lubricating oil, and 9 gallons of residuum.

SALEM GAS COMPANY.—Oil has been struck by this company at Salem in a well that was being drilled for gas.

SOUTH CAROLINA.

The following shipments of land phosphate rock from Charleston during March are reported by Mr. Paul C. Trenholm:

	1887		1888.	
	Crude. Tons.	Ground. Tons.	Crude. Tons.	Ground. Tons.
To domestic ports....	14,100	150	21,603	400
To foreign ports.....	2,550	.....	.....	.....
Total.....	16,650	150	21,603	400

There is a fair business being done at \$4.50 for crude, \$5.50 for kiln dried, and \$2.50 for ground rock. Very little is done in Charleston in River rock.

TEXAS.

A new mining district is just being opened west of El Paso, in the Potrillo range, which lies directly on the international boundary line between the United States and Mexico, but mostly within the former territory. The range had been known for many years past to contain mineral in large quantities, but prospecting had been difficult on account of the utter absence of water, the nearest supply being at Lanark Station, on the Southern Pacific Railroad. Press reports announce that a group of ten claims has just been located by Messrs. M. J. McKelligan, William Rankin, and Charles Buoy. Choice samples of the ores run 60 per cent copper, 25 ounces in silver, and \$25 worth of gold to the ton.

WASHINGTON TERRITORY.

THE WEST COAST COAL FIELD OF AMERICA.
A special correspondent writes us as follows:
The Valley of Puyallup rises gradually up to the foothills of the Cascade Mountains. Bluffs on both sides of this valley are several hundred feet high, and rise precipitously in places, making it impossible to approach these coal-fields by any other route than through this valley. The N. P. R. R. have built large bunkers of 4000 tons capacity, about equal to the facilities for shipment at Tacoma, and other centres of distribution at Seattle and Vancouver Island, B. C.

For present shipment of coal by vessel to California and elsewhere the arrangements are excellent, but larger accommodation for vessels loading at Tacoma and Seattle will have soon to be provided. The rapid settlement and development of local West Coast industries demand a considerable increase of coal output and shipment yearly.

On the completion of the N. P. R. R. tunnel through the Cascade Mountains next May or June, the facilities for the export of coal from Roslyn coal mines, via Tacoma, will be unsurpassed on the West Coast. The N. P. R. R. Company own and work these mines, which are 32 miles from Ellensburg, Kittitas County, and an easy gradient for 130 miles from Tacoma, by a "spur line" from Clealum Junction of the N. P. R. R. The mines have only been worked about one year, and the company owns 23,000 acres of good coal land and several seams of good coal, one of which is 5 feet thick, with only a dip of 10 degrees, so that the development is likely to be considerably increased, and the working expenses reduced from \$2 to \$1.50 per ton by the aid of Lechner's mining machine, which is being introduced. This will also save great waste of small coal. The present average output of coal is about 400 tons daily, capable of being increased to nearly 2000 tons per day. Two drifts of easy grade run from the openings on the side of the hill.

Local smelters and iron-works are reported to be in course of construction this spring. Coal will then be required in increased quantity for making coke and for other general purposes; but it is well to remember that reports and rumors are unreliable. Interested parties keep them aloft and often add thereto.

Real estate men take advantage of the credulity of the public, and boom city property wherever they can.

Both Tacoma and Seattle are now experiencing this excitement. Spokane Falls and Ellensburg have likewise been busy in this line of inflation of prices, on time speculation, by all classes, rich and poor; ultimately many of the lots sold will fall into the hands of the mortgagees.

Of the wealth of this and neighboring territories, and also British Columbia, in timber and minerals, there is no question or doubt; but in pastoral and agricultural lands there is not much to be said in their favor, either as to extent or quality of soil. The climate is excellent, and poor soils will give fairly good crops, but fail to yield any in the "drier regions." Ham, bacon, cheese, butter, eggs; fresh and tinned meats; oatmeal and other produce has to be imported from Chicago, Saint Paul and Minneapolis into the towns above named.

The sandy plains of Eastern Washington or of Northern Idaho—or the gravel valleys on the N. P. R. R. derived from basaltic and other rocks, are more or less unproductive, partly from the want of rain and dew, and partly from the poverty of the sandy or loamy soil. Many Eastern and Middle States farmers and carpenters come, and return East, frequently with sad disappointment. Many sell out their farm stock and leave the good lands in the colder parts of Southern Dakota and Minnesota, for the milder west coast, and with judgment and perseverance, thrift and industry, they may succeed, but the first few years will be hard, up-hill work, and none but hardy, steady men of endurance should be induced to make the change.

Those who are doing fairly well in the Eastern or Middle States should remain and persevere, where the increase of wealth, industries, and property is assured. For the present the demand for laborers out here is small. In Los Angeles, San Diego, and other Californian centers, thousands are without means, and sleep out of doors. The real estate agents meanwhile flourish.

(TO BE CONTINUED.)

WYOMING.

A mine of ozokerite, or mineral wax, is reported to have been found within twenty-five miles of Laramie.

COAL TRADE REVIEW.

NEW YORK, Friday Evening, April 20.

Statistics.

Production Bituminous Coal for week ended April 14th, and year from January 1st:

Tons of 2000 pounds, unless otherwise designated

EASTERN AND NORTHERN SHIPMENTS.

	1888.		1887.
	Week.	Year.	Year.
Phila. & Erie RR.....	40	16,871	.....
*Cumberland, Md.....	81,143	937,626	741,281
Barclay, Pa.....	3,414	54,014	70,088
Broad Top, Pa.	.....	.....	.....
H. & Broad Top RR.....	5,455	124,618	129,290
Clearfield Region, Pa.	.....	.....	.....
Snow Shoe.....	2,906	41,598	55,073
Karthaus (Keating).....	622	57,700	61,684
Tyrone & Clearfield.....	74,443	1,044,859	969,651
Tipton.....	1,327	14,500	.....
Alleghany Region, Pa.	.....	.....	.....
Gallitzin & Mountain.....	19,482	281,953	245,825
Pocahontas Flat Top Coal.	.....	.....	.....
Norfolk & West. RR.....	33,815	455,916	328,676
Kanawha Region, W. Va.	.....	.....	.....
Ches. & Ohio RR.....	38,454	539,191	426,068
Total.....	261,101	3,571,876	2,967,576
*Tons of 2240 lbs.	.....	.....	.....

WESTERN SHIPMENTS.

Pittsburg Region, Pa.	.....	.....	.....
West Penn RR.....	7,589	117,392	96,345
Southwest Penn. RR.....	1,364	32,130	50,634
Pennsylvania RR.....	5,877	84,718	69,505
Westmoreland Region, Pa.	.....	.....	.....
Pennsylvania RR.....	36,878	488,181	457,582
Monongahela Region, Pa.	.....	.....	.....
Pennsylvania RR.....	3,608	88,835	102,910
Total.....	55,116	811,256	776,976
Grand total.....	316,217	4,383,132	3,744,552

Production of Coke on line of Pennsylvania RR, for week ending April 14th, and year from January 1st, in tons of 2,000 pounds: Week, 68,849 tons; year, 1,111,344 tons; to corresponding date in 1887, 1,294,280 tons.

Production Anthracite Coal for week ended April 14th, and year from January 1st:

Tons of 2240 lbs.	1888.		1887.
	Week.	Year.	Year.
P. & Read. RR. Co.....	157,589	1,179,354	2,076,998
Cent. R. R. of N. J.....	123,299	1,294,904	1,274,533
L. V. RR. Co.....	130,336	1,372,903	1,935,375
D. L. & W. RR. Co.....	109,698	1,968,077	1,524,044
D. & H. Canal Co.....	79,043	1,320,531	1,164,849
Penna. RR.....	127,445	1,216,466	86,003
Penna. Coal Co.....	24,949	417,349	369,993
Total.....	732,349	8,769,524	9,259,705
Increase.....	80,446	.....	.....
Decrease.....	.....	490,151	.....

The above table does not include the amount of coal consumed and sold at the mines, which is about six per cent of the whole production.

Production for corresponding period:
1887..... 7,983,861 | 1885..... 6,942,585
1884..... 6,969,364 | 1886..... 8,746,619

Anthracite.

Mr. John H. Jones, Chief of Bureau of Anthracite Coal Statistics, has issued the following statement of anthracite coal tonnage for the month of March, 1888, compared with same period last year. This statement includes the entire production of anthracite coal, excepting that consumed by employes and for steam and heating purposes about the mines, but does not represent the entire anthracite coal tonnage actually transported by the respective railroad companies, adjustment being necessary in the compilation to avoid duplications, etc.

COMPANIES.	March, 1888.	March, 1887.	Difference.
Phila. & Reading RR.....	550,970	603,869	Dec. 52,979
Central RR. of N. J.....	361,075	433,722	Inc. 72,647
Lehigh Valley RR.....	448,507	618,567	Dec. 170,060
Del., Lack. & West. RR.....	498,652	452,181	Inc. 46,471
Del. & Hud. Canal Co.....	371,290	291,909	Inc. 79,381
Pennsylvania RR.....	303,933	284,632	Inc. 19,300
Pennsylvania Coal Co.....	80,423	138,192	Dec. 57,769
N. Y., L. E. & W. RR.....	70,919	68,000	Inc. 2,919
Total.....	2,685,729	2,911,272	Dec. 225,543

COMPANIES.	For year 1888.	For year 1887.	Difference.
Phila. & Reading RR.....	859,736	1,606,703	Dec. 746,967
Central RR. of N. J.....	1,051,983	1,043,981	Inc. 8,002
Lehigh Valley RR.....	1,080,859	1,509,015	Dec. 428,156
Del., Lack. & West. RR.....	1,756,838	1,384,538	Inc. 372,300
Del. & Hud. Canal Co.....	1,182,277	691,910	Inc. 490,367
Pennsylvania RR.....	969,229	763,244	Inc. 205,985
Pennsylvania Coal Co.....	361,319	315,029	Inc. 46,290
N. Y., L. E. & W. RR.....	207,493	191,206	Inc. 16,287
Total.....	7,469,744	7,705,588	Dec. 235,844

	March, 1888.	March, 1887.	Difference.
From Wyoming Region	1,661,833	1,481,244	Inc. 180,589
From Lehigh Region	216,527	549,284	Dec. 332,757
From Schuylkill Region	807,569	880,744	Dec. 73,175

	For year 1888.	For year 1887.	Difference.
From Wyoming Region	5,592,104	4,116,213	Inc. 1,475,891
From Lehigh Region	316,599	1,905,656	Dec. 1,589,057
From Schuylkill Region	1,561,041	2,283,719	Dec. 722,678

The stock of coal on hand at tide-water shipping points March 31st, 1888, was 465,709 tons; on February 29th, 1888, 232,501 tons; increase, 233,208 tons.

The anthracite trade is extremely dull, and stocks are accumulating at the principal shipping points. Nominally prices remain as follows: Broken, \$3.75; Egg, \$4; Stove and Chestnut, 4.25; Pea, \$3 to \$3.30 for free burning coals, f.o.b. But actual prices obtained by individual operators or their agents may be quoted as follows: Broken and Egg, \$3.45 and upward; Stove and Chestnut, \$3.65 and upward; Pea, \$2.60 to \$2.90 and upward f.o.b. for good free burning coals. We have heard of Stove coal alongside at \$3.90, and yet the companies are holding to their circular prices, and in fact we can see nothing else for them to do. As we stated when the present schedule was issued, we thought prices were started too high. We are quite convinced of that now; but having been established, it certainly would be bad policy for the companies to allow them to be reduced, and it will be wiser to curtail production and wait until the market requires more coal than individual operators can supply, when the prices will naturally come up to the circulars.

The demoralizing effect upon the market of the uncertainty as to whether the companies will amicably arrange the question of quota is still felt, and, no doubt, has its effect in deferring purchases and in creating an impression that prices will not be maintained.

The readers of the ENGINEERING AND MINING JOURNAL have learned to look there for a statement of the exact condition of affairs, whatever it may be. In recording the fact that the effect of this uncertainty as to the arrangement of quota is affecting the market, we can state our belief that it is doing so to an unnecessary degree. The companies have an unreasonable objection to hearing the word "combination" (as a matter of fact, there is no combination between them in the legal sense of the word), but we think there are indications that no serious difficulty will be met with in arranging the amount which each company is to produce—2,600,000 tons is understood to be the quantity.

ty to be produced this month, and the amount for May will probably not exceed 2,250,000 tons.

It is also believed that the companies will produce each about the same proportion of the whole as they did last year. It would be desirable to have something more than so guarded an expression of belief as this on this important subject; but, as we have stated, the companies appear to have a decided objection to taking any action which might bring them before a prying committee.

This is the dull season in the coal market, and the companies have nothing to do but to maintain prices and wait until the individual operators can no longer supply the market at cut rates. How long this will be it is impossible for us to say, as it depends largely on the impression that the trade may get as to the maintenance of prices; if it were assured that prices would be absolutely maintained, no doubt the demand would come much earlier than usual, for stocks in second hands are very light, and coal is now being bought only for immediate requirements.

Bituminous.

There is nothing new to say with regard to bituminous coal. The large purchasers, railroad and steamboat companies, are in the market and are considering bids. Within a few days several large contracts will be decided, and once the price is established a very large amount of business will be done within a few weeks. We therefore expect in our next issue to be able to state what the opening prices actually are, and to record how near the circulars the coal has been sold. The price f.o.b. at tidewater ports, Newport News, Baltimore, etc., should be \$2.60. The circular rates have been and are easily obtained for small orders in this harbor. Nevertheless, there seems to be an impression prevalent that some coal can be bought at less than these figures, and in our next we shall probably be able to say how far this impression is justified.

The anthracite producers are trying to regain some of their trade that last year was taken away by bituminous coal and have induced the New Jersey Central and Lehigh Valley roads to make a special rate of freight on pea and buckwheat in order to allow of competition with soft coal. These rates of freight to tide water are based on a minimum of \$1.25 per ton on pea coal and \$1.15 on buckwheat.

Boston. April 19.

Still waiting for trade to start, is the story in the anthracite branch of the trade. The retail trade are not obliged to buy, and furthermore don't want to buy just yet, so they complacently hold hold off to see if prices will break. Individuals are shading company prices ten to fifteen cents, quoting an inside range of say \$4.60 on Stove, \$4.35 on Egg and \$3.85 on Broken. Trade is expected to start up very soon.

In bituminous coal there is a rather quiet market. If much is being done the transactions are kept quiet. The award of the Merrimack Manufacturing Company's contract has been announced and is rather a disturbing element. Many bids were made and the company closed with a new shipper under circumstances which make it morally certain that the nominal pool price was badly cut. How much effect this incident will have on the trade remains to be seen. More or less coal is being offered at less than pool price of \$2.60 f.o.b., without secrecy, and it is pretty evident that very little coal is being sold straight. Competition is exceedingly sharp.

There is no change of note in freights. We quote, exclusive of discharging: New York, 70@80c.; Philadelphia, 90c.@\$1.00; Baltimore, \$1.05@1.10; Newport News and Norfolk, 90c.@ \$1.05; Richmond, \$1.15@1.25.

There is no movement at retail except among the dealers, who have reduced prices 50 cents per ton. As revised we quote delivered prices, 2000 pounds to the ton, as follows: Stove, \$3.25; Egg, \$6.00; Broken, \$5.75; Franklin, \$7.50; Lehigh Egg, \$6.25; Broken, \$6.00; Bituminous coal, on the wharf, \$4.00.

Buffalo. April 19.

The wholesale prices of coal are being arranged for in New York to-day, and next Tuesday our local dealers will meet and decide what the opening figures shall be.

There have been no events of importance to chronicle with regard to demand and supply at this port either for coal or coke, hence the absence of comments.

Outside the breakwater and for many a mile stretch there are immense fields of ice, some smooth, others furrowed and frozen in ridges. Several cold days and nights have consolidated the masses. It is impossible at time of writing to name an approximate date for the opening of navigation. "Old Boreas," the tugmen say, "has passed a resolution that the vessels shall not pass until May 1st." One of our line vessel managers says that he has no idea of getting out before May 10, and if the boats could be held several days longer the season would be all the more prosperous. One thing is favorable, and that is that the sun has been very powerful for several days, so that the ice may be honeycombed notwithstanding the frosty atmosphere.

The latest news from the Straits of Mackinaw is to the effect that navigation will not be resumed between Lakes Huron and Michigan for some days yet.

Most of the few vessels left over here after the first rush for charters have been engaged for coal at 75c. per net ton to Chicago and Milwaukee.

Charters at Cleveland for coal have been made at 75c. to Chicago, 35c. to Detroit, 40 to Windsor, and from Lorain to Milwaukee 70c. At Toledo, coal to Sheboygan 75c.

The Welland canal will be opened April 23d. Last Tuesday no ice was in sight at Erie, Pa.

The new railroad freight tariff on coal and coke in car lots which went into effect April 16th shows the rates to the following places to be as follows from Buffalo on anthracite coal per gross ton and coke per net ton: To Milwaukee and Racine, \$2.40; to Indianapolis, Columbus, and Dayton, \$1.75; to Decatur, \$1.60; to Ann Arbor, Mich., \$1.40; to Mackinaw City, \$3; to Peoria and Springfield, \$2.50; to Chicago, Grand Rapids, and Benton Harbor, \$2; to Cairo, Canton, and Quincy, \$3; to Davenport, Burlington, Clinton, Dubuque, Keokuk, Galena, and Hannibal, \$3.34. This will give your readers a general idea of ruling rates without publishing other points which would fill a dozen columns. [The rates on Blossburg and bituminous coal loaded in box cars in car-loads will be, per net ton, same as anthracite coal rates per gross ton.]

Twenty-two vessels have been chartered to carry ore from Ashland to Cleveland at \$1.25 per ton. Five to six trips are to be made at these figures. The men who have taken the contract are receiving some pretty harsh language from their brethren in the lake traffic business, but they take it quite composedly, and proclaim that the situation warrants their action.

Pittsburg.

[From our Special Correspondent.]

Notwithstanding the large business transacted in the coal market, prices are low. The coal exports by river from January to date were the largest for a long time, exceeding fifty-one million bushels. The rates are:

PRICE OF COAL PER 100 BUSHELS = 7600 LBS.			
First pool.....	\$4.75	Fourth pool.....	\$3.25
Second pool.....	4.25	Railroad coal.....	5.00
Third pool.....	3.75		

The market for Connellsville coal since our last has presented no new feature. The fight is still on and coke is selling at \$1 per ton, or below the actual cost of production. This condition of affairs can not continue, and the end can not be far off. The nominal rates are: Blast-furnace coke f.o.b., \$1; to dealers, \$1.10; foundry, \$1.25. Rumor says that it can be bought below these figures. How long this state of affairs will continue is more than can be found out. The demand is reported light. Freight rates per ton to Pittsburg 84 cents; Mahoning and Shenango Valleys, \$1.57; to Cleveland, \$2.10; to Chicago, \$3.15; to other points in the same proportion.

Later, at a meeting of the Pittsburg Committee, held at the office of the Lake Shore road, on Wood street it was decided to reduce rates on coke from the Connellsville region to all points West reached via any line. The new rates to be put in force will be the same as those in use prior to February 1st, 1887, and the reduction will amount to about 5 per cent. At that time, when business was brisk and the coke producers making plenty of money, the railroad companies advanced the rates 10 per cent. The furnacemen made a strenuous objection, but the railroads argued that the rates were too low as compared with the high prices the operators received for their coke. On March 21st, 1888, when shipments were falling off, the rates were reduced 5 per cent, but this did not suit the consumers, who said they should still go lower. As the price of coke declined, the railroads decided to make a further reduction of about 5 per cent, which will go into effect on the 23 inst. The new rates will be made upon the following basis: To Cleveland, \$2; Chicago, \$3; East St. Louis, \$3.50; Mahoning and Shenango valley points, \$1.50 per ton. The reduction will be appreciated by the consumers.

FREIGHTS.

The latest actual charters to April 19th, per ton of 2240 pounds:

From Philadelphia to:—Beverly, \$1.00; Boston, .90@1.00*; Cambridge, 1.05*3c.; Charleston, .80; Charlestown, .50*; Chelsea, .90@1.00*; Com. Pt., Mass., .95@1.00*; East Cambridge, .95*; Fall River, .80@.90; Gloucester, 1.05*; Lyon, 1.25*; Marblehead, 1.05*; Milton, 1.10*; New York, 9c.; New Bedford, .80@.90*; Newburyport, 1.15*; Norfolk, .60; Portsmouth, N. H., 1.15; Richmond, Va., .70; Salem, Mass., .90*; Savannah, .80; Washington, .85; Wilmington, N. C., .80.

From Baltimore to:—Banzor, Me., 1.05; Bath, 1.05@1.10; Boston, 1.05; Bridgeport, Conn., 1.00; Charleston, .80@1.00; Fall River, 1.00; Galveston, 3.00@3.05; New Bedford, .9@1.00; Newburyport, 1.30; New Haven, 1.00; New London, .95@1.00; New York, .90; Portland, 1.05; Portsmouth, N. H., 1.10; Providence, .95; Salem, Mass., 1.05; Savannah, .85@1.00; Williamsburg, N. Y., .90@1.00; Wilmington, N. C., 1.00.

From New York to:—Bath, Me., .75*; Beverly, .80*; Boston, .70*; Bridgeport, Conn., .55; Cambridge, Mass., .70*3c.; Cambridgeport, .70*3c.; Charlestown, .70*; Chelsea, .70*; Com. Pt., Mass., .75*; E. Boston, .70*; E. Cambridge, .70*3c.; E. Greenwich, R. I., .75; Fall River, .75; New Bedford, .80@85; Newburyport, .90*; New Haven, .55; New London, .70@75; Norwich, .75; Portsmouth, N. H., .85*; Providence, .75; Salem, .70*.

* And discharging. 3c. per bridge extra. † A'ongside.

MARKETS.

NEW YORK, Friday Evening, April 20.
Prices of Silver per ounce troy.

Apl.	Sterling exchange	London Pence.	N. Y. Cents.	Apl.	Sterling exchange	London Pence.	N. Y. Cts.
14	4.87	42½	93½	18	4.87½	42½	93½
16	4.87	42½	93½	19	4.87½	42½	93½
17	4.87	42½	93½	20	4.87½	42½	93

* 42 13-16. † 42 11-16.

The supply of 50 lacs per week and the silver ship-

ments in addition are rather more than the Indian exchange market can stand up under, hence the decline in silver rates.

Foreign Bank Statements.—The governors of the bank of England at their weekly meeting made no change in its rate for discount, and it remains at 2 per cent. During the week the bank gained £225,000, and the proportion of reserve to liability was raised from 38.74 last week to 40.82 per cent, against a slight increase in the corresponding week last year, when the rate of discount was 2½ per cent. The weekly statement of the Bank of France showed an increase of 3,125,000 francs in gold and 2,350,000 francs in silver.

Copper.—In accordance with the prediction which we ventured to insert in our last report on the condition of this market, the week just past has brought new vitality and strength, and quotations have again advanced, and that even before a further rise was generally expected. The strong tone which has now been noticeable for some time past becomes daily more and more apparent, and, in spite of the comparatively high prices now ruling, the quantity of copper coming into the market is remarkably small. This condition of affairs is only what might have been expected when it is borne in mind that the entire output of this country (with comparatively few exceptions) has been contracted for by the French syndicate, and they have not yet shown any anxiety to put any thing on the market. Beyond this contracted quantity there is really very little copper in the hands of second parties. During the week the transactions have not been very extensive, but quite large enough to show the strong tendency of the market. The "short" operators referred to in our last issue have kept themselves entirely aloof from the market during the last few days and seem to have come to the conclusion to wait for a more suitable opportunity to adjust their accounts. They evidently found out that when they attempted to buy to cover their April shorts it had the effect of driving the price of spot copper up to a very high point.

Export orders have not been so numerous lately, but those placed have been at full market prices.

Rumors have lately been afloat about negotiations now pending as to a sale of copper to consumers by the parties virtually controlling the output, but nothing definite on this subject has yet transpired.

The total quantity which has changed hands in the Metal Exchange for the past week will amount to about one million pounds. To-day's prices for Lake Copper are: Spot, 16 75; April, 16 75; May, 16 75; June, 16 70. Outside brands are unchanged at 15½ @16c.

In London the market for Chili bars opened on Monday at £80 for Spot, and afterwards touched £80 7s. 6d., closing to-day at £80 5s. Chili bars 3 months forward are £78. According to cable advices received from Messrs. Henry R. Martin & Co., of London, the statistics of visible supplies of copper show an increase of 3200 tons for the first half of this month.

The increase in visible supply of copper in Europe is creating rather more alarm than it should, for it must be borne in mind that under the advance in prices which the syndicate has made, not only have all available stocks been gathered up from every part of the world and dumped on the market, but consumers have worked up, or are working up, every thing they had on hand, and many of them have been able to get along with little or no fresh supply.

Those sources of increase in visible supply will shortly cease to operate, and the only increase will then be the natural excess of production over consumption, and for some time to come this must be small.

It is however evident that next year the syndicate will have to carry a pretty heavy load and one that will be steadily increasing.

The Chairman of the Namaqua United Copper Company states that the directors have concluded a contract with the Société des Métaux for three years certain, with continuation for a further like period, at the option of the French company, the quantity of ore to be delivered being 5500 tons the first year, 7000 tons the second year, 8000 tons the third year, and 9000 tons for subsequent years. The price is 12s. 9d. per unit, or £63 15s. per ton of copper.

The exports of copper from New York during the week were as follows:

To	Copper matte.	Lbs.	By S. S. City of Berlin	Sacks	2,066	206,600	\$15,000
"	Wisconsin	Sacks	274	32,984	1,680		
"	Giltia	Sacks	3,428	342,800	25,000		
"	Bitannic	Bbls.	120	121,406	6,000		
"	England	Sacks	5,698	661,464	34,000		
"	Egypt	Sacks	404	49,497	4,813		
To Liverpool—	Copper.						
By S. S. City of Berlin	Pigs	65	10,037	1,600			
"	Wisconsin	Pigs	5	410	63		
"	England	Pigs	740	112,046	17,000		
"	Egypt	Casks	35	44,300	7,400		
To Hamburg—							
By S. S. California	Casks	63	88,750	13,060			
"	Australia	Casks	67	112,750	18,000		
To Liverpool—old yellow metal—							
By S. S. City of Berlin	Pkgs	146	17,405	1,392			

The exports of copper from January 1st, 1888, to date were as follows:

To	Copper matte.	Copper.
	Pounds.	Pounds.
To Liverpool.....	20,671,411	10,465,816
" London.....	6,507,306	6,507,306
" Havre.....	6,205,356	6,205,356
" Bordeaux.....	694,030	694,030
" Rotterdam.....	45,000	405,349
" Amsterdam.....	201,655	201,655
" Antwerp.....	426,485	426,485
" Hamburg.....	531,062	531,062
" Leghorn.....	1,789,762	1,789,762
Total.....	20,318,066	27,016,170

U. S. COPPER PRODUCTION IN 1887.—Mr. C. Kirchhoff, Jr., agent of the United States Geological Survey, has sent out a preliminary bulletin relating to production and consumption of copper in 1887. He places the production as follows:

Table showing copper production in 1887 by state: Lake Superior (75,471,893), Arizona (17,720,462), Montana (78,039,677), New Mexico (283,664), California (100,000), Colorado (2,012,027), Utah (500,000), Nevada (200,000), New England (200,000), Southern States (2,432,804), Lead desilverizers (2,432,804), Total (177,420,524).

The returns from 32 works, including nearly all the principal brass and copper rolling mills, show an aggregate consumption during 1887 of 72,531,287 pounds, as compared with 63,921,217 pounds in 1886. Eighty brass foundries, machine works, valve manufacturers and pump makers report a total consumption in 1887 of 9,822,731 pounds, as compared with 8,146,866 pounds in 1886. Together, these two classes report 82,354,018 pounds in 1887, against 72,068,083 pounds in 1886, an increase of 14 per cent. From these data the conclusion is reached that the home consumption of the United States has been generally over-estimated, and was not much greater than about 100,000,000 pounds in 1887.

Tin.—The market has been comparatively lifeless during the week, and transactions have been rather small. The only change to be reported is in April delivery, which has advanced a little owing to the spot price having been kept up and the near approach of the spot and April settlements to each other. The anxiety on the part of the London operators to effect sales has been as evident as previously. We quote today: Spot, 36.50; April, 30.50; May, 26.50; June, 25.50.

The Tin Plate-Trade.—Proposal to Form Another Syndicate.—A South Wales correspondent writes under date April 5: A lengthy circular has been sent to all the tin-plate makers of England, which proposes to form a new syndicate to regulate the price and production of tin plates. The present scheme takes the form of a syndicate of makers with a capital of £200,000 to buy up all the make of tin-plates which can not be disposed of in the open market, at the minimum standard prices to be fixed by the syndicate. These prices will be on the basis of 14s. 9d. per box IC for coke tin-plates, with parity for superior grades delivered at Welsh ports. The advance to be made by the syndicate on plates, stored with them under warrant, will be six pence below the standard prices. In order to leave the share capital of the syndicate intact, it is proposed to levy a small contribution per box to meet working expenses. A heavy penalty has been fixed for breaking any of the terms of the proposed association, and it is proposed to carry out a reduction in make at once to the extent of 20 per cent. The scheme, which is to be binding for twelve months, is now under consideration by the tin-plate makers.

Lead.—The market has been pretty steady during the week, but the amount of business done has been insignificant. The tendency of the market may be described as rather weak, and the offerings by smelters (who seem rather anxious to make sales at present prices) continue and have now extended to May and June shipment. To-day's prices may be quoted: Spot, May and June, 4.70; later months neglected. Spanish lead in London, £14 10s.

Messrs. Everett and Post, of Chicago, telegraph today as follows: Absence of buyers coupled with uncertainty as to the tariff has effected a gradual decline since our last report. Demand is only moderate and there is but very little doing. Light sales at 4.50@4.60 are reported.

Messrs. John Wahl & Co., of St. Louis, telegraph today as follows: The situation remains substantially unchanged, the extreme quietness noted a week ago being still the prominent feature of the day. Refined is lightly saleable at 4.50 and Common at 4.47 1/2.

Spelter is rather weaker, and Domestic can be bought at from 4.75@4.80c. Foreign is also lower, and we now quote prime Silesian brands £18 10s.

Antimony steady at 10 1/2c. for Hallett's, and 13 1/2c. for Cookson's.

Chemicals.—Since our last report there is no change of consequence; the market continues dull, with sales in small lots to supply current wants.

Carbonated soda ash, 48 per cent, continues scarce, and is in very slight demand. Little or nothing is to be had on the spot, and only limited quantities are obtainable for forward delivery. We note no change in quotations of 1.25@1.27 1/2. High test is more active, though prices continue at the same figures.

Caustic soda ash, 48 per cent, is still without animation, and business is more or less of a jobbing character. Small lots bring 1.22@1.25, according to quantity and seller.

Bleaching powder has been fairly active, but unfortunately the increased demand does not raise prices much. We continue to quote Liverpool brands 1.92@1.95. Newcastle makes 1.85@1.89 1/2.

Refined alkali 36% is receiving no attention, and in the entire absence of business it is difficult to give a fair quotation. The nominal price is 1.10@1.12 1/2; 48% is quite active with prices ranging from 1.20@1.25. High test is not in much demand, and the quotations may be nominally put down at 1.10@1.15.

English sal soda is quiet, with little on the spot; the quotations are given at 1.12 1/2@1.15.

The situation in the acid market is without change. Acetic acid is quiet, with the price still fluctuating between 2 1/2@2 3/4, according to quantity and seller.

Sulphuric acid, 66 degrees, is moving fairly, though we hear of no large sales outside of contract orders. The price continues at 90@95c. for large lots, \$1@1.10 per 100 lbs. for smaller quantities.

Oxalic acid is in good demand, the present low price being apparently an inducement to buyers; 6 1/2@6 3/4 is the quoted price, though we hear of sales as low as 6 1/2c.

Fertilizing chemicals continue about the same. Dried blood, high grade, is 2.25@2.30; low grade, 2.15@2.20. Tankage, high, 21.50; low grade, 18.50. Fish scrap, \$25 per ton. Refuse bone black, \$17.

Sulphate of ammonia is plentiful, and quoted at 3.20@3.25.

Muriate of potash is active, and large quantities have arrived on contract orders. We continue to quote 1.77 1/2@1.80, 1.72 1/2 future sail shipments, and 1.77 1/2 prompt steamer shipments.

Double manure salt is not wanted, and quotations, except for small lots, are nominal: 1.17 1/2@1.20 is asked for small quantities, ex store, shipments 1.14 1/2@1.15.

Kainit is still very firm, with limited quantities obtainable on the spot; 11.50 is demanded for good ex store and 8.50@9.50 for April and May shipments.

Nitrate of soda is weaker, the large overstock on the spot being the cause. Goods are now offering, ex store and ex vessel in port, at 1.95c., against 2@2.05c. last week, nothing whatever being done in futures.

Brimstone is dull, and lower in price. Best unmixd seconds are now offering at \$19.50 per ton. No thirds

are offering here. On futures there is a slight advance, owing to increase in freight rates.

A correspondent of Kuhlows', from Halle-on-Saale, says the result of the negotiations of the Association of German Saline and Salt Mine-Owners has been the establishment of a convention in place of the sale union hitherto proposed. The convention will first of all include the private saline-works, a rise in the average sale price of 10 pf. per 100 kg. being arranged to take place on the 1st of April. The state saline-works of Prussia, Bavaria, Wurtemberg and Baden have not joined the convention. A circular will now be issued to all the state saline-works requesting them to either join the convention, to sign some special treaty with it, or at least to state in writing their readiness to follow the rules which the convention will lay down. Should this be refused, either the convention will be dissolved or a ruthless war will be waged with the state saline-works, their prices being steadily underbitten. The Prussian Minister of Public Works has lately pronounced very decidedly against the state saline-works joining a price convention.

IRON MARKET REVIEW.

NEW YORK, Friday Evening, April 20.

The market for pig-iron remains very quiet, with no new transactions of size reported. Some sellers of Southern irons are a little firmer in price, and decline to make further concessions. Quotations are unchanged. The Thomas Iron Company report that they have already sold for this year's delivery about 126,000 tons of iron, against 150,000 tons sold at the corresponding period last year. Their total production for 1887 amounted to 166,000 tons, and they closed the year some 20,000 tons behindhand in their

IMPORTATIONS AT NEW YORK DURING WEEK ENDING APRIL 18, AND FROM JAN. 1 TO SAME DATE.

Large table with multiple columns: Spelter, Zinc Sheets, Antimony, Pig Lead, Tin, Tin Plates, Spelter, Antimony, Chemicals, Pig-Iron, Steel Sheets, Blooms, Billets, etc., Old Rails, Bar-Iron, Scrap-Iron, Sheet Iron, Charcoal Iron, Spiegeleisen, Iron Ore. Columns include Week, Year, Tons, and Corres. date 1887.

WEEKLY REGISTER OF CURRENT QUOTATIONS.

CHEMICALS.

Table of chemical prices including Acid-Acetic, Muriatic, Nitric, Oxalic, Sulphuric, Alkali, Alum, Aqua Ammonia, Ammonia, Arsenic, Asbestos, Asphaltum, Borax, Bromine, Cambric, China Clay, Chrome Yellow, Cobalt, Copper, Cream of Tartar, Emery, Feldspar, Fuller's Earth, Gypsum, Hydrous, Kainit, Kaolin, Lead, Litharge, Magnesia, Manganese, Mercuric Chloride, Mineral Wool, Nitric, Phosphate Rock, Plumbago, Potassium, Potash, Pyrites, Quartz, Rotten Stone, Salt, Saltpeter, Soda Ash, Soda Caustic, and Sal.

Table of building materials including Bricks, Haverstraw, Building Stone, Granite, Slate, and Roofing.

BUILDING MATERIAL.

THE RARER METALS.

Table of rarer metal prices including Aluminum, Arsenic, Barium, Bismuth, Cadmium, Calcium, Cerium, Chromium, Cobalt, Didymium, Erbium, Gallium, Glucinum, Indium, Iridium, Lanthanum, Lithium, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Niobium, Osmium, Palladium, Platinum, Potassium, Rhodium, Ruthenium, Rubidium, Selenium, Sodium, Strontium, Tantalum, Tellurium, Thallium, Thorium, Tungsten, Vanadium, Yttrium, and Zirconium.

METALS.

Table of metal prices including Aluminum, Copper, Lead, Tin, Zinc, and Antimony.

IRON AND STEEL.

Table of iron and steel prices including American Pig-Iron, Bessemer Pig-Iron, Dalmellington, and various types of steel.

Table of iron and steel prices including Dalmellington, Bessemer Pig-Iron, Spiegelisen, Ferro Manganese, Steel Blooms, Steel Billets, Steel Nails Slabs, Steel Wire Rods, Steel Rails, and Structural Iron and Steel.

IRON AND STEEL.

Table of iron and steel prices including Cast-Iron Pipe, Wrought Iron Pipe, Boiler Tubes, Nail Fastenings, Wrought Scrap, Hot Blast Irons, Car Wheel and Malleable Irons, and various types of iron.

LOUISVILLE PRICES.

Table of Louisville prices including Hot Blast Irons, Neutral Coke, Cold Short, Mottled, and Car Wheel and Malleable Irons.

PITTSBURG PRICES.

Table of Pittsburgh prices including Coke or Bituminous Pig, Foundry No. 1, Foundry No. 2, Gray Forge No. 3, White, Mottled, Silvery, Bessemer, Charcoal Pig, Foundry No. 1, Foundry No. 2, Cold-Blast, Warm-Blast, 20 p. c. Spiegel, Muck-Bar, Steel Blooms, Steel Slabs, Steel Crop Ends, Steel Bloom Ends, Steel Billets, Old Iron Rails, Old Steel Rails, No. 2 W. Scrap, No. 1 W. Scrap, Steel Rails, light sections, Bessemer, Iron, nominal, Nails, Steel Nails, and Two per cent off for cash.

PHILADELPHIA PRICES.

Table of Philadelphia prices including Foundry No. 1, Foundry No. 2, Gray Forge, Bessemer Pig, Steel Rail Blooms, Foreign Bessemer, Spiegelisen, Scrap, Selected, No. 1, Cargo Scrap, Muck-Bars, Merchant Iron, and Plate Iron.

Table of tank iron prices including Tank Iron, Skep Iron, Angles, Beams and Channels, Nails, Steel Rails, and Old Rails.

STOCK MARKET QUOTATIONS.

Table of Baltimore stock market quotations including Atlantic Coal, Balt. & N. C., Big Vein Coal, Conrad Hill, Diamond Tunnel, George's Crk., Lake Chrome, N. State, Balto., Ore Knob, and Silver Valley.

BIRMINGHAM, ALA.

Table of Birmingham, Ala. stock market quotations including Ala. Conn. C., Bir. Min. & Mfg., Decat. L. Imp., & Fur., Decatur Min. L., Enterprise, Mfg. Co., Sloss I. & S., * Sloss I. & S., Sheffield C. & I., and Woodstock S&I.

BONDS.

Highest and lowest prices bid and asked during the week ending April 17th.

PITTSBURG, PA.

Table of Pittsburgh, Pa. stock market quotations including Allegheny Gas, Bridgewater Gas, Charlotte Mg. Co., Chartiers Val. Gas, Columbia Oil Co., Consignee Mg. Co., Forest Oil Co., Gogebel I. Syn., La Nora Mining, Lustre Mining, M'furers' Gas, Nat. Gas Co. of W. Va., N. Y. & C. Gas Coal, Ohio Valley Gas, Pennsylvania Gas, People's Nat. Gas, Philadelphia Gas, Silverton Mining, South Side Gas, Tuna Oil Co., Washington Oil, W'hs Air-Brake, Westmoreland & Cambria Gas, and Wheeling Nat. Gas.

Highest and lowest prices bid and asked during the week ending April 19th.

FOREIGN QUOTATIONS.

Table of foreign quotations including London and Paris prices for various commodities like Boleo, El Callao, Golden River, Lexington, Rio Tinto, and Tharsis.

PARIS.

Table of Paris stock market quotations including Boleo, El Callao, Golden River, Lexington, Rio Tinto, and Tharsis.

DIVIDEND-PAYING MINES.

NON-DIVIDEND-PAYING MINES.

Main table with columns: NAME AND LOCATION OF COMPANY, CAPITAL STOCK, SHARES, ASSESSMENTS, DIVIDENDS, NAME AND LOCATION OF COMPANY, CAPITAL STOCK, SHARES, ASSESSMENTS. Lists various mining companies and their financial details.

G. Gold, S. Silver, L. Lead, C. Copper. * Non-assessable. † This company, as the Western, up to Dec. 10th, 1881, paid \$1,400,000. Non-assessable for three years. ‡ The Deadwood previously paid \$75,000 in eleven dividends, and the Terra 75,000. Previous to the consolidation of the Copper Queen with the Atlanta, Aug., 1875, the Copper Queen had paid \$1,350,000 in dividends.

NEW YORK MINING STOCKS QUOTATIONS.

DIVIDEND-PAYING MINES.

NON-DIVIDEND-PAYING MINES.

Main table containing mining stock quotations for dividend-paying and non-dividend-paying mines, listing company names, dates (April 14-20), and sales figures.

*Dealt in at the New York Stock Ex. Unlisted Securities. †Dealt in at the Metal Ex. ‡Assessment unpaid. Dividend shares sold, 19,532. Non-dividend shares sold, 81,860. Total New York, 101,392.

BOSTON MINING STOCK QUOTATIONS.

Table of Boston Mining Stock Quotations, listing company names, dates (April 13-19), and sales figures.

* Ex dividend. Boston: Dividend shares sold, 10,055. Non-dividend shares sold, 14,625. Total Boston, 24,680.

COAL STOCKS.

Table of Coal Stocks, listing company names, dates (Apr. 14-20), and sales figures.

San Francisco Mining Stock Quotations.

Table of San Francisco Mining Stock Quotations, listing company names and closing quotations for April 13-19.

*Of the sales of this stock, 78,098 were in Philadelphia, and 286,380 in New York. Total sales, 568,978.

deliveries of foundry irons. Their furnaces are now working as well as ever, and making their usual 70 per cent of soft iron.

Scotch irons are unchanged in quotation, although the demand is very light.

Bessemer pig is lifeless, and quotations are purely nominal.

There is considerable inquiry for steel rails, but no new orders of size are reported. Several Eastern mills have already sold all of their additional allotment. The Western mills are not so fortunate, and it is not likely that their sales will be large until the complete adjustment of the railroad troubles.

A dispatch from Pittsburg to the New York Tribune states that the Edgar Thomson works will resume operations on Monday next, no matter how many of the strikers vote to return to their places. It is stated that measures have been taken for the protection of such non-union men as return to their work.

The demand for structural iron is fully as large as usual at this season, and bids have been invited for a considerable number of iron bridges and structures.

Prices of structural iron are lower, except of beams and channels, which remain at 3-3c. base. Plates are also lower. Foreign steel plates are offered for shipment at prices considerably under our quotations, but makers generally prefer American plates of known brands, especially as they can be obtained more quickly.

The same is true of Bessemer machinery and spring steel.

Old rails are again on the down grade. Doubles are offered at \$21 and Tees about \$20.50, with some transactions reported in doubles.

Nails are weaker, being obtainable at 1-90@1-95 in carload lots. The Western nail makers have adopted a new classification, but as this classification is merely to make a nominal "card rate," it is not likely to have any effect on actual selling prices.

The Eastern nail makers have not been able to agree on the proposed limitation of production, and are disposing of their product each mill on its own account. The demand is said to be more active.

Louisville. April 17. [Reported by HALL BROTHERS & Co.]

The same story is to be told of the iron market. There have been no noteworthy events during the past week. The demand is mainly for car-load lots and 50 to 100 tons, and occasionally larger inquiries, none of which have as yet materialized. The coming in of some of the new Southern furnaces may relieve the situation to the extent of giving the buyers the grades desired for early delivery, which some of the older furnaces have not been able to do. Up to this time, however, there has not been but one of the new coke furnaces in the South that has started up, but more are expected in the course of a short time.

Quotations for cash f.o.b. cars at Louisville will be found in our weekly register of prices.

Philadelphia. April 19. [From our Special Correspondent.]

No definable change has taken place in the Eastern Pennsylvania iron market. Buyers and sellers are not hastening business, yet the trade is in just such a condition that an improving tendency might at any time manifest itself. Consumers admit they have run low in stocks, and also that the policy involves some risks. Even should the Mills bill fail buyers do not look for a hardening tendency in prices, as furnace and mill interests will be too anxious to secure a few weeks or a few months work. The iron committees have about arranged their case for presentation to the railroad companies, and as early as possible a reply will be made. Iron makers have made out from their standpoint a very strong case. Negotiations are now in hand for Southern forge irons on a basis of \$16.25. A few more offers of western iron were made. Only a hand to mouth buying and selling is possible at present at the appended rates. Muck bars are selling daily in a small way. Foreign material contracts will be closed this week, brokers say. The depression in all kinds of rolled iron prices continues, and no encouragement for an early improvement can be found at stores, mills or offices. Matters are hanging until two or three elements of uncertainty are removed. At some mills a few furnaces have been laid off; one mill has suspended production for the present. The skip iron makers quoted the lowest rates for the season this week. Tubes are more active than pipes. Galvanized sheet iron orders drop in freely. No change one way or other has taken place at plate iron mills. The structural iron makers have had a number of building inquiries during the week and two bridge workers have presented specifications. Merchant steel production is not farther restricted, though much complaint is heard about trade. The Bessemer mills have been adding a good deal of general business, and the local offices have very little news as to steel rail probabilities. Old rails are dull, held 50 cents above buyers' views. Very little business has been done in cargo or yard scrap.

Coal managers say they are counting upon a sufficient Western demand to prevent such an overstocking of the markets East as to break prices. The furnace companies are anxious for cheap furnace coal, but there is very little probability of their getting it. Quotations will be found in our weekly register of prices.

Pittsburg. April 19. [From our Special Correspondent.]

In the iron trade the general position of the market has not varied much during the past week. Business continues slow as compared with what it usually is at this season of the year, although all that can reasonably be expected under existing circumstances. Com-

mon stock is offering freely, and some sales have been made recently at a slight reduction. It is contended by producers that present rates in some instances do not cover actual cost, also that the cost of production cannot be reduced below the present limit. On one point all parties agree, that business in raw iron is more depressed now than it has been at any time during the present year, and many are of the opinion that no improvement of any consequence is likely to take place for some time to come. On the other hand, some contend that business will soon improve, that the worst is over, that a revival will take place in the near future. The volume of sales show conclusively that it requires a good deal of raw iron to meet the current wants of consumers. The decrease in business as compared with the same time last year is not by any means the worst feature. The falling off in price leaves the producers with little or no margin in their entire output. Of course there will be an end to this condition of affairs some time; but when, that seems to be the important question. There are certain contingencies which might start a reaction, but there are others of equal probability, of an entirely opposite character, so that it is not worth while to present either side of the case until the tendency toward one or the other becomes more pronounced. The labor difficulties at Braddock continue. At the date of our last letter the general opinion was that a satisfactory arrangement was on the eve of being consummated. Up to this time no satisfactory conclusions have been reached. The mills are idle and will so remain unless the men go to work on the terms laid down by the company. The coke question is still badly mixed. Coke at one dollar per ton shows a poor condition of affairs for the manufacturers, as it can not be made for that money.

Coke and Coal Smelted Lake Ore.

3000 Tons Bessemer for Eastern Mill from Valley Furnace equal at Pittsburg to	16.60 cash.
1000 Tons Bessemer extra	17.70 cash.
650 Tons Bessemer	17.50 cash.
1000 Tons Bessemer	16.75 cash.
500 Tons Bessemer, May	16.60 cash.
150 Tons No. 1 Foundry	18.00 cash.
100 Tons all ore Mill	17.00 4 mo.
150 Tons Close Bessemer	16.25 cash.
325 Tons No. 1 Foundry, all Ore	17.75 4 mo.
175 Tons Mottled and White Bessemer	15.00 cash.
50 Tons No. 2 Foundry, all Ore	17.25 4 mo.

Charcoal.

150 Tons No. 2 Foundry	24.50 cash.
100 Tons No. 1 Foundry	25.50 cash.
75 Tons No. 1 Foundry	23.00 cash.
50 Tons No. 1 Foundry	23.50 4 mo.
25 Tons Cold Blast	25.50 cash.

Old Rails.

1100 Tons American Ts	23.00 cash.
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Muck Bar.

1000 Tons May	26.75 cash.
500 Tons Spot	27.00 cash.

Steel Slabs and Billets.

500 Tons Billets	28.50 cash.
400 Tons Slabs	28.50 cash.

Scrap Material.

150 Tons No. 1 Wrought Scrap	Net 19.00 cash.
150 Tons No. 2 Wrought Scrap	Net 18.50 cash.
125 Tons Cast Scrap	Gross 16.50 cash.
150 Tons Wrought-Iron Turnings	Net 14.00 cash.
125 Tons Cast-Iron Borings	Gross 12.75 cash.

FINANCIAL.

New York, Friday Evening, April 20.

It appears that the atmosphere of the new home of the Consolidated Stock and Petroleum Exchange has not been exhilarating on the mining stock market. But little is doing, and the degree of interest taken in the old hacks of the board is not very lively. What is needed here is an influx of good dividend-paying mines, and an exit of a troupe of more or less untamed felines.

There are so many good mines throughout the country that it seems strange more of their stocks do not come here. The Old Ontario and Homestake are "salted down," and no one hears much about them. They pay their dividends quietly and regularly. The fire in Plymouth is still pushing down that stock. What is wanted to make things active is a few "bonanzas"—Granite Mountains or some copper mines. South America promises to send us some active stocks, and the mines are far enough away to make the stocks active when they get here. Let us hope we shall soon have something to wake up the brokers and make the new exchange lively.

The boom predicted in El Cristo, and which we stated would probably not materialize, has collapsed for the present. The stock opened at \$3, and has steadily declined during the week, closing to-day at \$2.20.

Phoenix, of Arkansas, has again appeared on the list, selling at 54c.

Proustite showed a downward movement, going from \$2.15 to \$1.85.

Among the Colorado stocks Adams was active at from \$3 to \$3.35. Little Chief was quiet at 25c., and Leadville at from 25 to 28c. Iron Silver shows one sale at \$3.75. Dunkin a few at 95c. Security was not dealt in until the end of the week, when it opened at 50c., and later declined to 25c. Lee Basin shows a few sales at 60c. Cashier, one at 10c.

There have been no new developments at the mines of the Plymouth Consolidated Mining Company since our last report. The stock shows a further decline and sold as low as \$7.75 this week. Sales were made to-day at from \$8 to \$8.25.

Brunswick was neglected at 19@20c.

Bodie Consolidated ranged at from \$2.50@2.70. Standard declined from \$3.00@2.35, but advanced again later to \$3.00. Bulwer shows a few transactions at from 80@75c.

Quicksilver Preferred demanded but little attention. A few sales were made at from \$36.25 to \$39.

Amador was lower, going from \$2.40 to \$2.25. Middle Bar from 62 to 40c., selling to-day at 49c.

The event of the week has been the advance in Sufro Tunnel, which went from 18@23c. The stock had been neglected for many weeks past. The transactions this week amounted to 37,700 shares. The advance of this stock affected all the other Comstock shares, and in consequence considerable attention was directed to Consolidated California & Virginia, which was dealt in at prices ranging from \$13 to \$14.13. Yellow Jacket advanced from \$7.50 to \$7.75. Sierra Nevada shows one sale at \$4.10. Savage at \$5.50. Ophir went from \$8 to \$9.13. Hale & Norcross from \$9 to \$9.75. Gould & Curry was quiet at from \$4.25 to \$4.30. Crown Point at \$5.25. Belcher declined from \$6.75 to \$6.50. Utah sold at \$2.90. Union Consolidated was higher at from \$3.80 to \$4.10. Mexican at from \$4.75 to \$4.80. Exchequer at \$1.85. Consolidated Imperial advanced from \$6.00 to \$7.25, and later declined again to \$6.88. Bullion shows a few transactions at from \$1.95 to \$2.20. Best & Belcher at \$4.80. Alta at \$2.00.

Navajo declined from \$1.65@1.35, but later advanced to \$1.70, closing at \$1.55 to-day. North Belle Isle sold at \$1.38, Belle Isle at 55c., Found Treasure at \$2.05, Tornado at 70c.

The Homestake Mining Company has come forward with another monthly dividend of \$25,000, making a total of \$4,093,750. A few sales of the stock were at from \$10.50@11.50. Deadwood-Terra shows one sale at \$1.55. Father de Smet was neglected, selling at from \$2@45c. Caledonia advanced from \$1.95@2.10. Cleveland Tin shows a sale of 100 shares at \$1.55 per share.

Castle Creek shows one transaction at 9c., and Holyoke one at 7c.

Silver King remained firm at \$5.

Horn-Silver shows a declining tendency, going from .80 to 85c. Ontario records a few sales at from \$28.50 to \$28.75.

Rappahannock was quiet, selling at from 18@16c. Carupano remains unchanged at \$2.

The Lehigh & Wilkes-Barre Coal Company gives notice that ninety-eight (98) drawn Sterling Mortgage Bonds for £200 each will be paid with the maturing coupons on and after May 1st, proximo, on which date all interest thereon will cease. Bonds numbered as follows will be paid at the office of the company, 119 Liberty street, New York: 5164, 5256, 5269, 7753, 7761, 7770, 7807, 7844, 7866, 7884, 7956, 7958, 7989, 7996, 8007, 8012, 8034, 8151, 8189, 8291, 8301, 8302, 8340, 8342, 8390, 8395, 8397.

The remaining seventy-one (71) bonds issued in London will be paid at the office of the fiscal agents of the company, Messrs. J. Thompson T. Bonst & Company, London.

Dividends.

Columbia Oil Company has declared a dividend, No. 60, of two per cent, payable April 18th, at Pittsburg, Pa.

Eureka Consolidated Mining Company, of Nevada has declared a dividend of 25 cents per share, or \$12,500, payable May 7th, at Messrs. Laidlaw & Co.'s, No. 14 Wall street, New York City.

Homestake Mining Company, of Dakota, has declared a dividend, No. 117, of twenty cents per share, or \$25,000, payable April 25th, at Messrs. Lounsbury & Co.'s, No. 15 Broad street, New York City.

Pennsylvania Manufacturing, Mining and Supply Company has declared a monthly dividend, No. 11, of one per cent, payable May 1st at Pittsburg, Pa.

Assessments.

COMPANY.	No.	When levied.	D'l'nt' in office.	Day of sale.	Am't per share.
Anna, Dak	1	Apr. 10	May 10	June 1	.001
Anchor, Utah		Mar. 3	May 5	May 26	.10
Ande, Nev	33	Feb. 25	Apr. 2	Apr. 23	.25
Belcher, Nev	34	Mar. 13	Apr. 17	May 7	.50
Bodie Cons., Cal.	8	Feb. 13	Mar. 20	Apr. 26	.50
Crispin, Ariz.	1	Mar. 7	Apr. 15	May 5	.10
Crocker, Ariz.	5	Feb. 5	Mar. 27	May 1	.25
Dav, Nev	16	Feb. 8	Apr. 9	May 7	1.00
Equitable, Utah	33	Feb. 14	Mar. 30	May 9	.15
Enterprise M. & M.	1	Apr. 3	May 4	May 19	.15
Gould & Curry, Nev.	58	Mar. 12	Apr. 15	May 10	.50
Homeward B'd, Dak.	5	Mar. 24	May 21	June 21	.001
Idaho, Utah		Mar. 15	Apr. 20	May 10	.40
Iron Hill, Dak	12	Mar. 5	Apr. 7	Apr. 26	.075
Kennedy, Cal.	3	Feb. 20	Apr. 2	Apr. 23	.20
Keyes, Nev	1	Feb. 15	Apr. 10	May 7	.25
Mayflower, Cal.	41	Apr. 9	May 10	June 4	.20
Navajo, Nev		Apr. 12	May	June	.05
North Peer, Nev	4	Feb. 24	Mar. 28	Apr. 23	.25
Omaha, Cons., Cal.	1	Feb. 20	Mar. 24	Apr. 26	.25
Peerless, Ariz.	11	Apr. 4	May 7	May 28	.10
Phil Sheridan, Nev.	3	Mar. 7	Apr. 14	May 25	.025
Quincy, Dak	3	Mar. 3	May 1	May 31	.02
Rattler-Gilroy, Dak.	8	Mar. 6	Apr. 7	Apr. 26	.01
Seabury-Calkins, Dak	11	Apr. 7	May 7	May 28	.25
Sierra Nevada, Nev.	91	Apr. 3	May 8	May 23	.01
Silver Mint, Dak	2	Jan 4	Mar. 10	June 2	.04
Spanish, Cal.	17	Mar. 27	Mar 4	May 28	.10
Trojan, Nev	5	Feb. 28	Apr. 4	May 1	.05

* The delinquent day and day of sale were postponed to dates given above.

† Under the resolution levying the assessment, each shareholder is credited as paid on this assessment the amount paid to the company by him on his shares on and since August 9th, 1887.

‡ This assessment was rescinded April 6th.